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Grado en Odontología

CAUSAS, COMPLICACIONES Y TRATAMIENTO DE PERIIMPLANTITIS.

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RESUMEN

Introducción: La periimplantitis es una enfermedad que afecta a tejidos periimplantarios mediante un proceso inflamatorio. Su diagnóstico puede realizarse incluyendo una buena historia clínica y anamnesis, analizando parámetros clínicos comunes de la afectación como son el sondaje aumentado debido a las bolsas periimplantarias, sangrado gingival, pérdida del nivel de inserción y/o secreción purulenta, y analizando la pérdida ósea radiográfica.

Objetivos: qué es la periimplantitis y cómo se puede diagnosticar, qué factores de riesgo pueden causar la enfermedad, posibles complicaciones y los diversos tratamientos que existen.

Metodología: se realizó una búsqueda bibliográfica en bases de datos como Medline, Pubmed y Scielo, seleccionando los artículos más relevantes desde el año 2015, incluyendo finalmente 61 artículos y 6 libros.

Discusión: existen una serie de factores de riesgo asociados al desarrollo de la enfermedad que deben tenerse en cuenta a la hora de realizar el diagnóstico, y enfocar el plan de tratamiento. Entre las complicaciones se encuentran: la pérdida del implante dental, fractura mandibular o incremento de la inflamación que interfiere con la enfermedad cardiovascular. El tratamiento de la periimplantitis puede ser no quirúrgico o quirúrgico (en el último se procede a levantar colgajo para mejorar el acceso y profundizar en la bolsa periimplantaria).

Conclusiones: La periimplantitis es un proceso inflamatorio en el que se produce pérdida ósea; se diagnostica mediante parámetros clínicos como inflamación, profundidad de sondaje ≥ 6 mm, sangrado, pérdida ósea radiográfica ≥ 3 mm y supuración. Presenta diferentes factores de riesgo como la periodontitis preexistente, diabetes, tabaquismo, sobrecarga oclusal entre otros. Las complicaciones pueden ser la pérdida del implante, fractura mandibular e

incremento del riesgo de enfermedad cardiovascular. El tratamiento no quirúrgico puede curar formas leves o moderadas de la enfermedad, si persiste la periimplantitis se deberá llevar a cabo el tratamiento quirúrgico que está más indicado para grados severos.

ABSTRACT.

Introduction: Peri-implantitis is a disease that affects the peri-implant tissues through an inflammatory process. Its diagnosis can be made by completing a thorough clinical history and anamnesis, analyzing common clinical parameters such as increased probing due to peri-implant pockets, gingival bleeding, loss of insertion level and/or purulent discharge and analyzing radiographic bone loss.

Objectives: what is peri-implantitis and how can it be diagnosed, what risk factors can cause the disease, possible complications and the various treatments that exist.

Methodology: a literature search was performed in databases such as Medline, Pubmed and Scielo, selecting the most relevant articles since 2015, finally including 61 articles and 6 books.

Discussion: there are a few risk factors associated with the development of the disease that should be considered when making the diagnosis and focusing on the treatment plan. Among the complications are: loss of the dental implant, mandibular fracture or increased inflammation that interferes with cardiovascular disease. The treatment of peri-implantitis can be non-surgical or surgical (in the latter, a flap is raised to improve access and deepen the peri-implant pocket).

Conclusions: Peri-implantitis is an inflammatory process in which bone loss occurs; it is diagnosed by clinical parameters such as inflammation, probing depth ≥ 6 mm, bleeding, radiographic bone loss ≥ 3 mm and suppuration. It presents different risk factors such as pre-existing periodontitis, diabetes, smoking, occlusal overload among others. Complications can be implant loss, mandibular fracture, and increased risk of cardiovascular disease. Non-surgical treatment can cure mild or moderate forms of the disease, if peri-implantitis persists, surgical treatment should be performed, which is more indicated for severe degrees.

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INTRODUCCIÓN:

La periimplantitis es una condición clínica en la que se presenta la lesión inflamatoria de la mucosa periimplantaria acompañada de pérdida ósea. (1)

1.1. Periodonto:

El periodonto comprende diferentes tejidos como son: el ligamento periodontal, la encía, el cemento radicular y el hueso alveolar dicho propiamente. Éste último reviste el alvéolo dental, continuándose con el hueso alveolar (puede mostrarse como cortical alveolar en radiografías). La apófisis alveolar se propaga desde el hueso basal de los maxilares y está compuesta de hueso alveolar y hueso alveolar dicho propiamente. La función principal del periodonto consiste en la fijación del diente al hueso y garantizar la integridad de la superficie de la mucosa masticatoria de la cavidad oral. Así, el periodonto, también se puede denominar "aparato de inserción" o "tejidos de sostén de los dientes", y compone una unidad de desarrollo funcional y biológica que sufre determinados cambios debido a la edad, además de sufrir cambios morfológicos en relación con trastornos funcionales y del medioambiente oral. (1)

1.2. Anatomía ósea:

La apófisis alveolar forma y sostiene los alvéolos dentarios. (1) Respecto al maxilar, la cortical vestibular es delgada y los bordes de los alveolos son finos, frágiles y afilados. Sin embargo, es más gruesa la lámina cortical vestibular de los segundos y terceros molares, así como los bordes alveolares. El hueso es muy grueso en palatino, sobre todo en la parte más profunda de dientes anteriores y premolares, la cortical palatina se adelgaza como si se tratase de un papel sobre el alveolo del primer molar y más aún sobre el alveolo del segundo y tercer molar. (2)

En la mandíbula, en región de incisivos y molares por la cara vestibular, es más delgada la tabla ósea que en la cara lingual. En la región molar el hueso presenta mayor grosor de la superficie vestibular en comparación con la lingual (la presencia de la línea oblicua da lugar a un saliente óseo con forma de repisa en la zona vestibular de segundo y tercer molar). (1) En ocasiones el recubrimiento del hueso por la parte vestibular de maxilares es bastante fino o incluso falta del todo. Cuando se presenta una zona sin revestimiento óseo de la raíz se denomina dehiscencia. Cuando queda hueso por la porción más coronal pero hay defecto de hueso en apical se trata de una fenestración. Dichas situaciones pueden darse cuando se traslada un diente fuera de la arcada siendo más frecuente su aparición en dientes anteriores que posteriores. Si se dan estos defectos, únicamente queda sobre la raíz el ligamento periodontal y la mucosa que lo recubre. (1)

1.3. Elementos celulares del hueso:

Se pueden identificar diferentes componentes celulares en el interior del hueso: (1) los osteoblastos son aquellas células que se encargan de formar hueso, y regular la mineralización de la matriz (1), y sintetizan componentes orgánicos proteicos de la matriz ósea. (3) La superficie ósea es donde se localizan los osteoblastos y depositan la matriz, y finalmente se pueden diferenciar en células que revisten el hueso y osteocitos. (1)

Los osteocitos son células óseas con forma estrellada (1) maduras que se confinan en una laguna propia (3), dichas lagunas se incluyen en el interior de la matriz ósea mineralizada. Presentan una trama osteocítica que son prolongaciones citoplasmáticas que se extienden hacia distintas áreas y contactan con vasos sanguíneos y otros osteocitos. Los osteocitos participan regulando la homeostasis del calcio que circula en la sangre, perciben la carga mecánica, y transmiten la información a las otras células del hueso para poder seguir

manteniendo la función de osteoblastos y osteoclastos, estas funciones las consiguen mediante la traducción de señales mecánicas en mediadores bioquímicos. (1)

Los osteoblastos mediante la secreción de señales regulan la formación de osteoclastos. (3)

Los osteoclastos son células que complementan la actividad formadora de hueso produciendo la resorción ósea, son capaces de adherirse a la matriz ósea y desarrollarse, y, a continuación, segregar ácidos y enzimas líticas que producen la descomposición y degradación de componentes orgánicos y minerales del hueso y cartílago calcificado. (1)

1.4. Periodontitis, bacterias:

La periodontitis se define como una enfermedad infecciosa en la que se produce inflamación en los tejidos de soporte del diente, con pérdida progresiva de inserción, y pérdida del hueso alveolar. Se caracteriza por la formación de bolsas periodontales y recesiones gingivales. Puede ocurrir en todas las edades, pero tiene mayor prevalencia en adultos. (4)

La periodontitis es una patología que comienza con gingivitis inducida por placa, lesión reversible que si no es tratada evoluciona a periodontitis crónica (lesión irreversible). (1)

La cantidad de destrucción tisular es proporcional a la cuantía total de factores etiológicos. La enfermedad está asociada a factores predisponentes locales (anatomía dental o factores yatrogénicos), también puede asociarse a enfermedades sistémicas (VIH, diabetes), e incluso puede asociarse con alteraciones en los mecanismos de defensa. (4)

Clínicamente la periodontitis se caracteriza por ciertos signos como son las alteraciones de la textura, color y volumen de la encía marginal, sangrado al sondaje en el área de la bolsa gingival, disminución de la resistencia al sondaje de los tejidos blandos marginales (formación de bolsas periodontales o aumento de la profundidad de bolsa), pérdida del nivel de inserción clínico, retracción del margen gingival, pérdida de hueso alveolar (angular u horizontal),

exposición de la furca radicular, incremento de movilidad dentaria y desplazamiento, y finalmente puede conllevar a la exfoliación dentaria. (1)

Las enfermedades periodontales están relacionadas con la presencia de placa bacteriana o biopelícula, existen grupos de bacterias específicos dentro de las biopelículas. (5)

La periodontitis es una enfermedad multifactorial, resultado de una interacción compleja entre los microorganismos, los mecanismos del huésped y otros factores modificadores. (6)

Entre las bacterias de la placa subgingival se encuentran los colonizadores primarios: *Streptococcus gordonii*, *Streptococcus mitis*, *Streptococcus oralis* y *Streptococcus sanguinis*. Los colonizadores secundarios son: *Actinomyces naeslundii, Capnocytophaga ochracea*, *Eikenella corrodens*, *Haemophilus parainfluenzae*, y *Veillonella atypica*. Tanto colonizadores primarios como secundarios son considerados colonizadores tempranos junto a *Actinomyces*. Los colonizadores puente son aquellos que co-agregan los colonizadores tempranos con los colonizadores tardíos como: *Fusobacterium nucleatum*. Las especies que aumentan numéricamente tras los colonizadores tempranos son: *F. nucleatum*, *Campylobacter gracilis*, *Eubacterium nodatum*, *Fusobacterium periodonticum*, *Peptostreptococcus micros*, *Prevotella intermedia*, *Prevotella nigrescens* y *Streptococcus constellatus*. Y finalmente existen especies colonizadoras tardías con gran asociación a la destrucción periodontal: *Porphyromonas gingivalis, Tannerella forsythia* y *Treponema denticola.*(7)

El *Aggregatibacter actinomycetemcomitans* está presente en gran parte de la población normal, sin embargo, en ciertas poblaciones se encuentra como causa de la periodontitis agresiva. En base a ello, cabe destacar que, aunque muchas personas son portadoras de esos microbios no tienen por qué presentar progresión de la enfermedad, ya que la mayoría de la gente está en equilibrio con su biopelícula durante la mayor parte del tiempo y la enfermedad

únicamente aparece cuando se rompe ese equilibrio. La enfermedad puede ocasionarse debido a influencias ambientales que implican el aumento oportunista de la proporción de microorganismos, debido a la disminución de mecanismos defensivos del huésped, o debido a ambas cosas. (1)

1.5. Periimplantitis:

En la actualidad se sigue produciendo pérdida de piezas dentales en la población, lo que conlleva un aumento de la puesta de implantes para ofrecer una mejor calidad de vida. Se prevé un incremento del fracaso de los mismos ya que el objetivo de los implantes es suplir a los propios dientes y como tal necesitan cuidados para mantenerlos en boca el mayor tiempo posible. La periimplantitis es una de las causas principales del fracaso de la colocación de implantes. (8)

Clínicamente la periimplantitis se caracteriza por ser un proceso inflamatorio en el que se ve afectada la función fisiológica tanto del tejido duro como blando circundante a un implante osteointegrado, o a expensas de osteointegración. Por otro lado, la mucositis periimplantaria se considera una afectación reversible en la que existe inflamación del tejido que rodea al implante, sin pérdida de hueso. (8)

Figura 1. Imagen de un caso de periimplantitis con evidencia de pérdida de tejidos circundantes. (9)

Cabe señalar la importancia de la distinción entre remodelado inicial óseo fisiológico y la pérdida progresiva de hueso crestal periimplante, en la última se desarrolla un proceso patológico. La remodelación ósea crestal inicial es considerada un proceso fisiológico que aparece tras la colocación del implante. Este proceso se ve influenciado por una serie de factores que pueden ser biológicos (como por ejemplo el grosor de la mucosa), técnicos (por ejemplo, por conexiones protésicas), y quirúrgicos (como puede ser por la colocación de los implantes). Por tanto, la evidencia demuestra que la pérdida ósea crestal progresiva que rodea los implantes sin la presencia de signos clínicos inflamatorios en tejidos blandos es un evento inusual. (10)

A propósito de estudios retrospectivos la prevalencia actual de enfermedades periimplantarias se encuentra en un rango de 19-65% en el caso de mucositis periimplantaria con una media de 40,1% y un rango de 1-47% en el caso de la periimplantitis con una media de 15%. (11) (12)

La prevalencia de periimplantitis es significativamente mayor en la región anterior del maxilar y menor tasa en la región canina mandibular. (13)

La ubicación de los implantes en maxilar presenta un pronóstico menos favorable que los implantes mandibulares. (14)

El tabaquismo, diabetes mellitus, antecedentes de periodontitis previa, así como una combinación de tabaco e infección periodontal son considerados como factores de riesgo para el desarrollo de la enfermedad periimplantaria. (12)

El mecanismo de producción puede explicarse de forma breve: se produce una condición inflamatoria crónica la cual es estimulada por el biofilm de la placa dental, pero el huésped también puede mediar en la respuesta al igual que en la periodontitis. Por consiguiente, de

igual modo, la periimplantitis es considerada como una entidad destructiva comenzada por la placa dental, y, es sensible a una variedad de factores sistémicos (modificables o no) y locales. Se muestra con recambio óseo y degradación de la matriz. De esta manera, la susceptibilidad de la periimplantitis viene dada por factores que conllevan la inflamación de los tejidos, como, por ejemplo, el tabaco, control deficiente de la placa dental o la hiperglucemia (diabetes), y, por tanto, todos ellos son consideradores factores de riesgo. (15)

Entre las principales causas para el desarrollo de la periimplantitis se sitúa la enfermedad periodontal preexistente, no necesariamente la acumulación de placa debuta en una prolongación del proceso inflamatorio, sin embargo, en los implantes el infiltrado inflamatorio en la mucosa periimplantaria presenta una extensión periapical más marcada. (8) Por otro lado, otro factor a tener en cuenta es la presencia de tejido queratinizado alrededor de los implantes ya que aquellos que se rodean de encía libre no queratinizada tienen mayor riesgo de desarrollar la enfermedad. La disposición de las fibras es totalmente diferente en la unión ginigivodentaria donde se disponen de manera perpendicular, mientras que en la unión de tejido conectivo con el implante se disponen principalmente de forma longitudinal creando una entrada en línea recta a los microorganismos, favoreciendo la destrucción del tejido de soporte del implante. (8)

De modo similar a la periodontitis se produce un desequilibrio huésped y carga bacteriana en pacientes susceptibles. La infección periimplantaria presenta gran cantidad de microflora gram anaeróbica y algunas de esas bacterias también están asociadas a la enfermedad periodontal como *Porphyromonas gingivalis, Tannerella forsythia*, *Treponema denticola*, *Fusobacterium sp*., *Prevotella intermedia*, y *Aggregatibacter actinomycetemcomitans* (16),

además los microorganismos nombrados son los principalmente relacionados con la periimplantitis. (8)

1.6. Superficie de los implantes:

Los implantes constituyen un material ajeno al organismo, y cualquier material extraño implantado es susceptible de ser colonizado por bacterias, es por ello que los implantes pueden acumular en sus superficies biofilms bacterianos, lo que, puede ser crucial para el desarrollo de las enfermedades periimplantarias y puede producir alteraciones de la biocompatibilidad de la superficie de los implantes. (17)

La formación de la biopelícula puede verse afectada por las características superficiales del implante/emergente y los elementos de restauración, incluidas la rugosidad superficial, la composición química, la energía superficial y la humectabilidad. Debido a diversos estudios realizados in vitro e in vivo se ha podido afirmar que una mayor rugosidad superficial de titanio da lugar a una mayor adhesión de microorganismos y formación de biofilms. Puede explicarse el efecto de la rugosidad superficial sobre la adhesión de la biopelícula por diversos factores como el incremento del área de adhesión, la protección frente a fuerzas cortantes, y el mayor impedimento para limpiar superficies rugosas, lo que va a permitir la veloz neoformación de la película por crecimiento de especies de bacterias residentes. (1)

Existe una variedad de materiales de restauración para la fabricación de componentes de implantes como el oro, titanio, cerámica y zirconio. Ciertos estudios revelan que el uso de zirconia como material emergente de implantes presentó una baja acumulación de biopelícula cuando se usó dentro de la cavidad bucal. (1)

En función de la rugosidad de la superficie del implante se pueden encontrar tres niveles según una escala de tamaño: macro, micro y nano. (18)

El nivel macro presenta un rango de milímetros a decenas de micras, dicha escala se relaciona de forma directa con la geometría de los implantes, con el tornillo de rosca y con tratamientos de superficie macroporosa, produciendo una rugosidad superficial mayor de 10 nm. La alta porosidad ofrece un engranaje mecánico entre la superficie del implante y el nuevo hueso. Sin embargo, la elevada rugosidad puede derivar en un mayor riesgo de periimplantitis. (18) El nivel microtopográfico presenta una rugosidad de superficie dentro de un rango de entre 1 a 10 nm, lo que maximiza el engranaje entre la superficie del implante y el hueso mineralizado. El perfil nanométrico aporta un papel destacado en adsorción de proteínas, adhesión de osteoblastos y, como consecuencia, en la osteointegración. (18)

La finalidad de modificar la superficie del implante es influir positivamente en la respuesta tisular del huésped con respecto al implante. Los métodos de modificación de la superficie pueden clasificarse en dos procesos: sustractivos o aditivos. (19) En concreto, los métodos sustractivos son aquellos que eliminan material de la superficie implantaria, como son, la técnica de voladura, grabado ácido, o técnica oxidativa; mientras que los métodos aditivos se basan en la adicción de material, como, por ejemplo, la pulverización de plasma de titanio. (19)

Las superficies de los implantes rugosas o que están tratadas (como por ejemplo las arenadas o grabadas) proporcionan un incremento en la adhesión y proliferación celular, fundamentalmente en la actividad de los osteoblastos que producen un número más alto de proteínas morfogenéticas que aceleran la respuesta celular biológica. (20)

Tras la colocación del implante se produce una interacción con células y proteínas que está influenciada por la superficie del implante. La mayoría de los tratamientos que se aplican a las superficies de los implantes mejoran la actividad de las células formadoras de hueso y sus

mediadores, logran tanto proporcionar un aumento de la formación de hueso nuevo como promover la osteointegración y mayor estabilidad secundaria del implante. (21) La superficie microestructurada de los implantes ha mostrado ventajas para la formación ósea, además de la microtopografía, ciertos factores biofísicos como la química de la superficie, la carga superficial o la humectabilidad también son factores influyentes en la formación de hueso. (21) El recubrimiento de las superficies de los implantes con componentes biológicos como proteínas de la matriz extracelular, péptidos, factores de crecimiento, lípidos, etc., pueden favorecer aún más la osteointegración. (21) El revestimiento de un implante ideal debe tener propiedades osteointegrativas como antibacterianas. Existen diferentes tipos de recubrimientos superficiales de implantes que pueden contener plata, cobre, fluoruro, zinc, o clorhexidina y antibióticos como la gentamicina, cefalotina, amoxicilina, etc., los cuales han sido probados para proporcionar propiedades antibacterianas.(22)

1.7. Conexión implante-pilar:

Existen diferentes sistemas de restauraciones implantosoportadas, pero no todos ellos consiguen niveles óptimos de ajuste en la interfaz implante-pilar, obtener dicho ajuste de forma perfecta es complicado ya que a lo largo de todo el proceso de fabricación suelen aparecer desajustes de cientos de micras. Los valores aceptables se encuentran por debajo de 150 µm. (23)

Pueden generarse elevados niveles de tensión en la unión hueso-implante debido a los desajustes en las restauraciones de los implantes, pudiendo con ello afectar la osteointegración del implante y ocasionar complicaciones biológicas y mecánicas, como, por ejemplo, aflojamiento de tornillos, fractura de tornillos, resorción ósea, etc. (24)

El diseño macroscópico del implante está fundamentalmente diseñado para conseguir una adecuada estabilidad primaria en la cirugía con un torque favorable de inserción, para mantener a largo plazo el hueso periimplantario y favorecer la adaptación a los diferentes casos clínicos en sus opciones de edentulismo total o parcial. Con el paso del tiempo la macrogeometría de los implantes se ha ido modificando de forma continua con el fin de adaptarse y poder mejorar procedimientos clínicos nuevos como los implantes postextracción, la carga inmediata o precoz, o presencia de hueso poco favorable en densidad y volumen. En la actualidad, los mejores resultados a nivel clínico y la obtención de buenas propiedades biomecánicas se logran gracias a una macrogeometría roscada con forma de raíz dentaria. (20)

Tanto la plataforma del implante como la conexión prostodóncica son determinantes para el diseño del implante. La plataforma tiene influencia sobre la fase quirúrgica, y anchura biológica, debido a que es un área en la que se concentra alta cantidad de estrés mecánico, y consecuentemente influye sobre la prótesis. Así, la plataforma del implante debería ser levemente mayor que el calibre externo de la rosca del cuerpo del implante dental. De esta forma se consigue cerrar de manera completa la osteotomía que se ha realizado y actúa como barrera para el paso de bacterias o tejido fibroso en el proceso de cicatrización inicial, que favorece la estabilidad inicial. (20)

La conexión interna, comparada con la conexión externa, produce una mejora de la estabilidad mecánica. Además, al adoptar la forma de cambio de plataforma por parte de la conexión interna, la distribución de la tensión del implante es reducida ya que contribuye a alejar el microgap (el microgap es “una fisura” que se presenta en la unión del implante con el pilar)

del tejido óseo periimplantario y a conservarlo. También aporta disminución del aflojamiento o fractura del tornillo, las microfiltraciones, los micromovimientos y la pérdida ósea. (25)

Es fundamental para el éxito a largo plazo del tratamiento con implantes dentales la estabilidad ósea y de los tejidos blandos periimplantarios. Mantener la altura ósea crestal aumenta el éxito y la supervivencia de los implantes dentales a largo plazo. El cambio de plataforma puede colaborar en la disminución de fuerzas oclusales y aumentar la altura de la mucosa de inserción reduciendo la inflamación de los tejidos blandos de alrededor del implante con una disminución de reabsorción ósea y mucositis. (20)

El término platform switching o plataforma reducida se basa en utilizar un pilar de menos diámetro que el de la plataforma del implante dental, su principal objetivo es la preservación del nivel de hueso crestal periimplantario, con las consecuentes ventajas estéticas en el sector anterior. La preservación ósea alrededor del implante, sobre todo en frente anterior, es crucial, debido a que permite el soporte de tejidos blandos preservando la integridad de la papila, y, en consecuencia, una mejor estética. (20)

Figura 2. Implante con platform switching o plataforma reducida. (20)

Las restauraciones cementadas son menos críticas que las restauraciones atornilladas en términos de ajuste porque el agente cementante disminuye la tensión en el complejo de la prótesis del implante. (23)

En los implantes unitarios se debe cumplir el propósito de antirrotación ya que presentan más dificultades de retención las restauraciones de un solo diente mediante implantes. (23)

Cabe destacar que el diseño de conexión cónica consigue mejor ajuste protésico por su fricción. En aquellas áreas de demanda estética esta conexión aporta mayor estabilidad a los tejidos periimplantarios, especialmente en biotipos de encías delgadas. (23)

Al utilizar un pilar cónico no hay micromovimiento (siempre y cuando se cumplan todos los parámetros de autobloqueo cónico, que incluyen: el ángulo del cono, la longitud de la superficie cónica, fabricación), por tanto, se evita la microfiltración y el daño mecánico que dan lugar a la pérdida ósea crestal en torno al cuello del implante. (23)

1.8. Oclusión:

Cabe destacar que aportar una oclusión correctamente controlada y mantenida en prótesis sobre implantes puede proporcionar la reducción de complicaciones biológicas y mecánicas, consiguiendo ampliar su longevidad en el tiempo. (26)

Las complicaciones pueden ser mecánicas como fallos biomecánicos del implante, o biológicas como perder hueso marginal o incluso perder completamente la osteointegración, añadiendo de ese modo la acumulación de bacterias anaerobias, lo que deriva en enfermedad periimplantaria. Todo ello por una incorrecta oclusión que causa la sobrecarga oclusal. (26)

(27) A diferencia de los dientes naturales los implantes no están rodeados por ligamento periodontal ni poseen receptores periodontales (26), se conectan al hueso por medio de osteointegración, la llamada anquilosis funcional (27), dado el caso, tienen mayor susceptibilidad a sobrecargas oclusales, ya que presentan menor habilidad de soporte de carga, menor adaptación a fuerzas oclusales y menor mecanorrecepción. (26)

Hay una serie de principios que deben ser aplicados en la oclusión de prótesis sobre implantes, como son: la dirección de las cargas oclusales, éstas deben ser axiales, lo que aporta compresión deseada y menor daño en la interfase hueso-implante (26), y no crear fuerzas no axiales, laterales u horizontales (27), que provocan incremento de fuerzas de tracción más dañinas a nivel de la unión hueso-implante, concretamente al hueso periimplantario marginal o crestal. Otro principio es evitar contactos oclusales prematuros para que no aparezcan sobrecargas en implantes. Por otro lado, el último principio de la oclusión que se debe tener en cuenta es la anchura oclusal en sector posterior, que se sugiere reducirla en un 30-40% en región molar ya que si no se realiza pueden producirse voladizos y flexión eventual. (26)

1.9. Historia clínica y diagnóstico:

El diagnóstico de la periimplantitis es fundamental para la prevención y manejo adecuado de las complicaciones biológicas como la pérdida ósea. Las revisiones rutinarias y regulares de los pacientes con implantes dentales son recomendadas en la actualidad y suponen una mejora del mantenimiento de la salud periodontal. Si se detectan complicaciones biológicas en etapas tempranas y reversibles se interceptará o prevendrá la progresión de las complicaciones biológicas periimplantarias. (28)

En primer lugar, es fundamental recopilar datos de la historia clínica mediante una anamnesis detallada debido a que facilita el diagnóstico de la enfermedad. Ciertos datos resultan

significativos y permiten ser relacionados con la periimplantitis, algunos siendo incluso factores de riesgo. (8)

Los hábitos, como el consumo de tabaco, pueden aumentar la tasa de fracaso del implante, la incidencia de infecciones postoperatorias y la pérdida de hueso marginal. (29) Las enfermedades sistémicas o la toma de fármacos también pueden influir, cabe destacar la diabetes como afectación sistémica, asociada a un mayor riesgo de periimplantitis (15) y los bifosfonatos como fármacos que pueden causar osteonecrosis en ciertos casos. (30) También se puede incluir la historia de periodontitis previa como factor de riesgo, debido a la asociación entre periodontitis crónica y una mayor prevalencia de periimplantitis en comparación con pacientes con periodonto sano. (31) La incorrecta higiene oral y escaso control de placa bacteriana da lugar a un incremento de bacterias que pueden causar la periimplantitis. (8)

Otros aspectos a tener en cuenta dentro de la historia clínica son el número de implantes colocados y la conexión que poseen, el tipo de implante, si se encuentra en mandíbula o en maxilar, y si es anterior o posterior. Asimismo, sería conveniente conocer la fecha de colocación, tipo de carga del implante, tipo de prótesis, etc. (13) (14) (20)

Es posible que ciertos datos no lo sepan con exactitud los pacientes por lo que si se posee una historia clínica previa se analizará, y además se tratará de contrastar en boca con la exploración. (8) (13)

A continuación, seguido de la anamnesis se procede a realizar una exploración minuciosa de la cavidad oral para evaluar el biotipo de encía, el estado de los dientes remanentes, los implantes y la rehabilitación protésica. (1)

La exploración radiológica completa la información disponible y ayuda en el diagnóstico. (13)

Los parámetros clave que deben tenerse en cuenta para el diagnóstico de la periimplantitis son: presencia de signos de inflamación alrededor del implante, evidencia radiográfica de pérdida ósea mayor o igual a 3 mm, profundidad de sondaje mayor o igual a 6 mm (32), sangrado durante el sondaje (0,15 Ncm) (31). Se debe señalar que el sangrado durante el sondaje no siempre implica periimplantitis, pudiéndose corresponder con falso positivo. Por ello, tiene mayor fiabilidad el uso de índices no dicotómicos que permitan conocer el registro de la extensión y profusión de sangrado en vez de indicar solamente la presencia/ausencia. (31)

Figura 3. Imagen de un caso de periimplantitis con un sondaje de bolsa ≥ 6 mm y presencia de sangrado. (28)

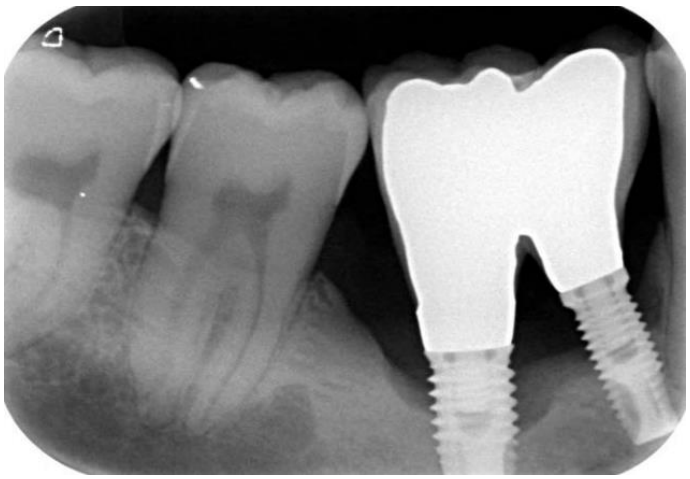

Figura 4. Radiografía periapical de periimplantitis con pérdida ósea ≥ 3 mm. (28)

OBJETIVOS:

Objetivo principal:

- Definir el concepto de periimplantitis y cómo se lleva a cabo su diagnóstico.

Objetivos secundarios:

- Analizar los factores de riesgo que puedan causar la enfermedad, y las complicaciones de la misma.
- Conocer las distintas posibilidades de tratamiento de periimplantitis.

METODOLOGÍA:

Se procedió a realizar una búsqueda bibliográfica en la base de datos de recursos digitales como Medline, Pubmed, y Scielo.

Se introdujeron **las palabras clave:**

Anatomía oral, periodontitis, periimplantitis, epidemiología periimplantaria, incidencia periimplantaria, causas periimplantitis, factores de riesgo, historia clínica, superficie implante, diagnóstico, complicaciones, tratamiento periimplantario, biofilm, conexión del implante, oclusión, antibióticos, antisépticos, tratamiento no quirúrgico periimplantario, tratamiento quirúrgico periimplantario, láser.

Key words:

Oral anatomy, periodontitis, peri-implantitis, peri-implant epidemiology, peri-implant incidence, causes peri-implantitis, risk factors, clinical history, surface implant, diagnosis, complications, peri-implant treatment, biofilm, implant connection, occlusion, antibiotics, antiseptic, non-surgical peri-implant treatment, surgical peri-implant treatment, laser.

Para la redacción de la introducción se usaron varios libros ya que en dicho apartado predomina la fundamentación teórica, por dicho motivo, la fecha de los libros no sigue el criterio de inclusión de la fecha que cumplen los artículos.

LIBRO	AUTORES	FECHA
1. Periodontología Clínica e Implantología Odontológica.	Lindhe J, Karring T, Lang N.	2005
2. Anatomía, fisiología y oclusión dental.	Nelson SJ, Manzanares Céspedes MC, Bascones Martínez A, Wheeler RC.	2015
3. Temas clave biología celular e histología.	Gartner LP, Hiatt JL, Strum JM, Vigo Anglada M.	2007
4. Practical Periodontal Diagnosis and Treatment Planning.	Dibart S, Dietrich T.	2009
5. A Clinician's Guide to Systemic Effects of Periodontal Diseases.	Craig RG, Kamer AR.	2016
6. Pathogenesis of Periodontal Diseases: Biological Concepts for Clinicians.	Bostanci N, Belibasakis GN.	2018

Criterios de inclusión:

- Se seleccionaron artículos científicos con reciente fecha de publicación, acotando la búsqueda a aquellos publicados desde el año 2015 al 2021.

- Se eligieron aquellos artículos de revisiones sistemáticas y metaanálisis que presentan resultados estadísticamente significativos, y con un número de artículos comparados razonable para obtener dichos resultados y llegar a conclusiones lógicas.
- Cabe destacar que los resultados de ciertas revisiones sistemáticas como son las que tratan la eficacia del láser, la fotodinámica, el uso de probióticos, entre otros, no son concluyentes, y por eso se explica que son necesarios más estudios para llegar a conclusiones certeras y exactas, dichos artículos son de actualidad según su año de publicación por lo tanto no quedan obsoletos.
- Se escogieron aquellos artículos que presentaron un tamaño muestral significativo.

Criterios de exclusión:

- Se excluyeron artículos con fecha de publicación anterior a 2015.
- Se descartaron artículos cuyos resultados no fueron estadísticamente significativos, exceptuando lo anteriormente nombrado sobre la terapia con láser, etc.
- Se rechazaron aquellos artículos con tamaño muestral pequeño o poco significativo.

	Año	Tipo de artículo	Revista	Tamaño de muestra/artículos.
7. Ji S, Choi YS, Choi Y. Bacterial invasion and persistence: Critical events in the pathogenesis of periodontitis?	2015	Artículo de revisión.	J Periodontal Res.	176 artículos.

8. García Calderón AG, Donohue Cornejo AM, Cuevas González V, Ávila Valdéz R, Cuevas González JC. Periimplantitis: Revisión de la Literatura.	2016	Revisión de la literatura.	Int J Odontostomat.	31 artículos.
9. Romanos GE, Javed F, Delgado-Ruiz RA, Calvo-Guirado JL. Peri-implant diseases: A review of treatment interventions.	2015	Artículo de revisión.	Dent Clin North Am.	160 artículos.
10. Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis.	2018	Revisión de la literatura.	J Periodontol.	167 artículos.
11. Salvi GE, Cosgarea R, Sculean A. Prevalence of Periimplant Diseases.	2019	Revisión de la literatura.	Implant Dent.	28 artículos.
12. Krebs M, Kesar N, Begić A, von Krockow N, Nentwig GH, Weigl P. Incidence and prevalence of peri-implantitis and peri-	2019	Estudio clínico restrospectivo.	Clin Implant Dent Relat Res.	274 implantes. 17 a 23 años después de la colocación del implante.

implant mucositis 17 to 23 (18.9) years postimplant placement.				
13. Segura Andrés G, Gil Pulido R, Vicente González F, Ferreiroa Navarro A, Faus López J, Agustín Panadero R. Periimplantitis y mucositis periimplantaria: factores de riesgo, diagnóstico y tratamiento.	2015	Revisión bibliográfica.	Av en Periodoncia e Implantol Oral.	58 artículos.
14. Manicone PF, Passarelli PC, Bigagnoli S, Pastorino R, Manni A, Pasquantonio G, et al. Clinical and radiographic assessment of implant-supported rehabilitation of partial and complete edentulism: A 2 to 8 years clinical follow-up.	2018	Seguimiento clínico.	Eur Rev Med Pharmacol Sci.	75 pacientes. 156 implantes.

15. Monje A, Catena A, Borgnakke WS. Association between diabetes mellitus/hyperglycaemia and peri-implant diseases: Systematic review and meta-analysis.	2017	Revisión sistemática y metaanálisis.	J Clin Periodontol.	57 artículos. Finalmente 7 estudios incluidos en la síntesis cuantitativa (metaanálisis).
16. Canullo L, Peñarrocha-Oltra D, Covani U, Botticelli D, Serino G, Penarrocha M. Clinical and microbiological findings in patients with peri-implantitis: A cross-sectional study.	2016	Estudio clínico transversal.	Clin Oral Implants Res.	534 pacientes.
17. Fernández Vidal E. Modelo de biofilm bacteriano in vitro : evaluación en superficies de implantes y comparación de agentes antimicrobianos.	2018	Trabajo de investigación (tesis).	Universidad complutense de Madrid.	125 artículos.

18. Oteo Morilla S, Bascones Martínez A. Influencia de las diferentes superficies de implantes en la periimplantitis.	2017	Revisión de la literatura.	Av en Periodoncia e Implantol Oral.	40 artículos.
19. De Bruyn H, Christiaens V, Doornewaard R, Jacobsson M, Cosyn J, Jacquet W, et al. Implant surface roughness and patient factors on long-term peri-implant bone loss.	2017	Revisión de la literatura.	Periodontol 2000.	55 artículos.
20. Bish González M, Ortiz García I, Jiménez Guerra A, Monsalve Guil L, Moreno Muñoz J, Núñez Márquez E, et al. La respuesta tisular a implantes dentales con plataforma reducida (platform switching).	2020	Revisión de la literatura.	Av Odontoestomatol.	43 artículos.

21. Jenny G, Jauernik J, Bierbaum S, Bigler M, Grätz KW, Rücker M, et al. A systematic review and meta-analysis on the influence of biological implant surface coatings on periimplant bone formation.	2016	Revisión sistemática y metaanálisis.	J Biomed Mater Res.	19 estudios elegibles. 43 artículos.
22. Kulkarni Aranya A, Pushalkar S, Zhao M, LeGeros RZ, Zhang Y, Saxena D. Antibacterial and bioactive coatings on titanium implant surfaces.	2017	Revisión de la literatura.	J Biomed Mater Res.	48 artículos.
23. Camós Tena R, Escuin Henar T, Torné Duran S. Conical connection adjustment in prosthetic abutments obtained by different techniques.	2019	Estudio clínico.	J Clin Exp Dent.	15 implantes de conexión interna.

24. Recio Sánchez A. Complicaciones biomecánicas de los implantes: fractura y aflojamiento de tornillos.	2018	Trabajo de fin de grado. Revisión bibliográfica.	Universidad de Sevilla.	56 artículos.
25. Liu Y, Wang J. Influences of microgap and micromotion of implant–abutment interface on marginal bone loss around implant neck.	2017	Revisión de la literatura.	Arch Oral Biol.	83 artículos.
26. García Ayarzagüena Y. La importancia de la oclusión sobre la prótesis implantosoportada.	2017	Revisión de la literatura.	Universidad de Salamanca.	38 artículos.
27. Sheridan RA, Decker AM, Plonka AB, Wang HL. The Role of Occlusion in Implant Therapy: A Comprehensive Updated Review.	2016	Revisión de actualización completa.	Implant Dent.	122 artículos.

28. Hirooka H, Renvert S. Diagnosis of Periimplant Disease.	2019	Revisión de la literatura.	Implant Dent.	31 artículos.
29. Ramos Chrcanovic B, Albrektsson T, Wennerberg A. Smoking and dental implants: A systematic review and meta-analysis.	2015	Revisión sistemática y metaanálisis.	J Dent.	107 artículos elegibles.
30. Chaurand-Lara J, Pacheco-Ruiz L, Trejo-Campos JL, Facio-Umaña JA, Mora-Pérez J. Incidence of osteonecrosis of the jaw by the use of osteoclast inhibitors in patients with bone metastases: A retrospective cohort study.	2019	Estudio de cohorte retrospectivo.	Cir Cir.	802 pacientes que recibieron bifosfonatos.
31. Monje A, Amerio E, Vilarrasa J, Sanz-martín I, Nart J. Periimplantitis:	2020	Artículo de revisión.	Periodoncia clínica.	55 artículos.

diagnóstico y factores asociados a la patología.				
32. Rokaya D, Srimaneepong V, Wisitrasameewon W, Humagain M, Thunyakitpisal P. Peri-implantitis Update: Risk Indicators, Diagnosis, and Treatment.	2020	Artículo de actualización.	Eur J Dent.	90 artículos.
33. Hu C, Lang NP, Ann Ong MM, Lim LP, Tan WC. Influence of periodontal maintenance and periodontitis susceptibility on implant success: A 5-year retrospective cohort on moderately rough surfaced implants.	2020	Estudio de cohorte retrospectivo.	Clin Oral Implants Res.	200 pacientes. 289 implantes.
34. Sgolastra F, Petrucci A, Severino M, Gatto R, Monaco A. Periodontitis,	2015	Metaanálisis.	Clin Oral Implants Res.	Selección de 16 estudios. 49 artículos.

implant loss and peri-implantitis: A meta-analysis.				
35. Arunyanak SP, Sophon N, Tangsathian T, Supanimitkul K, Suwanwichit T, Kungsadalpipob K. The effect of factors related to periodontal status toward peri-implantitis.	2019	Estudio transversal.	Clin Oral Implants Res.	200 pacientes.
36. Canullo L, Peñarrocha Oltra D, Covani U, Rossetti P. Microbiologic and Clinical Findings of Implants in Healthy Condition and with Peri-Implantitis.	2015	Estudio transversal.	Int J Oral Maxillofac Implants.	110 pacientes. 235 implantes.
37. Zhou Y, Gao J, Luo L, Wang Y. Does Bruxism Contribute to Dental Implant Failure? A	2016	Revisión sistemática y metaanálisis.	Clin Implant Dent Relat Res.	7 estudios de cohorte fueron analizados. 60 artículos.

Systematic Review and Meta-Analysis.				
38. Isler SC, Uraz A, Kaymaz O, Cetiner D. An evaluation of the relationship between peri-implant soft tissue biotype and the severity of peri-implantitis: A cross-sectional study.	2019	Estudio transversal.	Int J Oral Maxillofac Implant.	87 pacientes. 229 implantes.
39. Dalago HR, Schuldt Filho G, Pessoa Rogrigues MA, Renvert S, Bianchini MA. Risk indicators for Peri-implantitis. A cross-sectional study with 916 implants.	2017	Estudio transversal.	Clin Oral Impl Res.	916 implantes.
40. Romandini M, Lima C, Pedrinaci I, Araoz A, Soldini MC, Sanz M. Prevalence and risk/protective indicators of peri-implant diseases : A university-	2021	Estudio transversal.	Clin Oral Implants Res.	99 pacientes. 458 implantes.

representative cross-sectional study.				
41. Daubert DM, Weinstein BF, Bordin S, Leroux BG, Flemmig TF. Prevalence and Predictive Factors for Peri-Implant Disease and Implant Failure: A Cross-Sectional Analysis.	2015	Estudio transversal.	J Periodontol.	96 pacientes. 225 implantes.
42. Gürlek Ö, Gümüş P, Buduneli N. Smokers have a higher risk of inflammatory peri-implant disease than non-smokers.	2018	Estudio trasnversal.	Oral Dis.	142 implantes (74 en no fumadores; 68 en fumadores). 43 pacientes.
43. Naval Gías L, Rodriguez Campo F, Naval Parra B, Sastre Pérez J. Pathological mandibular fracture: A severe complication of periimplantitis.	2015	Reporte de un caso.	J Clin Exp Dent.	3 casos clínicos.

44. Froum SJ, Hengjeerajaras P, Liu K-Y, Maketone P, Patel V, Shi Y. The Link Between Periodontitis/Peri-implantitis and Cardiovascular Disease: A Systematic Literature Review.	2020	Revisión sistemática de la literatura.	Int J Periodontics Restorative Dent.	51 artículos incluidos.
45. Ustaoğlu G, Erdal E. Relationship between risk markers for cardiovascular disease and peri-implant diseases.	2020	Estudio transversal.	Int J Implant Dent.	126 pacientes.
46. Papi P, Letizia C, Pilloni A, Petramala L, Saracino V, Rosella D, et al. Peri-implant diseases and metabolic syndrome components: A systematic review.	2018	Revisión sistemática.	Eur Rev Med Pharmacol Sci.	63 artículos. 6 estudios incluidos para análisis cualitativo.

47. Hentenaar DFM, De Waal YCM, Van Winkelhoff AJ, Meijer HJA, Raghoebar GM. Non-surgical peri-implantitis treatment using a pocket irrigator device; clinical, microbiological, radiographical and patient-centred outcomes—A pilot study.	2020	Estudio retrospectivo, estudio piloto.	Int J Dent Hyg.	24 pacientes.
48. Renvert S, Hirooka H, Polyzois I, Kelekis-Cholakis A, Wang HL. Diagnosis and non-surgical treatment of peri-implant diseases and maintenance care of patients with dental implants – Consensus report of working group 3.	2019	Informe de consenso.	Int Dent J.	11 artículos.
49. Mayer Y, Ginesin O, Horwitz J. A nonsurgical treatment of peri-	2020	Estudio de seguimiento durante 1 año.	Clin Exp Dent Res.	69 pacientes. 106 implantes.

implantitis using mechanic, antiseptic and anti-inflammatory treatment: 1 year follow-up.				
50. Schwarz F, Schmucker A, Becker J. Efficacy of alternative or adjunctive measures to conventional treatment of peri-implant mucositis and peri-implantitis: a systematic review and meta-analysis.	2015	Revisión sistemática y metaanálisis.	Int J Implant Dent.	40 publicaciones incluidas para análisis cualitativo y cuantitativo. 79 artículos.
51. Heo SJ, Kim HJ, Joo JY, Lee J, Kim SJ, Choi J. Simplified nonsurgical treatment of peri-implantitis using chlorhexidine and minocycline hydrochloride.	2018	Estudio clínico retrospectivo.	J Periodontal Implant Sci.	20 pacientes. 45 implantes.

52. John G, Sahm N, Becker J, Schwarz F. Nonsurgical treatment of peri-implantitis using an air-abrasive device or mechanical debridement and local application of chlorhexidine. Twelve-month follow-up of a prospective, randomized, controlled clinical study.	2015	Estudio clínico prospectivo, randomizado.	Clin Oral Investig.	25 pacientes.
53. Schwarz F, Becker K, Renvert S. Efficacy of air polishing for the non-surgical treatment of peri-implant diseases: A systematic review.	2015	Revisión sistemática y metaanálisis.	J Clin Periodontol.	5 estudios con criterios de inclusión deseados. 33 artículos.
54. Awad Shibli J, Sanchez Ferrari D, Shinoske Siroma R, De Figueiredo LC, De Faveri M, Feres M. Microbiological and clinical	2019	Estudio restrospectivo.	Braz Oral Res.	24 pacientes. 36 implantes.

effects of adjunctive systemic metronidazole and amoxicillin in the non-surgical treatment of peri-implantitis: 1 year follow-up.				
55. Laleman I, Pauwels M, Quirynen M, Teughels W. The usage of a lactobacilli probiotic in the non-surgical therapy of peri-implantitis: A randomized pilot study.	2020	Estudio piloto aleatorizado.	Clin Oral Implants Res.	19 pacientes analizados.
56. Mattar H, Bahgat M, Ezzat A, Bahaa El-Din B, Keraa K, El Taftazany I. Management of peri-implantitis using a diode laser (810 nm) vs conventional treatment: a systematic review.	2021	Revisión sistemática.	Lasers Med Sci.	44 estudios, finalmente 3 elegibles.

57. Lerario F, Roncati M, Gariffo A, Attorresi E, Lucchese A, Galanakis A, et al. Non-surgical periodontal treatment of peri-implant diseases with the adjunctive use of diode laser: preliminary clinical study.	2016	Estudio clínico preliminar.	Lasers Med Sci.	27 pacientes.
58. Khan A, Goyal A, Currell SD, Sharma D. Management of Peri-Implantitis Lesions without the Use of Systemic Antibiotics: A Systematic Review.	2020	Revisión sistemática.	Dent J.	66 artículos. 11 estudios con los criterios de inclusión.
59. Chambrone L, Wang HL, Romanos GE. Antimicrobial photodynamic therapy for the treatment of periodontitis and peri-	2018	Revisión de la bibliografía.	J Periodontol.	60 artículos. 26 estudios incluidos en la revisión.

implantitis: An American Academy of Periodontology best evidence review.				
60. Silva Fraga R, Azeredo Alves Antunes L, Fernandes da Costa Fontes KB, Calvano Küchler E, Lopes Pontes Póvoa Iorio N, Santos Antunes L. Is Antimicrobial Photodynamic Therapy Effective for Microbial Load Reduction in Peri-implantitis Treatment? A Systematic Review and Meta-Analysis.	2018	Revisión sistemática y metaanálisis.	Photochem Photobiol.	3 estudios incluidos. 29 artículos.
61. Hallström H, Persson GR, Lindgren S, Renvert S. Open flap debridement of peri-implantitis with or without	2017	Ensayo clínico randomizado.	J Clin Periodontol.	31 pacientes.

adjunctive systemic antibiotics: A randomized clinical trial.				

DISCUSIÓN

La rehabilitación con implantes dentales presenta una gran demanda en los últimos años, este incremento en la utilización de implantes supone que también aumente el número de fracasos de estos, dando lugar a complicaciones como son las enfermedades periimplantarias. (8)

Cabe destacar que la prevalencia de la periimplantitis representa un tema controvertido, ya que con el tiempo se ha ido informando de una amplia variedad de prevalencias de las enfermedades periimplantarias. Según la literatura los rangos medios ponderados y las prevalencias estimadas basadas en sujetos ascienden al 43% (con un rango de entre 19 a 65%) para la mucositis periimplantaria, y al 22% (con un rango de entre 1% a 47%) en el caso de la periimplantitis. (11)

4.1. Causas de la periimplantitis.

Según un estudio restrospectivo con un período de seguimiento medio de 6,8 años, los cuidados de mantenimiento periodontal regular están asociados a una menor prevalencia de periimplantitis y pérdida de hueso periimplantario. En dicho estudio se seleccionaron a 200 pacientes los cuales fueron tratados con implantes dentales. 100 pacientes presentaban mantenimiento periodontal regular y los otros 100 carecían de documentación de mantenimiento periodontal. La periimplantitis fue definida como sangrado al sondaje, aumento de la profundidad de sondaje y pérdida ósea periimplantaria ≥ 0,5 mm. Cinco implantes de 289 se perdieron, el 6% de los pacientes con mantenimiento periodontal regular presentaban periimplantitis, y en el grupo que carecía de documentación de mantenimiento periodontal 20% tenía periimplantitis. En el primer grupo únicamente 1 implante mostró pérdida ósea mayor o igual a 2 mm, sin embargo, en el segundo grupo 13 implantes mostraron

esa pérdida ósea. Por tanto, se puede contrastar con este artículo que la ausencia de mantenimiento regular se asocia de manera significativa con la periimplantitis. (33)

La periodontitis preexistente es considerada como un factor de riesgo para la periimplantitis. Sgolastra F. y colaboradores mediante los resultados de su metaánalisis, confirman con un fuerte nivel de evidencia, la hipótesis de que la enfermedad periodontal aumenta el riesgo de periimplantitis y la pérdida de los implantes dentales, y, que la enfermedad periodontal se relaciona con una mayor pérdida de hueso alrededor del implante dental. El riesgo es más elevado para pacientes con periodontitis agresiva en comparación con aquellos pacientes que presentan periodontitis crónica. Además, dentro del grupo de pacientes con periodontitis crónica, aquellos que presentan periodontitis grave tienen mayor riesgo de pérdida del implante. Los pacientes con periodontitis moderada tienen un riesgo mayor, pero no tan significativo. (34)

El estudio transversal realizado por Arunyanak SP. y cols., trata de evaluar 200 pacientes con implantes durante sus visitas de mantenimiento periodontal, a través de exámenes radiográficos y clínicos. Los resultados muestran que los pacientes con antecedentes de periodontitis crónica tienen significativamente mayor prevalencia de periimplantitis que aquellos sin historial anterior de enfermedad periodontal, en concreto 25% frente a 10,9%. De acuerdo con el metaanálisis anterior nombrado, se afirma que pacientes con antecedentes de periodontitis crónica grave tienen mayor prevalencia de periimplantitis. El estado de salud periimplantario está asociado significativamente con el anterior estado periodontal del paciente, el estado del mantenimiento, y el actual estado periodontal. (35)

Con respecto a la presencia de bacterias, un estudio transversal incluyó dos grupos de pacientes con implantes, uno con condiciones saludables y otro con periimplantitis. En él se

compararon parámetros clínicos y composición microbiológica en tres zonas: surco periimplantario, en el interior de la conexión del implante y en el surco gingival de dientes adyacentes. Las especies del complejo naranja (*P. intermedia, F. nucleatum, P. micros)* fueron las bacterias más prevalentes en las tres zonas estudiadas para los dos grupos, y la prevalencia bacteriana fue mayor para el grupo de periimplantitis. Además, hubo diferencias microbiológicas en los grupos, donde la carga bacteriana fue más elevada dentro de la conexión del implante que en el surco periimplantario, resultando la conexión un potencial reservorio microbiano para desarrollar enfermedades periimplantarias. Cabe resaltar que presentaban bruxismo sólo un 2% de sujetos en el grupo de implantes sanos, mientras que en el grupo de periimplantitis el 68% presentaba bruxismo, por tanto, existe una diferencia estadísticamente significativa, suponiendo un factor de riesgo que afecta a la salud periimplantaria. (36)

La sobrecarga oclusal de los implantes dentales puede dar lugar a una serie de complicaciones como es la pérdida ósea marginal o incluso interfiriendo negativamente en la osteointegración del implante. Por ello es fundamental que se realice un buen diagnóstico y plan de tratamiento que conlleve el establecimiento de un buen soporte, la individualización de factores de fuerza, prótesis que presenten ajuste de forma pasiva, y una retención y forma correctas, asimismo, sería ideal un sistema que incluya cargas de manera progresiva para poder reducir tensiones que se sitúen por encima de límites fisiológicos. (26)

El bruxismo constituye una importante causa de sobrecarga oclusal para los implantes dentales. El metaanálisis realizado por Zhou Y. y colaboradores trató de comprobar si es cierto que el bruxismo contribuye al fracaso de los implantes dentales. Se pudo llegar a la conclusión de que las prótesis en pacientes bruxistas tienen una tasa más elevada de fallos que aquellas

que portan pacientes no bruxistas. El bruxismo puede contribuir a la aparición de complicaciones biológicas o técnicas de los implantes y producir su fracaso, entre las complicaciones se encuentran la periimplantitis o la rotura de la porcelana de la prótesis. (37) El biotipo de encía fino aumenta la probabilidad de ser más propenso a la periimplantitis. Así se indica en un estudio transversal en el que se estudiaron 87 pacientes con un total de 229 implantes con periimplantitis. Los valores clínicos de sangrado gingival, recesión gingival/mucosa, nivel de inserción clínica y pérdida ósea marginal fueron significativamente más favorables en el grupo de encía gruesa en comparación con el grupo de biotipo fino. No hubo diferencias en dichos grupos para valores de profundidad de sondaje e índice de placa. (38) El objetivo de otro estudio transversal, en el cual se incluyeron 183 pacientes tratados con 916 implantes de titanio osteointegrados durante al menos 1 año de funcionamiento, fue identificar factores de riesgo sistémicos y locales que pudieran asociarse con la periimplantitis. (39) Además, se estudió la prevalencia de periimplantitis, que fue del 16,4% para pacientes y del 7,3% para los implantes, dichas cifras se encuentran dentro del rango descrito al principio de la discusión. Gracias a los resultados obtenidos se pudo concretar que aquellos pacientes con antecedentes de enfermedad periodontal presentan un aumento del riesgo de tener periimplantitis (2,2 veces superior), también, hay un aumento de 3,6 veces más de riesgo en restauraciones cementadas en comparación con aquellas atornilladas, 2,4 veces más elevado el riesgo cuando se muestran facetas de desgaste en la corona protética, 16,1 veces superior en rehabilitaciones totales comparado con aquellas individuales. Sin embargo, en este estudio no se encontró relación entre las características del implante y la presencia de periimplantitis. (39)

Romandini M. y cols. en su estudio transversal evalúan la prevalencia de enfermedades periimplantarias e identifican aquellos factores de riesgo y factores protectores para la enfermedad. Se analizaron 99 pacientes examinándolos clínica y radiográficamente, el número total de implantes dentales fue 458. Con respecto a la prevalencia de periimplantitis de los sujetos estudiados, fue de 56,6% para paciente y 27,9% para implante. Como factores de riesgo para la enfermedad periimplantaria se identifican el tabaquismo, la periodontitis moderada/grave, malposición de los implantes dentales, tipo de restauración: es decir, puente en comparación con corona unitaria, y traumatismo como causa de pérdida dentaria. (40) La diabetes mellitus o hiperglucemia igualmente está asociada con un mayor riesgo de periimplantitis, así lo indican Monje A. y colaboradores en una revisión sistemática y metaanálisis. Se afirma que el riesgo de periimplantitis es aproximadamente un 50% más elevado en pacientes con diabetes que en pacientes que no presentan la condición sistémica. Cabe destacar que en aquellos pacientes no fumadores con hiperglucemia el riesgo de periimplantitis aumenta 3,39 veces más en comparación con cifras de normoglucemia. En dicho metaanálisis no se encontró una asociación estadísticamente significativa entre diabetes y mucositis periimplantaria. (15)

Por tanto, en el metaanálisis se indica que, al analizar las opciones y planificación de tratamiento con implantes dentales en pacientes con hiperglucemia/diabetes es recomendable tener en consideración ese aumento de riesgo. Se debe concienciar al paciente que probablemente se requiera un hábito de higiene bucal domiciliaria más estricto complementándolo con visitas periódicas de mantenimiento profesional para conseguir una buena retención y gran éxito del implante a largo plazo. Los autores explican que dada la relación establecida entre el nivel de glucemia y las complicaciones periimplantarias debe

advertirse a los pacientes prediabéticos que es importante conseguir y mantener un correcto control glucémico, no solo por su salud general, sino también para poder prevenir el fracaso de los implantes dentales. Destacan los autores que al excluir de los estudios a pacientes no fumadores se disminuye el sesgo debido a la importancia del hallazgo que demuestra que hay un aumento de riesgo de periimplantitis en la hiperglucemia sin ningún efecto potencial sinérgico del tabaquismo. (15) Dicho metaanálisis indica que sería interesante que además se examine el efecto en dirección opuesta, es decir, la relación bidireccional: si la colocación de los implantes dentales y las enfermedades periimplantarias pueden tener efectos sobre los niveles de glucemia. Para ello, sería necesario evaluar niveles de glucosa en sangre tanto antes como después de colocar los implantes, y a continuación llevar a cabo un control periódico mediante un estudio longitudinal para poder observar cualquier cambio de los niveles de glucemia relacionados con la colocación de implante dental y el desarrollo de las enfermedades periimplantarias. (15)

Según el estudio transversal de Daubert DM. y colaboradores, después de 11 años 1 de cada 6 implantes y 1 de cada 4 pacientes presentan periimplantitis. Se analizaron 96 pacientes con 225 implantes, y se realizó un seguimiento de los mismos durante 10,9 años. Los resultados obtenidos revelaron que la prevalencia de mucositis periimplantaria fue del 33% a nivel de implantes y 48% a nivel de pacientes, mientras que la periiimplantitis sucedió en el 16% de los implantes y en el 26% de los pacientes. En el estudio se concluye que la pérdida del implante se asocia con diabetes mellitus, colocación inmediata del implante dental, e implantes con diámetros mayores. También se sugiere que el estado periodontal y diabético del paciente puede ser útil para predecir los resultados de los implantes dentales. (41)

En cuanto al tabaco como factor de riesgo es cierto que aparece en varios estudios mostrando una fuerte asociación con la periimplantitis, un ejemplo de ello es un estudio en el que estudiaron 142 implantes, 74 de ellos en no fumadores y 68 en fumadores, los pacientes que participaron eran sanos, no presentaban ninguna condición sistémica de enfermedad, únicamente unos eran fumadores y otros no. Los resultados obtenidos afirman que en el grupo de pacientes fumadores el número de casos de periimplantitis y mucositis era significativamente mayor que en el grupo de no fumadores. Fueron significativamente más elevadas las puntuaciones de hemorragia, supuración, y placa alrededor del implante en fumadores que en no fumadores. (42)

4.2. Complicaciones de la periimplantitis.

El fracaso del implante puede dar lugar a la periimplantitis, la cual se traduce en un proceso inflamatorio que produce la afección de tejido blando y duro periimplantario. La periimplantitis conlleva la pérdida de hueso alrededor del implante, que se asocia a una profundidad de sondaje aumentada (mayor de 5 mm), sangrado gingival al sondaje y/o supuración. Dicho fracaso puede generar exudado purulento, dolor o incluso movilidad, y en ocasiones la pérdida de soporte óseo puede derivar en la pérdida del implante, así lo indican Segura AG. y cols. en su revisión de la literatura. (13)

Según un estudio de Naval Gías L. y colaboradores se consideran una complicación grave, aunque rara, las fracturas patológicas mandibulares debido a la instauración de la enfermedad periimplantaria. Pacientes con mandíbula muy atrófica o tratados con radioterapia tienen un aumento del riesgo de sufrir fracturas patológicas mandibulares. El tratamiento del cáncer mediante radioterapia ocasiona endarteritis e hipoxia siendo los tejidos irradiados más susceptibles a cualquier daño local. La periimplantitis causa pérdida ósea de soporte y

debilidad estructural mandibular, lo que puede conducir a la fractura ósea; pudiendo desencadenarse dicha fractura por un traumatismo leve o por la masticación de rutina. (43) En casos graves de periimplantitis el riesgo de fractura patológica mandibular es mayor. En ciertos casos de periimplantitis que presenten riesgo de fractura, se debe valorar la retirada temprana del implante mediante la utilización de dispositivos de contra torque. (43)

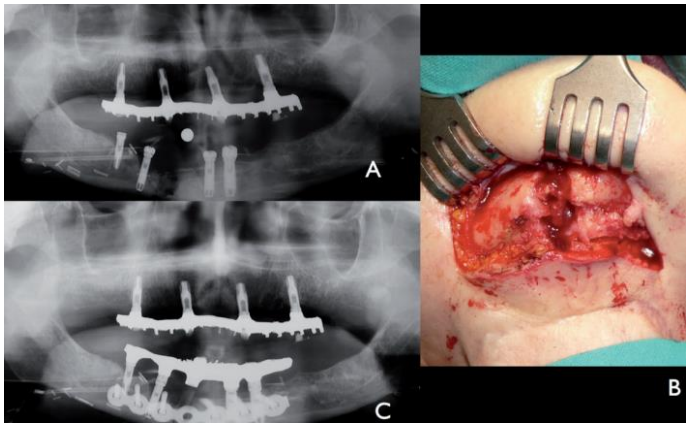

Figura 5. (A) Radiografía panorámica de un caso de fractura mandibular debido a periimplantitis. (B) Imagen extraoral de la fractura patológica. (C) Radiografía panorámica del postoperatorio. (43)

La literatura describe que existe una posible relación entre la periimplantitis y enfermedades cardiovasculares. Según ciertos estudios los pacientes con periodontitis presentan un riesgo mayor de desarrollar enfermedades cardiovasculares; la periodontitis se asocia con enfermedades como hipertensión, aterosclerosis, accidente cerebrovascular hemorrágico, accidente cerebrovascular isquémico, enfermedad coronaria. El posible motivo de la relación es que la periodontitis y la enfermedad cardiovascular presentan los mismos patógenos causantes, otro motivo puede ser el aumento de inflamación sistémica: la inflamación aumenta la concentración de citoquinas circulantes dañando a su vez el endotelio vascular y produciendo aterosclerosis. La periodontitis crónica influye a largo plazo en el desarrollo de la

enfermedad cardiovascular. El tratamiento periodontal es eficaz para disminuir los niveles de mediadores inflamatorios. La similitud que presenta la flora bacteriana de la periimplantitis y periodontitis permite explicar la relación de la enfermedad cardiovascular con la periimplantitis, además también acontece con un aumento de inflamación. Sin embargo, a pesar de que se está estudiando la asociación, no se han realizado los suficientes estudios, y, en consecuencia, no es posible sacar conclusiones exactas. La enfermedad cardiovascular debe ser considerada al menos un factor que se relaciona con la periodontitis, aunque no exista una clara relación causa-efecto. (44)

Otro estudio llevado a cabo trató de estudiar los parámetros séricos bioquímicos también considerados como marcadores de riesgo del sistema cardiovascular en pacientes tratados con implantes dentales. En el estudio se incluyeron 58 pacientes con periimplantitis, 49 sujetos con mucositis periimplantaria y 49 sujetos sanos. Los resultados revelaron que el grupo de periimplantitis obtuvo niveles más elevados de triglicéridos, ácido úrico y leucocitos, es decir, marcadores de riesgo de enfermedad cardiovascular. Niveles altos de triglicéridos y ácido úrico pueden implicar un riesgo para enfermedades periimplantarias, y, también, para enfermedades cardiovasculares. Según este estudio la asociación entre periimplantitis y enfermedad coronaria puede deberse a la elevación de lípidos plasmáticos. Existe por tanto un historial de enfermedades cardiovasculares que se relacionan con la periimplantitis, sin embargo, de acuerdo con el artículo anterior, la relación entre periimplantitis y enfermedad cardiovascular no está demostrada con claridad, hacen falta más investigaciones para poder evidenciarlo. (45)

La revisión sistemática descrita por Papi P. y colaboradores, acorde con los estudios previos nombrados de la relación entre enfermedad cardiovascular y periimplantitis, indica que las

investigaciones son insuficientes, se debe ahondar mayormente en el tema buscando resultados estadísticamente más significativos. Los estudios incluidos en la revisión eran controvertidos ya que algunos artículos no mostraron relación, mientras que otros afirmaron una significativa asociación entre periimplantitis y enfermedad cardiovascular. (46) Por otro lado, también se analizó en esta revisión sistemática la asociación entre diabetes y periimplantitis, llegando a la conclusión de que los pacientes con diabetes presentan más riesgo de desarrollar enfermedad periimplantaria que aquellos con cifras de normoglucemia. (46)

4.3. Tratamiento de la periimplantitis.

El tratamiento de la periimplantitis consiste fundamentalmente en la descontaminación de la superficie implantaria. Se debe controlar la infección y resolver la inflamación con el fin de lograr una mejoría de la salud periimplantaria y evitar la pérdida ósea. (47) (48)

Se puede dividir el tratamiento de la periimplantitis en dos grandes grupos: las técnicas quirúrgicas y las no quirúrgicas. Dentro de la modalidad no quirúrgica se incluyen diversos métodos: desbridamiento mecánico (realizado mediante pulido con aire y/o ultrasonidos, o curetas), utilización del láser (Er: YAG, diodo) y/o terapia fotodinámica, o tratamientos farmacológicos (antibióticos tanto locales como sistémicos, antisépticos como la clorhexidina). (47)

Según las actas del tercer taller europeo en periodoncia la actuación de tratamiento de la periimplantitis se puede establecer en un esquema según ciertos parámetros clínicos: el nivel A se refiere a casos en los que se presenten bolsas de menos de 4 mm y el tratamiento consistirá en la limpieza mecánica e higiene oral adecuada y mejorada por parte del paciente; el nivel B es aquel en el que las bolsas son de 4 a 5 mm y en este caso se trata siguiendo el

protocolo del nivel A junto con la utilización de un antiséptico local como es la clorhexidina, ya sea en forma de enjuague o de gel, además de un control radiográfico; en caso de haber bolsas de 5 mm se agrega terapia con antibióticos al tratamiento, siendo el nivel C; finalmente, si se presentan bolsas de más de 5 mm se pondrán en funcionamiento el nivel A + B + C, y adicionalmente tratamiento quirúrgico para conseguir la modificación morfológica de los tejidos blandos y del defecto de hueso, siendo este último el nivel D. (13)

Acerca del plan de tratamiento a llevar a cabo, es fundamental en primer lugar controlar los factores de riesgo: se debe instruir al paciente con técnicas adecuadas de higiene oral; conocer si es fumador, y en casos necesarios proporcionar ayuda para dejar el hábito tabáquico; es importante analizar la supraestructura protética observando la presencia de aditamentos mal ajustados, o si existen defectos de diseño que imposibiliten un óptimo acceso para la higiene oral. (48) De igual modo, es importante evitar la sobrecarga sobre la interfase implante-hueso en la fase restauradora, lográndose gracias a un correcto diagnóstico. El diagnostico debe dar lugar a un plan de tratamiento en el que la retención y forma de la prótesis sean adecuadas, la prótesis tenga ajuste pasivo, se presente un buen soporte, se individualicen los factores de fuerza, y además presente un sistema de cargas progresivas que reduzcan el riesgo de tensiones que superen límites fisiológicos. (26)

Independientemente del tratamiento, cabe recalcar que un control de placa adecuado por parte del paciente es imprescindible para obtener resultados exitosos. En caso de que la inflamación persista tras muchas visitas de mantenimiento, puede ser necesario modificar o reemplazar la supraestructura del implante. Cuando la inflamación se presenta alrededor de uno o más implantes y la restauración protésica está cementada el dentista debe comprobar la presencia de restos de cemento en la bolsa periimplantaria, si se presentan esos residuos

el cemento se debe eliminar. En caso de no tener un correcto acceso para poder eliminar adecuadamente el exceso de cemento debe considerarse la intervención quirúrgica para facilitar la remoción. (48)

Siguiendo con el plan de tratamiento, si se concluye que el tratamiento puede llegar a ser insuficiente e irracional estará indicada la extracción del implante. Si la decisión del profesional es mantener el implante en boca, principalmente se debe controlar la infección, siendo la terapia no quirúrgica el primer planteamiento para poder evaluar la respuesta curativa de los tejidos y la capacidad de mantenimiento de higiene oral del paciente. En ocasiones la terapia no quirúrgica y el buen mantenimiento higiénico pueden ser suficientes. (48) Otras veces, sin embargo, es necesario realizar terapia quirúrgica para obtener un acceso adecuado a la superficie implantaria, y así poder llevar a cabo el desbridamiento mecánico y la descontaminación química. Los abordajes quirúrgicos suelen incluir cirugía de acceso, cirugía resectiva o terapia regenerativa, el método a utilizar depende del tipo de defecto y el posicionamiento del implante en la cavidad oral. En pacientes fumadores la terapia regenerativa está desaconsejada. (48)

El desbridamiento mecánico tiende a reducir la inflamación debido a la eliminación de la placa microbiana que se encuentra en la superficie implantaria. Los instrumentos mecánicos utilizados para eliminar dicha placa pueden ser: curetas de plástico, curetas de metal, ultrasonidos con punta de metal, cepillos metálicos (titanio), y utilización de aire abrasivo. (32) Tanto las curetas metálicas como los ultrasonidos con puntas de metal pueden conseguir eliminar material superficial hasta un tamaño de 0,83 μm y eliminar de forma eficaz las

bacterias, sin embargo, si se usan incorrectamente pueden producirse “arañazos” en la superficie del implante. (32)

Figura 6. Imagen de tratamiento no quirúrgico de periimplantitis mediante el uso de un instrumento mecánico. (9)

Un informe de consenso sugiere que la terapia convencional mecánica no quirúrgica como tratamiento de la periimplantitis (como por ejemplo, únicamente desbridamiento mecánico) proporciona resultados clínicos notables de mejora como la reducción de la tendencia al sangrado (entre un 20% a 50%) y en ciertos casos reducción de las bolsas (menos o igual a un milímetro de reducción), no obstante, en casos avanzados de periimplantitis no sirve para una completa resolución de la enfermedad, y habría que recurrir a tratamiento quirúrgico. (48)

Debe realizarse el tratamiento preoperatorio no quirúrgico antes de emplear una intervención quirúrgica, dicha fase preoperatoria permite mejorar la higiene oral e incluso puede conseguirse la resolución de la infección que ocasiona la enfermedad. En aquellos casos en los que persistan los signos de periimplantitis tras el tratamiento no quirúrgico debe de considerarse realizar el tratamiento quirúrgico. (48)

Además del desbridamiento y el legrado de tejidos blandos, está demostrado según ciertos artículos, que el tratamiento complementario local con antiinflamatorios y antisépticos o antibióticos durante la fase mecánica mejora parámetros clínicos. (49) Así lo concluyen Mayer Y. y colaboradores en su estudio prospectivo, en el que se incluyeron 69 pacientes con 106 implantes, y diagnosticados con periimplantitis: con una profundidad de sondaje ≥ 6 mm, pérdida ósea radiográfica ≥ 3 mm, y sangrado al sondaje. Los pacientes se dividieron en dos grupos: el grupo M fue tratado con desbridamiento ultrasónico con puntas finas y legrado de tejidos blandos con curetas de teflón. Mientras que en el grupo P se trató adicionalmente la superficie del implante con una pieza de mano con cerdas de quitosano empapadas en solución salina estéril 2 minutos antes de su uso (el suero fue para conseguir que las fibras se hincharan, y se volvieran flexibles y suaves para una resistencia óptima), después se realizó el legrado de tejidos blandos en combinación con la aplicación de hipoclorito al 0,95% con aminoácidos (consistencia de gel), dejándolo actuar durante 30 segundos, y en último lugar se aplicó 1 mg de minociclina. La aplicación de hipoclorito y el legrado de tejidos blandos se realizó 3 veces en la misma sesión. 6 meses después del tratamiento ambos grupos mostraron una disminución significativa del índice de placa, profundidad de sondaje, y sangrado al sondaje, y una mejora en el nivel de inserción clínica. Entre los 6 y 12 meses después del tratamiento el grupo P obtuvo mejores resultados de disminución de profundidad de sondaje en comparación con el grupo M, y tras 12 meses la disminución del sangrado fue significativamente mayor en el grupo P. (49)

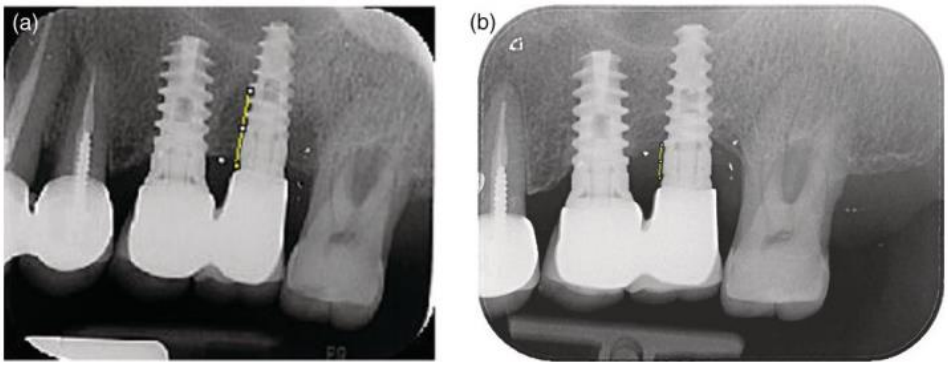

Figura 7. (A) Radiografía periapical pretratamiento de un caso de periimplantitis. (B) Radiografía periapical 12 meses post-tratamiento (grupo P). (49)

De la misma manera, en una revisión sistemática de Schwarz F. y colaboradores se concluye que las medidas locales complementarias, como el uso de antisépticos o antibióticos, mejora la eficacia del tratamiento convencional no quirúrgico de la periimplantitis. Con respecto a la terapia antiséptica complementaria, se indica en la revisión que se produce una mejora significativa de la profundidad de sondaje gracias al uso local de clorhexidina. La administración local de antibiótico, en concreto la minociclina, consigue una reducción mayor de la profundidad de sondaje y del sangrado al sondaje, además, la doxiciclina presenta resultados clínicos similares. (50)

El estudio de Heo S. y colaboradores reclutó a 20 pacientes con 45 implantes osteointegrados que presentaron periimplantitis, los pacientes fueron estudiados durante 2 años aproximadamente. Los criterios seleccionados fueron: profundidad de sondaje ≥ 5 mm con sangrado circundante en al menos un punto periimplantario, y pérdida ósea radiográfica de ≥ 2 mm. Se quiso estudiar la eficacia del tratamiento no quirúrgico mediante el uso de antiséptico y antibiótico local. No se utilizó desbridamiento mecánico ya que no presentaban

mucosa queratinizada alrededor de los implantes y esto no permitía la introducción de instrumentos mecánicos en el surco. Por tanto, se llevó a cabo la irrigación con clorhexidina (utilizando una jeringa de diámetro pequeño para facilitar su uso), en combinación con la aplicación de gel tópico de minociclina. Los resultados indicaron que la profundidad de sondaje, la pérdida de inserción clínica y el sangrado al sondaje se redujeron de forma significativa al final del estudio con respecto al inicio. (51)

Un estudio de cohorte prospectivo trató de evaluar el efecto de un dispositivo irrigador de bolsa en el tratamiento no quirúrgico de la periimplantitis, el cual está basado en alta frecuencia, y permite alternar el lavado y la evacuación. Participaron 24 pacientes, de los cuales 38 implantes fueron diagnosticados con periimplantitis, las bolsas periimplantarias fueron irrigadas seis veces en tres semanas consecutivas. Tres meses después del tratamiento se encontraron resultados clínicos favorables en términos de sangrado al sondaje, profundidad de sondaje e índice de placa. Cabe destacar que los pacientes informaron de niveles bajos de dolor durante el primer tratamiento según la escala de VAS, e incluso, niveles de dolor menores durante el último tratamiento, pudiendo ser por la disminución de la inflamación. Sin embargo, el irrigador de bolsa no constituye un tratamiento eficaz en cuanto a la resolución de la enfermedad. Dicha terapia de aplicación repetida no parece dar resultados significativamente mejores en comparación con los resultados obtenidos con "tratamiento único" como puede ser el láser. (47)

El tratamiento no quirúrgico de la periimplantitis también puede llevarse a cabo mediante un dispositivo de aire abrasivo. (52) El pulido con aire abrasivo se introdujo como una alternativa para la limpieza supra y submucosa de los implantes de titanio, consistente en la aplicación repetida de aminoácido glicina o bicarbonato sódico en polvo. Sirve para eliminar de forma

completa la biopelícula de la placa bacteriana sin causar importantes daños en las superficies arenadas y grabadas con ácido de los implantes de titanio. (53) La superficie implantaria debido a su condición y estructura especial (rosca del tornillo y rugosidad superficial intraósea) presenta mayor dificultad a la hora de desinfectarse y eliminar la biopelícula en comparación con la superficie dentaria. Las curetas de plástico tienen facilidad de manejo, pero no consiguen alcanzar correctamente las micro y macroporosidades superficiales de los implantes, pudiendo dejar áreas con placa residual tras el tratamiento. El uso de aire abrasivo consigue llegar más fácilmente a esas zonas. (52)

A través de una revisión sistemática y metaanálisis llevada a cabo por Schwarz F. y colaboradores se propuso el objetivo de encontrar la eficacia que presenta el pulido con aire abrasivo para combatir los signos de inflamación. La conclusión fue que el uso del pulido de aire consigue una reducción mayor del índice de sangrado en comparación con el desbridamiento mecánico con o sin terapia local de antisépticos en el tratamiento no quirúrgico de la periimplantitis, a pesar de dicha mejora no se logra con este método una resolución completa de la enfermedad periimplantaria. (53)

John G. y colaboradores realizaron un estudio prospectivo de doce meses para comparar la efectividad de dicho dispositivo (aminoácido glicina en polvo) con el desbridamiento mecánico combinado con antiséptico (digluconato de clorhexidina). Los 25 pacientes que participaron y fueron sometidos a tratamiento presentaban periimplantitis de estadio inicial a moderado: en concreto pacientes con profundidad de sondaje ≥ 4 mm, sangrado al sondaje, supuración, y pérdida radiográfica de soporte óseo ≤ 30%. Además, no presentaban movilidad del implante ni signos de sobrecarga oclusal, mantenían una buena higiene oral, y presencia mínima de 2 mm de encía adherida queratinizada. Ambos procedimientos lograron resultados similares y

comparables en cuanto a reducción de profundidad de sondaje y ganancia de nivel de inserción clínica, no obstante, la reducción del sangrado fue significativamente más alta en el grupo que recibió tratamiento con aire abrasivo comparado con el grupo tratado con desbridamiento mecánico y clorhexidina. (52)

La terapia antibiótica sistémica también puede ser utilizada en el tratamiento de la periimplantitis. En un estudio en el cual se hizo seguimiento de un año, se trataron pacientes con periimplantitis grave (profundidad de sondaje mayor a 5, pérdida ósea mayor a 4, sangrado al sondaje y/o supuración). Los pacientes se dividieron en dos grupos: un grupo recibió tratamiento mediante desbridamiento subgingival no quirúrgico, y también se les prescribió metronidazol de 400 mg más amoxicilina de 500 mg tres veces al día durante 14 días. El otro grupo (de control) recibió placebo y tratamiento de desbridamiento (en ambos grupos se hizo mediante curetas de teflón). Los resultados obtenidos revelaron que ambos protocolos realizados, tanto con terapia antibiótica como sin ella, consiguen mejorar parámetros clínicos como la profundidad de sondaje, índice de placa, sangrado gingival, supuración y pérdida de inserción clínica (distancia desde el margen periimplantario hasta el final de la bolsa). A pesar de ello, no se encontraron diferencias estadísticamente significativas entre ambos grupos. En definitiva, no se encuentran beneficios clínicos o microbiológicos debido al uso de terapia antibiótica sistémica asociada al desbridamiento mecánico. Asimismo, el hecho de que la mitad de los implantes en ambos grupos no consiguieran éxito clínico sugiere que ninguno de los protocolos llevados a cabo es eficaz en el tratamiento de la periimplantitis grave. (54)

Un estudio piloto aleatorizado de Laleman I. y colaboradores examinó los beneficios microbiológicos y clínicos de un probiótico (*Lactobacillus Reuteri*) en el tratamiento de la

periimplantitis en estadio inicial, es decir, pacientes con una profundidad de sondaje máxima de 6 mm y pérdida radiográfica de hueso no mayor a 3 mm. Los pacientes se dividieron en dos grupos: uno de ellos recibió el tratamiento local con gotas de probiótico, y en el otro grupo se administró un tratamiento placebo. Ambos grupos se sometieron a una profilaxis oral previa y se desbridaron las zonas afectadas por la periimplantitis. Se analizaron parámetros clínicos como profundidad de sondaje, sangrado y placa; y se extrajeron muestras microbiológicas de saliva, lengua y la zona subgingival periimplantaria. Los resultados mostraron que tras 12-24 semanas todos los parámetros clínicos se redujeron de forma significativa en los dos grupos. Los niveles de placa fueron menores en los implantes del grupo tratado con probiótico en comparación con el grupo control. Además, la disminución del sangrado en zonas de sondaje fue mayor también en el grupo de probióticos. No hubo diferencias destacables en cuanto a los resultados microbiológicos en ninguno de los grupos. Dicho estudio no puede afirmar que haya un efecto curativo añadido gracias al uso de probióticos en el tratamiento no quirúrgico de la periimplantitis. Se mostró que la mejora de parámetros clínicos se producía fundamentalmente por el desbridamiento y la correcta higiene oral. Sin embargo, tampoco se consigue con tratamiento no quirúrgico (solo con desbridamiento) una resolución completa de la enfermedad. (55)

La técnica del láser como tratamiento de la periimplantitis, consigue irradiar fácilmente toda la superficie implantaria, y en especial las superficies irregulares y rugosas a las que es difícil acceder mediante instrumentos mecánicos. Los láseres permiten inactivar las toxinas bacterianas y matar a las bacterias, tienen efecto directo sobre bacilos anaerobios gram negativos, pudiendo ser útiles para el tratamiento de la periimplantitis. El láser de diodo es un láser de alta potencia, sobre todo presenta alta absorción por la melanina que se encuentra

en cantidades elevadas en bacterias pigmentadas, como son las bacterias anaerobias gram negativas, las cuales absorben el láser y son erradicadas. Además, el láser, también tiene un efecto biomodulador: reduce el número de mediadores inflamatorios y estimula el factor de crecimiento de fibroblastos, dando lugar a la cicatrización de heridas y reparación de daños. (56) El propósito de una revisión sistemática fue evaluar el efecto que produce el láser de diodo de 810 nm en el tratamiento de la periimplantitis. Los estudios incluidos en la revisión compararon el tratamiento láser con la terapia convencional mediante desbridamiento mecánico, y el período de seguimiento fue de 6 meses a 1 año. De la comparativa realizada se obtuvo la conclusión de que a pesar de que científicamente el efecto del láser de diodo puede ayudar en la mejora de los parámetros clínicos de la enfermedad (debido a la descontaminación que se produce en la superficie de los implantes) los resultados de la revisión no pudieron probar ese hecho. Se concluyó que son necesarios más estudios y llevar a cabo períodos de seguimiento a largo plazo para analizar la efectividad del láser, ya que actualmente no se puede respaldar que su uso cure la periimplantitis. (56)

Otro estudio clínico analizó también el efecto del láser, en dicho estudio se dividieron los pacientes en dos grupos: uno de control que recibió tratamiento no quirúrgico convencional únicamente y otro grupo que recibió tratamiento no quirúrgico convencional combinado con láser de diodo de 810 nm. Los pacientes tratados con el láser presentaron una reducción significativa de profundidad de sondaje y de sangrado, pero se indica que podría ser por la combinación con la terapia convencional. Finalmente, en las conclusiones del artículo incluyen los autores que son necesarios más estudios acerca del láser para poder concretar su efectividad. (57)

La revisión sistemática de Khan A. y colaboradores sobre la eficacia de los diferentes tratamientos de la periimplantitis también menciona el uso del láser. Se indica que, el láser tiene efectos limitados en la mejora de parámetros clínicos como profundidad de sondaje o ganancia de nivel de inserción, consigue reducir la inflamación del tejido circundante al implante, pero, sin embargo, no se encuentra superioridad de dicho tratamiento sobre el tratamiento mecánico convencional. En la revisión se propone llevar a cabo más estudios, necesarios para sacar una conclusión concreta. (58)

Otra técnica no quirúrgica es la terapia fotodinámica antimicrobiana: consiste en utilizar láseres de diodo de baja intensidad en combinación con fotosensibilizadores para disminuir o eliminar bacterias. Principalmente se basa en el uso de un producto de tinción sin toxicidad y sensible a la luz denominado fotosensibilizador que se combina con luz visible inofensiva (energía baja) con una apropiada longitud de onda, para que pueda coincidir con el espectro de absorción del agente. Dicho proceso estimula la tinción para formar radicales libres de oxígeno en estado excitado que se comportan como agentes tóxicos para la bacteria o célula. (59) La revisión sistemática de Chambrone L., Wang HL. y Romanos GE. evalúa la eficacia de la terapia fotodinámica como coadyuvante del tratamiento no quirúrgico o quirúrgico en pacientes con periimplantitis de moderada a grave (con profundidad de sondaje ≥ 5 mm) y también en el tratamiento de periodontitis severa agresiva o crónica (profundidad de sondaje ≥5 mm). Se reveló que, en general, los resultados de los estudios comparados en la revisión muestran una reducción significativa de la profundidad de sondaje y ganancia del nivel de inserción, logrado con tratamiento de desbridamiento mecánico convencional (raspando la superficie dental e implataria) en combinación con terapia fotodinámica, pero, únicamente se consigue un beneficio clínico modesto. Por tanto, según la opinión de los expertos se pone en

cuestión el uso de esta técnica ya que consideran que faltan pruebas y el nivel de certeza aún es bajo. En esta revisión sistemática se debate si la mejora modesta de los resultados puede deberse a otros motivos en vez de ser por la terapia fotodinámica en sí, como por el desbridamiento mecánico llevado a cabo. Asimismo, se plantean los autores que las diferencias también podrían deberse a la repetición de enjuagues de la bolsa periodontal debido a la irrigación producida con la tinción y solución salina, en lugar de concebir estas diferencias por la fotodinámica. (59)

Comparando dos revisiones sistemáticas, la de Chambrone L. y cols. con la de Silva Fraga R. y cols., se puede comprobar que hay controversia en la efectividad de la terapia fotodinámica en cuanto a la disminución del recuento de patógenos microbiológicos, en ambas revisiones hay artículos que afirman que sí hay una disminución de bacterias gracias al uso de la terapia, y en contraposición hay artículos que no encuentran evidencia de que se disminuya el recuento bacteriano. Por tanto, dichas revisiones indican que son necesarios más estudios e indagar más acerca de la fotodinámica. (59) (60)

Para concluir con el tratamiento se procede a explicar en qué consiste el tratamiento quirúrgico y su eficacia.

El tratamiento quirúrgico de la periimplantitis se puede clasificar en tres grupos: cirugía de acceso, cirugía resectiva o terapia regenerativa. (13)

La cirugía de acceso permite exponer la superficie del implante para que el profesional proceda a eliminar depósitos bacterianos, que con el tratamiento no quirúrgico no se hubiera podido realizar ya que no se pueden tratar zonas profundas. Por tanto, el resultado con la terapia quirúrgica es más fiable y predecible, y así lo indican Segura AG. y cols. en su artículo de revisión de la literatura. (13)

Los pasos que se realizan en la cirugía de acceso son los siguientes: se comienza con el desbridamiento quirúrgico que se hace posible retirando la prótesis, a continuación se despega un colgajo mucoperióstico a espesor total, y se procede a detoxificar la superficie del implante o realizar la implantoplastia, finalmente se realiza una ostectomía lo más conservadora posible para poder regularizar la anatomía del hueso y se sutura.(13)

Figura 8. Imagen de tratamiento quirúrgico de un caso de periimplantitis con colgajo abierto y descontaminación con láser de diodo. (9)

La cirugía resectiva es utilizada para los casos en los que las pérdidas de hueso son mayores de 5 mm, consiste en una técnica predecible que genera buenos resultados clínicos. Se indica para reducir el tamaño de bolsas mayores de 5 mm con desbridamiento quirúrgico del tejido de granulación presente, después, se procede a detoxificar y modificar la rugosidad de los implantes dentales mediante la implantoplastia, y por último se corrige la arquitectura del hueso negativa. Se debe realizar un colgajo de reposición apical, que conlleva un compromiso estético, pero se consigue la mejora de la salud periodontal. Los autores indican que es muy importante establecer un protocolo adecuado para controlar la placa bacteriana. (13)

La última técnica quirúrgica es la terapia regenerativa, con la que se pueden solventar los defectos óseos acontecidos por la enfermedad periimplantaria. (13) Se realiza en el caso de que la morfología ósea permita soportar un material de injerto. (48)

Existen diferentes métodos de tratamiento utilizados en la terapia quirúrgica, los cuales se van a comparar por medio de tres artículos de interés: Khan A. y cols., Schwarz F. y cols., y Romanos GE. y cols. (9) (58) (50)

En la revisión de Khan A. y cols. se expone que: el uso del ácido ortofosfórico al 35% no produce mejores resultados clínicos o microbiológicos que el desbridamiento con solución salina en el tratamiento quirúrgico resectivo. Además, el ambiente ácido junto con las fuerzas mecánicas puede dan lugar a alteraciones morfológicas notables y corrosión de la superficie de titanio del implante. (58)

También se indica en dicha revisión que el uso de clorhexidina al 0,12% o 0,2% para tratar lesiones periimplantarias avanzadas reduce de forma inmediata las bacterias, pero no causa mejora clínica o radiográfica en cirugía resectiva con colgajo de reposición apical + regularización ósea + desbridamiento. Y tampoco cuando se combina la clorhexidina con CPC. (58) Los autores de esta revisión ponen en duda la eficacia del láser como tratamiento adyuvante en la terapia quirúrgica ya que su uso adicional no tiene efectos beneficiarios. (58)

En cuanto a la terapia regenerativa, según Khan A. y cols.: el uso de derivados de la matriz del esmalte se asocia positivamente con una supervivencia del implante hasta 5 años, pero se indica que es necesario indagar más y realizar más estudios. (58)

En la revisión de Schwarz F. y cols., se expresa, de igual modo, la eficacia que pueden tener ciertas medidas adyuvantes en el tratamiento periimplantario. El uso del láser de dióxido de carbono como medida adjunta a la cirugía de colgajo resectivo en comparación con el uso de

pulido de aire presentan resultados comparables de índice de sangrado y profundidad de sondaje a los 5 años. (50)

Dicha revisión sistemática muestra que en el tratamiento quirúrgico de la periimplantitis (colgajo abierto + desbridamiento + gasas empapadas en solución salina estéril + remodelado óseo + reposición apical del colgajo) el uso complementario de la clorhexidina no aporta mejoras clínicas. (50) Del mismo modo, tampoco revela mejoras clínicas el uso del láser de diodo como complemento del desbridamiento mecánico con colgajo abierto. (50)

Con respecto a la terapia resectiva complementaria, Schwarz F. y cols. exponen la eficacia de la implantoplastia realizada con fresas de diamante/arkansas y pulidores de silicona, utilizada como complemento del desbridamiento con colgajo abierto, regularización ósea y reposicionamiento apical del colgajo. La terapia resectiva con modificación de la topografía de la superficie ofrece niveles de hueso estables a los 3 años e influye positivamente en la supervivencia de los implantes. (50)

Por otro lado, la terapia aumentativa complementaria al desbridamiento con colgajo abierto mediante la aplicación de gránulos de titanio poroso en el defecto intraóseo (a los 12 meses del desbridamiento) da lugar a un aumento significativo de relleno del defecto radiográfico en comparación con la cirugía con colgajo abierto únicamente. Además, se incrementa el cociente de estabilidad del implante. (50) También se comparan en la revisión sistemática de Schwarz F. y cols. varios protocolos de terapia aumentativa con distintos métodos de descontaminación de la superficie, distintos rellenos de hueso (como por ejemplo xenogénico, autógeno, aloplástico), y distintas membranas de barrera (de colágeno y sintéticas) durante un período de 5 años. Los resultados revelan que se reducen los niveles de profundidad de sondaje y de sangrado, y que, adicionalmente, también hay relleno de defectos radiográficos.

El resultado depende del tipo de relleno (por ejemplo: el mineral derivado de bovino de reabsorción lenta es mejor que el hueso autógeno y que material aloplástico), depende también de las características del defecto (mejores resultados en defectos circunferenciales que dehiscencias), y de las características de la superficie del implante (superficies moderadamente rugosas mejores que superficies rugosas). (50)

Finalmente, en el artículo de revisión de Romanos GE. y cols.: acerca de la descontaminación mecánica se informa que la implantoplastia en la cirugía resectiva mejora parámetros clínicos como supuración, sangrado y profundidad de sondaje, y aumenta la supervivencia del implante. (9)

Romanos GE. y cols. también indican que el uso de factores de crecimiento como complemento de la regeneración ósea guiada mejora la osteointegración y promueve la formación de hueso nuevo alrededor de los defectos periimplantarios. (9)

La descontaminación también se puede realizar con productos químicos como antimicrobianos. La aplicación de tetraciclina para limpiar alrededor de implantes con defectos óseos facilita la re-osteointegración y además facilita el relleno óseo en la regeneración ósea guiada. (9)

Los productos químicos más usados son el peróxido de hidrógeno y la clorhexidina, se trata de productos que no producen alteraciones en la superficie de titanio de los implantes. El desbridamiento mecánico asociado al uso de clorhexidina permite mejorar el control de placa bacteriana y reducir el índice de sangrado, sin embargo, no actúan sobre el nivel de inserción o la profundidad de sondaje. (13)

Cabe destacar que se realizó un estudio clínico randomizado donde se investigan los resultados obtenidos tras el desbridamiento quirúrgico con colgajo abierto con o sin

antibióticos, y se concretó que el tratamiento quirúrgico con la prescripción de Azitromicina no obtuvo beneficios clínicos en comparación con el grupo que solo recibió tratamiento con desbridamiento mediante colgajo abierto. Se dividieron los pacientes en dos grupos, en uno de ellos se prescribió 2 tomas de 250 mg de Azitromicina el día de la cirugía y una toma de 250 mg durante 4 días adicionales, y en el otro grupo no tomaron antibiótico. El análisis microbiológico identificó una tendencia a disminuir el recuento bacteriano en los primeros meses después de la terapia, pero, sin embargo, los niveles de carga bacteriana al final del estudio fueron similares a los niveles iniciales, llegando a la conclusión de que el tratamiento quirúrgico con adicción de Azitromicina no proporciona resultados clínicos más beneficiosos que el tratamiento únicamente de desbridamiento con colgajo abierto. (61)

La revisión sistemática de Khan A. y colaboradores pretende evaluar la eficacia del protocolo de descontaminación y desbridamiento empleado en el tratamiento de la periimplantitis (quirúrgico o no quirúrgico) en ausencia de tratamiento antibiótico sistémico. Los autores concluyen que el tratamiento quirúrgico de la periimplantitis, sin el uso de terapia antibiótica, puede presentar mayor eficacia que el abordaje no quirúrgico. Además, también indican los autores que son necesarios más estudios para determinar el mejor protocolo de tratamiento para la periimplantitis, ya que muchos estudios publicados en la literatura acerca de este tema no presentan una calidad metodológica adecuada, un tiempo de estudio prolongado o un tamaño muestral considerable. No se encuentra una evidencia consolidada de que haya una intervención de tratamiento que sea más eficaz para la periimplantitis, a pesar de que la mayoría de los tratamientos pueden dar lugar a resultados exitosos. (58)

CONCLUSIONES:

- La periimplantitis es una patología consistente en un proceso inflamatorio de los tejidos que rodean al implante dental y en la que se produce pérdida ósea. El diagnóstico comienza con la anamnesis e historia clínica donde se debe prestar especial atención a posibles factores de riesgo que presenten los pacientes. Los parámetros clínicos propios de la enfermedad que deben evaluarse son: signos inflamatorios circundantes al implante, pérdida ósea radiográfica mayor o igual a 3 mm, profundidad de sondaje igual o mayor a 6 mm, presencia o no de supuración, y finalmente, el sangrado, que no tiene por qué darse en todos los casos de periimplantitis.
- Hay muchos factores de riesgo que pueden incrementar la probabilidad de desarrollar la enfermedad. Son factores de riesgo: la mala higiene oral, la existencia de periodontitis previa, el tabaquismo, la diabetes mellitus, la sobrecarga oclusal, la malposición de los implantes, el biotipo fino de encía, el bruxismo, entre otros. La periimplantitis puede conducir a la producción de complicaciones como son: pérdida del implante, fractura mandibular o aumento de inflamación que puede afectar a la enfermedad cardiovascular.
- El tratamiento de la periimplantitis puede dividirse en dos grandes grupos: tratamiento no quirúrgico y tratamiento quirúrgico. Las técnicas no quirúrgicas pueden llegar a resolver periimplantitis leves o moderadas, sin embargo, no sirven para tratar casos graves de periimplantitis. Los casos graves de periimplantitis se resuelven con técnicas quirúrgicas en las que se procede a levantar un colgajo para facilitar el acceso a la bolsa

periimplantaria y poder detoxificar la superficie del implante, es más eficaz que la técnica no quirúrgica.

RESPONSABILIDAD SOCIAL:

Antiguamente los implantes dentales tenían mayor tasa de fracaso, pero gracias al desarrollo e investigación del tratamiento de la periimplantitis y su prevención, ha mejorado significativamente. El conocimiento de sus factores de riesgo y diagnóstico precoz, junto con la evolución y mejora de las técnicas de higiene, supone un aumento en la supervivencia de los implantes dentales en boca.

La colocación en la cavidad oral de implantes dentales permite mejorar la calidad de vida de los pacientes. Con ellos se consigue restituir la estética dental mejorando la imagen personal, y por consiguiente se aumenta la autoestima y confianza de la persona que se somete al tratamiento. También se logra el restablecimiento de las funciones orales, como son la función masticatoria y el habla.

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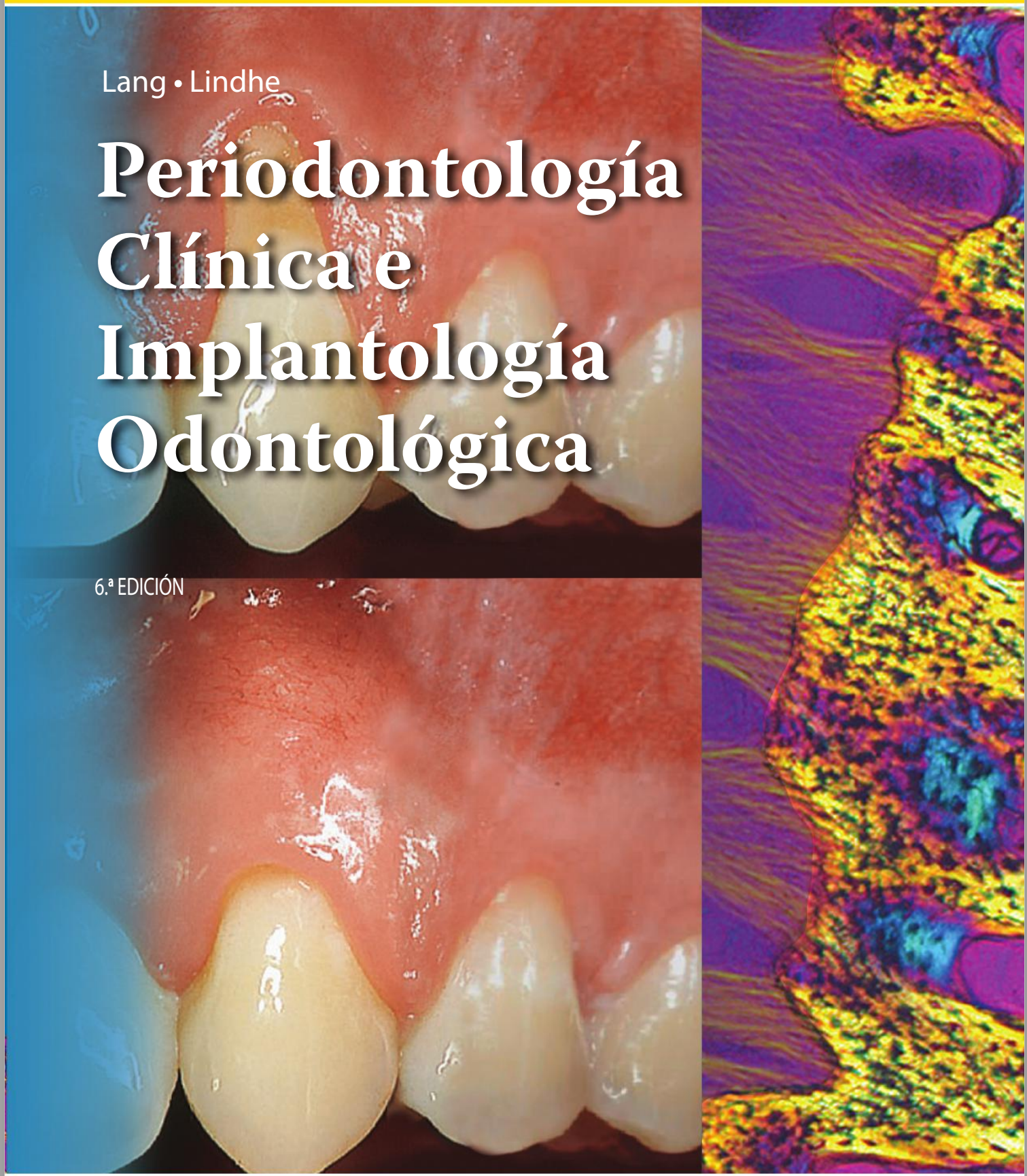

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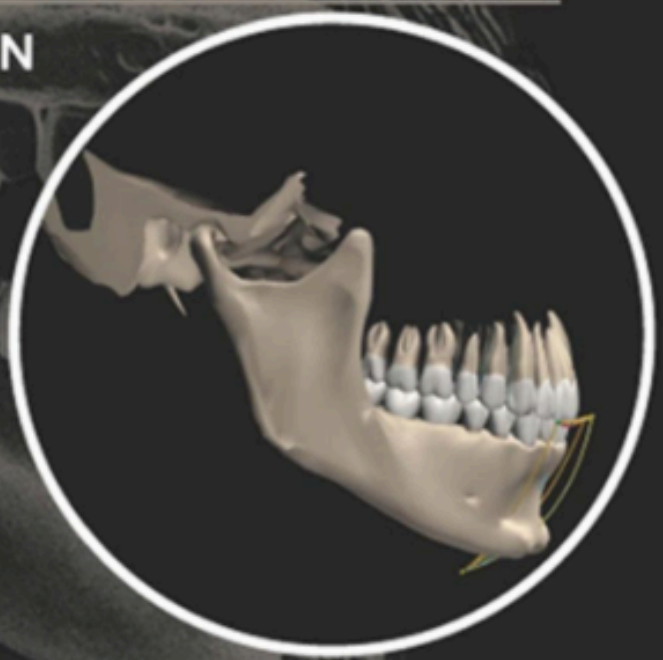

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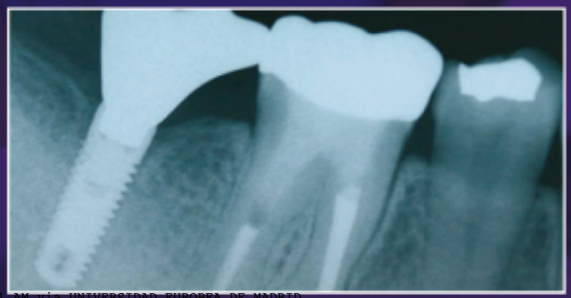

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Review Article

Bacterial invasion and persistence: critical events in the pathogenesis of periodontitis?

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Ji S, Choi YS, Choi Y. Bacterial invasion and persistence: critical events in the pathogenesis of periodontitis? J Periodont Res 2015; 50: 570–585.

Periodontitis is chronic inflammation of the periodontium caused by the host's inflammatory response to plaque biofilm, which destroys tooth-supporting soft and hard tissues. Periodontitis is a complex disease that involves interactions among three main features – microbial challenge, the host immune response, and environmental and genetic risk factors – in its pathogenesis. Although periodontitis has been regarded as the result of hyperimmune or hyperinflammatory responses to plaque bacteria, recent studies indicate that periodontal pathogens are rather poor activators and/or suppressors of the host immune response. This raises the question of how periodontal pathogens cause inflammation. To resolve this issue, in the present review we propose that bacterial invasion into gingival tissue is a key event in the initiation of periodontitis and that the persistence of these bacteria within host tissue results in chronic inflammation. In support of this hypothesis, we present the ways in which microbial, environmental and genetic risk factors contribute to bacterial invasion. It is hoped that the current model will instigate active discussion and new research to complete the puzzle of this complex disease process.

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Key words: microbiology; periodontal immunology; periodontal pathogens; periodontal risk factor

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Periodontitis is the chronic inflammation of the periodontium caused by the host's inflammatory response to plaque biofilm, which destroys tooth-supporting soft and hard tissues. It is a complex disease that involves microbial components, environmental factors and host genetic variations in its development (1). It is widely accepted that the conversion from periodontal health to disease accompanies a shift in the indigenous flora of the plaque biofilm from gram-positive facultative to gram-negative anaerobic motile microorganisms (2,3). For decades, periodontitis has been regarded as the result of hyperimmune or hyperinflammatory responses to plaque bacteria (4–6). In addition, it has been a prevalent concept that periodontal pathogens induce hyperinflammatory responses, whereas commensal bacteria are well tolerated (7). However, recent studies indicate that periodontal pathogens are rather poor activators and/or suppressors of the host immune response, raising the question of how they cause inflammation (8). To resolve this issue, we propose that invasion of bacteria into gingival tissues and the persistence of periodontal pathogens are major events leading to chronic inflammation.

Host–microbe interactions in the gingival sulcus

The gingival sulcus is a unique anatomic site surrounded by hard tissue at one side and soft tissue at the other. At the interface where the gingiva meets the tooth surface, up to 700 bacterial species can colonize the gingival sulcus in varying amounts, from approximately 10^3 bacteria in healthy sulci to $> 10^8$ bacteria in pathologic pockets (3,9). Some of the bacteria exist in harmony with the host; however, certain bacteria can disrupt this bacteria-host homeostasis (7,10). According to Socransky's classifica-

Int. J. Odontostomat.,
10(2):255-260, 2016.

Periimplantitis: Revisión de la Literatura

Peri-Implantitis: Literature Review

Alma Graciela García-Calderón[*]; Alejandro Donohue-Cornejo[**]; María Verónica Cuevas-González[***]; Roberto Ávila-Valdéz[****] & Juan Carlos Cuevas-González[*****]

GARCÍA-CALDERÓN, A. G.; DONOHUE-CORNEJO, A.; CUEVAS-GONZÁLEZ, M. V.; ÁVILA-VALDÉZ, R. & CUEVAS-GONZÁLEZ, J. C. Periimplantitis: revisión de la literatura. *Int. J. Odontostomat., 10(2)*:255-260, 2016.

RESUMEN: El uso de implantes ha tomado un gran auge en los últimos años, sin embargo así como se ha visto un aumento en la demanda también se ha visto un incremento en el fracaso de los mismos, existen múltiples razones que intervienen para esto como son; deficiencias en la cantidad y calidad de hueso, patologías óseas preexistentes, mala técnica quirúrgica, implante inadecuado, hábito tabáquico, entre otras. La mucositis periimplantaria y la periimplantitis son las primeras causas de complicaciones en los implantes, los pacientes con enfermedades crónico degenerativas, fumadores y con mala higiene son considerados pacientes de riesgo para presentar periimplantitis. La literatura ofrece tratamientos quirúrgicos y no quirúrgicos los cuales van enfocados a la eliminación de microorganismos y a la desinfección de la superficie del implante, el tratamiento quirúrgico como la debridación y curetaje tienen la finalidad de eliminar la placa bacteriana, desinfectar la superficie del implante así como retirar el tejido dañado por el proceso inflamatorio, el realizar una adecuada historia clínica y valoración previa, permitirá identificar a los pacientes con mayor o menor riesgo de desarrollar periimplantitis, las citas de mantenimiento ayudan a detectar oportunamente posibles complicaciones.

PALABRAS CLAVE: periimplantitis; mucositis periimplantaria; enfermedad periodontal.

INTRODUCCION

El uso de implantes ha tomado un gran auge en los últimos años, sin embargo así como se ha visto un aumento en la demanda también se ha visto un incremento en el fracaso de los mismos, existen múltiples razones que intervienen para esto como son; deficiencias en la cantidad y calidad de hueso, patologías óseas preexistentes, mala técnica quirúrgica, implante inadecuado, hábito tabáquico, entre otras, sin embargo a pesar de controlar en medida de lo posible los factores antes mencionados, se llega a presentar el fracaso en el sitio de colocación del implante, dentro de las principales causas se encuentra la periimplantitis, la cual en términos clínicos se define como un proceso inflamatorio que afecta la función fisiológica del tejido duro y blando que se encuentra alrededor de un implante osteointegrado, o en vías de la osteointegración (McCrea, 2014) (Fig. 1) y la mucositis periimplantaria, en donde se aprecia una inflamación reversible del tejido circundante al implante, sin que haya perdida de tejido óseo.

La prevalencia que se conoce sobre el desarrollo de la periimplantitis es muy variada, Schmidlin *et al*. (2012) realizaron un estudio transversal dirigido a odontólogos en donde determinaron una prevalencia que entre del 5–6 % y 7–9 % posterior a 5 y 10 años

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Peri-implant Diseases

A Review of Treatment Interventions

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KEYWORDS

• Guided bone regeneration • Laser • Nonsurgical • Peri-implantitis
• Peri-implant mucositis • Surgical • Treatment

KEY POINTS

- Risk factors of peri-implant mucositis and peri-implantitis are comparable to those of gingivitis and periodontitis.
- The ideal management of peri-implant diseases focuses on infection control, detoxification of implant surfaces, regeneration of lost tissues, and plaque control regimens via mechanical debridement.
- Implantoplasty (modification in implant surface topography), when used in combination with resective surgery, has been reported to significantly reduce the clinical parameters of peri-implantitis.
- A new technique, laser-assisted peri-implantitis protocol, is under investigation.
- There is lack of standardized treatment protocols for peri-implant disease.

Several studies[1–6] have reported that dental implants are functionally stable and have long-term success rates, and are therefore increasingly being used in the oral rehabilitation of partially and completely edentulous individuals. However, with the increasing number of patients receiving dental implants, the prevalence of inflammatory conditions around a dental implant has also escalated.[7] The consensus report from the 6th European Workshop on Periodontology has defined peri-implantitis as the presence of inflammation of the peri-implant mucosa and simultaneously loss of supporting bone.[8] In addition, it has also been described as a site-specific infection that

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JOURNAL OF Periodontology

2017 WORLD WORKSHOP

Peri-implantitis

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The proceedings of the workshop were jointly and simultaneously published in the *Journal of Periodontology* and *Journal of Clinical Periodontology*.

Abstract

Objectives: This narrative review provides an evidence-based overview on peri-implantitis for the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions.

Methods: A literature review was conducted addressing the following topics: 1) definition of peri-implantitis; 2) conversion from peri-implant mucositis to peri-implantitis, 3) onset and pattern of disease progression, 4) characteristics of peri-implantitis, 5) risk factors/indicators for peri-implantitis, and 6) progressive crestal bone loss in the absence of soft tissue inflammation.

Conclusions:

1) Peri-implantitis is a pathological condition occurring in tissues around dental implants, characterized by inflammation in the peri-implant connective tissue and progressive loss of supporting bone.

2) The histopathologic and clinical conditions leading to the conversion from peri-implant mucositis to peri-implantitis are not completely understood.

3) The onset of peri-implantitis may occur early during follow-up and the disease progresses in a non-linear and accelerating pattern.

4a) Peri-implantitis sites exhibit clinical signs of inflammation and increased probing depths compared to baseline measurements.

4b) At the histologic level, compared to periodontitis sites, peri-implantitis sites often have larger inflammatory lesions.

4c) Surgical entry at peri-implantitis sites often reveals a circumferential pattern of bone loss.

5a) There is strong evidence that there is an increased risk of developing peri-implantitis in patients who have a history of chronic periodontitis, poor plaque control skills, and no regular maintenance care after implant therapy. Data identifying "smoking" and "diabetes" as potential risk factors/indicators for peri-implantitis are inconclusive.

Prevalence of Periimplant Diseases

Giovanni E. Salvi, Prof Dr med dent,* Raluca Cosgarea, PD, Dr med dent,†‡ and Anton Sculean, Prof Dr med dent, MS§

Purpose: *To report the prevalence of periimplant diseases (ie, periimplant mucositis and periimplantitis).*

Material and Methods: *A literature search was performed in MEDLINE through PubMed database of the US National Library of Medicine for articles published until March 2018 using Medical Subject Heading (MeSH) search terms complemented by free terms and in different combinations.*

Results: *A wide range of prevalences of periimplant diseases has been reported in the literature. Subject-based estimated weighted mean prevalences and ranges were reported to amount to 43% (range: 19%–65%) for periimplant mucositis and to 22% (range: 1%–47%) for periimplantitis.*

Conclusion: *Differences in case definitions impact on extent and severity of periimplant diseases and make comparisons among studies difficult. Convenience samples rather than randomly selected population samples are often analyzed to estimate prevalence of periimplant diseases. More recent studies report implant- and subject-based prevalences of periimplant diseases. (Implant Dent 2019;28:100–102)*

Key Words: dental, implant, periimplant infection, epidemiology, periimplantitis, periimplant mucositis

Periimplant diseases have been defined as (1) development of periimplant mucosal inflammation without loss of supporting bone (ie, periimplant mucositis) and (2) presence of periimplant mucosal inflammation with additional loss of supporting bone (ie, periimplantitis).[1] As with the onset of gingivitis and periodontitis, the formation of microbial biofilms on dental implants has been documented to be involved in the development of periimplant mucositis[2] and periimplantitis.[3] In subjects diagnosed with moderate to severe periimplantitis, the onset of the disease was shown to occur within 3 years after implant loading and to display a nonlinear accelerating pattern over 9 years.[4]

Furthermore, iatrogenic factors such as poor prosthetic implant positioning, excess cement[5] and lack of cleansability of the implant-supported restoration[6] may contribute as plaque-retentive factors to the onset and progression of periimplant diseases.

The aim of the present review was to summarize the evidence on the prevalence of periimplant diseases.

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MATERIALS AND METHODS

A literature search was performed in MEDLINE through PubMed database of the US National Library of Medicine for articles published until March 2018 using Medical Subject Heading (MeSH) search terms complemented by free terms and in different combinations. To be included, articles had to be written in the English language and be published in an international peer-reviewed journal.

Abstracts, narrative reviews, studies reporting on early complications before implant loading, and studies with insufficient/unclear informations on clinical and/or radiographic parameters not allowing a case definition of periimplant mucositis and periimplantitis were excluded.

Prevalence of Periimplant Diseases

The prevalence of periimplant diseases has recently been reported to represent a controversial issue.[7] Subject-based estimated weighted mean prevalences and ranges for periimplant mucositis and periimplantitis were reported in a systematic review with meta-analysis.[8] The prevalence for periimplant mucositis was reported at 43% ranging from 19% to 65%, whereas for periimplantitis, it amounted to 22% ranging from 1% to 47%.[8] In addition, outcomes from cross-sectional studies[9–14] not included in the systematic review referred to above[8] reported comparable prevalences for periimplantitis ranging from 12.9% to 26%.

The prevalence of cases with periimplant mucositis or periimplantitis was recently reported in a case series study with a 21- to 26-year follow-up.[15] In that study,[15] 86 of 294 subjects who had previously received dental implants[16] were re-examined on average

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WILEY

ORIGINAL ARTICLE

Incidence and prevalence of peri-implantitis and peri-implant mucositis 17 to 23 (18.9) years postimplant placement

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Abstract

Purpose: To evaluate the prevalence of peri-implantitis (PI) and peri-implant mucositis (PM) in a long-term follow-up with comparison among different PI and PM definitions, and to report on the incidence of PI.

Materials and Methods: In a retrospective clinical study five different PI and PM definitions were applied onto a population with 274 implants 17 to 23 years postimplant placement. Recommendations by the Eighth European Workshop on Periodontology (EWOP) were used as base reference. Clinical and radiological measurements were considered. Risk factors were evaluated in a regression analysis.

Results: After an average observation period of 18.9 years, 40.1% of the implants were diagnosed with PM and 15.0% with PI (Eighth EWOP). PI incidence reached 7.9% on implant level and 13.2% on patient level. Implants diagnosed with PI and progressive bone loss displayed exceptionally vertical bone defect configuration (BDC). Diabetes mellitus, smoking, regular maintenance, or a former periodontal infection did not show significant influence on the prevalence of peri-implant diseases. Patients with bruxism displayed significantly less PM and PI.

Conclusions: Vertical BDC seems to correspond with active PI, wherefore we estimate such a defining factor of importance. Diagnosis of PM and evaluation of probing pocket depths might be only of descriptive interest as they could lead to false-positive results.

KEYWORDS

bone loss, bone regeneration, clinical research, clinical study, defect configuration, mucositis, peri-implant lesions, peri-implantitis, retrospective

Mischa Krebs and Nikolina Kesar contributed equally to this study.

Periimplantitis y mucositis periimplantaria. Factores de riesgo, diagnóstico y tratamiento

Risk factors, diagnosis and treatment of peri-implant disease: A literature review

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Segura Andrés G, Gil Pulido R, Vicente González F, Ferreiroa Navarro A, Faus López J, Agustín Panadero R. *Periimplantitis y mucositis periimplantaria. Factores de riesgo, diagnóstico y tratamiento.* Av Periodon Implantol. 2015; 27, 1: 25-36.

RESUMEN

Introducción: El objetivo de este trabajo es profundizar en el conocimiento de la enfermedad periimplantaria y los tratamientos existentes descritos en la literatura. *Material y método:* Revisión bibliográfica de las enfermedades periimplantarias, basada en una búsqueda en bases de datos Pubmed, Medline y Cochrane Library, utilizando como palabras clave "*periimplantitis, mucositis, tabaquism, oral microbiota, occlusal overload, surgical treatment, antimicrobial therapy, detoxification, regenerative therapy, bone defects*".
Desarrollo y discusión: Análisis de los factores de riesgo, el diagnóstico y el tratamiento de las enfermedades periimplantarias.
Conclusiones: Los factores como el tabaco o una historia de periodontitis, junto con una mala higiene oral, son las principales causas de las enfermedades periimplantarias. Un correcto diagnóstico de la etiología, así como, la adecuada elección de la terapéutica, pueden detener el avance de la enfermedad periimplantaria. Tras el tratamiento realizado, será muy importante el control periódico y el mantenimiento de una correcta higiene oral.

PALABRAS CLAVE: Periimplantitis, mucositis, tabaco, microbiota oral, sobrecarga oclusal, tratamiento quirúrgico, terapia antimicrobiana, detoxificación, terapia regenerativa, defectos óseos.

SUMMARY

Introduction: The aim of this paper is to deepen the knowledge of peri-implant disease and existing treatments described in the literature.
Material and methods: Literature review of peri-implant disease based on a search in databases like PubMed and Medline using keywords "periimplantitis, mucositis, tabaquism, oral microbiota, occlusal overload, surgical treatment, antimicrobial therapy, detoxification, regenerative therapy, bone defects".

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Clinical and radiographic assessment of implant-supported rehabilitation of partial and complete edentulism: a 2 to 8 years clinical follow-up

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Abstract. – OBJECTIVE: The aim of this study was to find out the rates of survival and success of implant rehabilitation, and the influence of some risk indicators on the medium- and long-term prognosis.

PATIENTS AND METHODS: Of the 102 patients eligible for this study rehabilitated with dental implants during the years 2009-2015, 75 patients with 156 implants of different implant systems placed and loaded by the same team were recalled. For each subject, pocket-probing depth, bleeding on probing, plaque buildup, mobility of the fixtures, and the presence/absence of prosthetic complications were recorded. Radiographic evaluation was based on the analysis of bone levels around the fixtures, as shown by intraoral radiographs.

RESULTS: The average follow-up was 4.4 years, ranging from 1.5 to 7.8 years. One hundred and fifty-four of the implants survived, while two implants failed; 98.8% of the prostheses survived, while 75.9% were successful. Success was achieved in 90.4% of implants and in 80% of patients. The sample showed average radiographic bone resorption of 1.09 mm. The average pocket probing depth was 2.79 mm. Bleeding on probing was found in 18% of all sites, and 59.6% of implants showed bleeding on probing in at least one site. Mucositis was found in 90% of patients, and peri-implantitis was found in 16% of patients.

CONCLUSIONS: The rates of success and survival showed the reliability of implant therapy. Plaque accumulation, smoking and upper jaw location, seem to increase the risk of failure of implant-supported rehabilitation.

Key Words
Implant survival, implant succes, risk factors, implant failure, dental implant, implant supported rehabilitation

Introduction

Implant-prosthetic rehabilitation represents nowadays a highly predictable therapy for partially and completely edentulous patients. In recent years, reported survival and clinical success rates have kept improving[1-5]. Biological aspects of osseointegration have been investigated, resulting in extremely high rates of early biological success. However, there is still concern about mechanical or technical complications and about late biological complications. Several factors have been suggested to be detrimental for long-term prognosis of implant rehabilitations, including jaw location, local anatomy, implant dimensions, bone density at the surgical site, bone augmentation procedures[6-10] and patient-related factors such as smoking and a history of periodontal disease [11-16]. Implant therapy complications can be summarized as biological or prosthetic. Early biological complications involve the osseointegration process, and can cause fast loss of the fixture, while late complications include peri-implant infective diseases like mucositis or peri-implantitis.

Prosthetic complications are divided into mechanical (mechanical failure of industrial elements of the rehabilitation) or technical ones (lab-made element failure). Overdentures (OVDs) on implants show a high rate of complications such as loss of retention, clip/attachment fracture, relining needs and other problems that must be treated by clinicians[17,18]. A common complication of implant-supported restorations such as single crowns (SCs) or fixed partial dentures (FPDs) is fracture or chipping of crown restoration, or screw loosening. Screw retention and cement retention do not seem to be risk factors for the prognosis of rehabilita-

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SYSTEMATIC REVIEW

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Association between diabetes mellitus/hyperglycaemia and peri-implant diseases: Systematic review and meta-analysis

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Abstract

Aim: This systematic review investigates whether hyperglycaemia/diabetes mellitus is associated with peri-implant diseases (peri-implant mucositis and peri-implantitis).

Materials and Methods: Electronic and manual literature searching was conducted. An a priori case definition for peri-implantitis was used as an inclusion criterion to minimize risk of bias. The Newcastle-Ottawa Scale was used for quality assessment; random effect models were applied; and results were reported according to the PRISMA Statement.

Results: Twelve studies were eligible for qualitative and seven of them for quantitative analyses. Meta-analyses detected the risk of peri-implantitis was about 50% higher in diabetes than in non-diabetes (RR = 1.46; 95% CI: 1.21–1.77 and OR = 1.89; 95% CI: 1.31–2.46; $z = 5.98$; $p < .001$). Importantly, among non-smokers, those with hyperglycaemia had 3.39-fold higher risk for peri-implantitis compared with normoglycaemia (95% CI: 1.06–10.81). Conversely, the association between diabetes and peri-implant mucositis was not statistically significant (RR = 0.92; 95% CI: 0.72–1.16 and OR = 1.06; 95% CI: 0.84–1.27; $z = 1.06$, $p = .29$).

Conclusions: Within its limits that demand great caution when interpreting its findings, this systematic review suggests that diabetes mellitus/hyperglycaemia is associated with greater risk of peri-implantitis, independently of smoking, but not with peri-implant mucositis.

KEYWORDS

dental implants, diabetes complications, epidemiology, gestational diabetes, glycosylated, haemoglobin A, humans, review, systematic

1 | INTRODUCTION

Peri-implant diseases—that reportedly affect around half the individuals with dental implants (Derks & Tomasi, 2015)—constitute one of the major challenges in contemporary implant dentistry and hence require primary prevention and early diagnosis (Sanz, Chapple, & Working Group 4 of the VIII European Workshop on Periodontology 2012; Tonetti, Chapple, Jepsen, & Sanz, 2015; Tonetti, Eickholz et al., 2015). One of the main obstacles to early diagnosis is the lack of standard case definitions for peri-implant diseases (Sanz & Chapple, 2012). Moreover, local and systemic factors have been shown to substantially and negatively impact the peri-implant tissues, leading to increased susceptibility, which—in the presence of biofilm on the fixture surface—may trigger an inflammatory response that ultimately will lead to tissue breakdown in especially susceptible persons (Renvert & Polyzois, 2015). Therefore, identification of risk indicators based on patients' risk profiles is essential to prognosticate disease occurrence and provide individually tailored preventive intervention (Jepsen et al., 2015; Tonetti, Eickholz et al., 2015; Tonetti, Chapple, Jepsen, & Sanz, 2015).

With the realization that the individual host inflammatory response is the main promoter of several chronic diseases and conditions,

CLINICAL ORAL IMPLANTS RESEARCH

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Clinical and microbiological findings in patients with peri-implantitis: a cross-sectional study

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Key words: BoP, keratinized mucosa, microbiota, peri-implantitis

Abstract

Objective: The aim of this study was to analyze clinical and microbiological characters in subjects and implants affected and not affected by peri-implantitis. Additionally, same features were analyzed also intra-individually, comparing healthy and diseased implants within the same subject.

Materials and methods: A total of 534 patients who received at least 1 implant and coming to routine check-up or spontaneous visits at the University of Valencia were recruited. Clinical parameters including Bleeding on probing (BoP), Probing pocket depth (PPD), and Pi were screened. Samples for microbiological analysis were obtained from three locations: peri-implant sulci (PIS), inner parts of the implant connections (I), and gingival sulci of neighboring teeth (GS). Quantitative real-time PCR was performed for total counts of 10 microorganisms.

Results: A total of 534 patients with 1507 dental implants were analyzed. The prevalence of peri-implantitis was found 10.3% for patients and 7.3% for implants. Higher percentage of healthy periodontal subjects were found in the non-peri-implantitis group. The analysis within the 53 patients affected by peri-implantitis revealed that the implants affected by peri-implantitis presented a higher percentage of plaque, BoP, and number of implants presenting <2 mm attached gingiva. Additionally, more cemented crowns and implants inserted in bone-augmented sites were found among the diseased implants. The microbiologic analysis presented no relevant differences between the analysis at the peri-implant sulcus (PIS) and the connections inside the abutments surfaces (PI). The microbial composition at the neighboring teeth (GS) resembled the composition found at the PIS with a high frequency of *Pg, Tf, Pi, PM,* and *Ec*.

Conclusions: The results of this study seem to indicate that inadequate oral hygiene and the presence of bleeding from the gingiva/mucosa in patients with dental implant were associated with an higher prevalence of peri-implantitis; moreover, in the patients affected by peri-implantitis, the lack of sufficient height keratinized mucosa (<2 mm) and bone regenerative procedures at implant level were also associated to higher prevalence of peri-implantitis as well.

One of the key factors for the long-term success of oral implants is the maintenance of healthy tissues around them. Bacterial plaque accumulation induces inflammatory changes in the soft tissues surrounding oral implants and it may lead to their progressive destruction (peri-implantitis) and ultimately to implant failure (Mombelli et al. 1987; Albrektsson et al. 1994).

While mucositis is a marginal inflammation without attachment/bone loss, peri-implantitis is described as an inflammatory reaction of soft tissues associated with loss of marginal supporting bone around an implant in function (Zitzmann & Berglundh 2008).

On the other hand, different etiopathological figure was described by Albrektsson et al. (2012a,b), which pointed out the importance of an unbalanced foreign body reaction to explain crestal bone loss/peri-implantitis process.

The occurrence of peri-implantitis was described to be not rare. Depending on the different diagnostic criteria to define peri-implantitis, in the same patients' sample, a substantial variance in prevalence ranging from 11.3% to 47.1% has been reported (Koldsland et al. 2010; Mir-Mari et al. 2012). Nevertheless, peri-implantitis was described with dramatically lower occurrence in a retrospective long-term study (Buser et al. 2012).

UNIVERSIDAD COMPLUTENSE DE MADRID

FACULTAD DE ODONTOLOGÍA

Departamento de Estomatología III (Medicina y Cirugía Bucofacial)

TESIS DOCTORAL

Modelo de biofilm bacteriano *in vitro*: evaluación en superficies de implantes y comparación de agentes microbianos

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

Eva Fernández Vidal

Director

David Herrera González

Madrid, 2018

Influencia de las diferentes superficies de implantes en la periimplantitis

Influence of different implant surfaces on periimplantitis

OTEO MORILLA S*
BASCONES MARTÍNEZ A**

Otero Morilla S, Bascones Martinez A. Influencia de las diferentes superficies de implantes en la periimplantitis. Av Periodon Implantol 2017; 29, 2: 59 -66

RESUMEN

El uso de implantes dentales se ha convertido en un tratamiento de rutina en la clínica. Un importante prerrequisito para asegurar la correcta interfase hueso-implante es una adecuada estabilización primaria de implante durante la primera cicatrización. Para obtener el éxito clínico en prótesis e implantes dentales es imprescindible una conexión duradera y firme la superficie del implante y el hueso. Estas superficies se pueden modificar mediante recubrimientos, chorreados con diferentes abrasivos, tratamientos ácidos o combinación de varios y/o todos ellos.

PALABRAS CLAVE: Implantes dentales, prótesis, periimplantitis.

SUMMARY

The use of dental implants has become a routine treatment in the clinic. An important prerequisite to ensure proper bone-implant interface is adequate primary implant stability during healing. For clinical success in prosthetics and dental implants is essential a firm and lasting connection to the implant surface and bone. These surfaces can be modified using coatings, different abrasive blasting, or acid treatments, combination of several or all of them.

KEY WORDS: Dental implants, prosthetics, periimplantitis.

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INTRODUCCIÓN

¿Cuál es el riesgo de desarrollar periimplantitis según el tipo de superficie implantaria?

La acumulación de placa en la superficie de los implantes puede dar lugar a periimplantitis, e incluso a la pérdida del implante. La estabilidad a largo plazo de los implantes depende de la integración del biomaterial en los tejidos de alrededor (1,32).

Si hablamos de las superficies implantarias y de la periimplantitis es importante conocer dos modelos experimentales. El primero fue desarrollado por Lindhe et al. en 1992 (2); el experimento se llevó a cabo en cinco perros Beagle con el objetivo de evaluar la respuesta de la mucosa y encía periimplantaria tras el acúmulo de placa y formación de bolsa periodontal, con evaluación clínica y radiográfica. Los perros recibieron una dieta que permitiera una gran formación de placa, los premolares derechos mandibulares se extrajeron y se procedió a la colocación de dos. Dos ligaduras se colocaron en posición subgingival a ambos lados, en los premolares del lado izquierdo y en los implantes durante seis

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Implant surface roughness and patient factors on long-term peri-implant bone loss

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Evolution in implant dentistry

Dental implants are widely used to restore function, aesthetic appearance and quality of life in partially and fully edentulous patients. Over 50 years of clinical scientific research have led to continuous improvement of dental implant designs, implant surface topography and a better understanding of bone and soft tissue biology. Compared with the era of the introduction of dental implants in clinical practice half a century ago, implant survival is today predictable, regardless of implant length, implant diameter, bone quality, available bone volume, surgical or prosthetic treatment protocol. The overwhelming positive acceptance of dental implants during the past decade has been lowered by suggestions of large incidences of biological complications that may only be clinically detected or become relevant after a sufficiently long time of follow-up. Suggestions have been made that implant surface topography may well have an impact on changes in peri-implant bone levels and consequently may affect the incidence of biological complications such as peri-implantitis.

Peri-implant bone level and peri-implant health

During the first European Workshop on Periodontology, opinion leaders from both academic and clinical backgrounds described the healing of dental implants and the diagnostic criteria for success, failure, health and disease. This included the classification of biological complications occurring in the tissues surrounding dental implants. They defined mucositis as a local, plaque-related inflammation of the surrounding supracrestal mucosa and peri-implantitis as a localized inflammation that also yields irreversible crestal bone loss beyond the normal bone remodeling related to the initial healing process. It was well understood that the long term and predictable success of an implant was largely dependent on the crestal bone level preservation over time, logically assessed through radiographic assessment at regular time intervals. With the available implant surfaces at that time, this was described as not exceeding on average 0.2 mm yearly after the first year of function. De Bruyn and co-workers (22) reviewed the aspect of radiographic assessment of dental implants and suggested that mean bone loss may be useful in clinical research for comparison of implant systems or protocols, but yields very limited information on the condition of individual implants. Given the fact that a majority of implants yield very stable crestal bone levels over time with no bone loss at all, the statistical interpretation of mean values often hides the condition of implants positioned in the upper quartile of the bone level spectrum.

This was demonstrated by Pettersson & Sennerby (43) in a 5-year follow-up study including 88 patients treated with an anodized moderately rough surface implant. The cumulative survival was 99.6% and the average crestal bone loss from the day of implant placement to 5 years of function was 0.1 mm. However, widely spread and extreme values were reported and 15% of the implants showed more than 2 mm bone loss. Based on the cross-sectional evaluation at 5 years, it is tempting to suggest that these are at risk for peri-implantitis when applying, for

La respuesta tisular a implantes dentales con plataforma reducida (platform switching)

Tissue response to dental implants with platform switching

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RESUMEN

La evolución en los diseños de los sistemas de implantes y en la configuración de los pilares protésicos ha desarrollado el concepto de plataforma reducida que comprende la colocación de un pilar más estrecho que la plataforma del implante para aumentar su distancia de la interfase hueso-implante. La plataforma reducida es considerada un factor importante para preservar la estabilidad del hueso crestal y de los tejidos blandos y asegurar el éxito de los implantes dentales a largo plazo. La plataforma reducida reduce las fuerzas oclusales y la contaminación bacteriana en la interfase entre el hueso crestal y el implante. Los estudios experimentales en animales y clínicos en pacientes muestran su eficacia para prevenir la pérdida ósea y de los tejidos blandos periimplantarios

Conclusiones. La introducción de la plataforma reducida constituye un importante campo en la investigación experimental en implantología oral y en el tratamiento clínico con implantes para mantener los tejidos periimplantarios.

PALABRAS CLAVE: Implantes dentales, plataforma del implante, plataforma reducida, superficie de implante, superficie rugosa, oseointegración.

ABSTRACT

The evolution of designs of implant systems and abutments configurations has developed the concept of platform-switching that involves the connection of a narrower abutment to the platform implant to allow horizontal distance of the interface bone-implant. Platform-switching is considered an important factor to preserve the stability of crestal bone and soft tissue ensuring the success of dental implants in the long-term follow-up. Platform-switching reduces the forces of occlusal loading and bacterial contamination in the interface between the crestal bone and the implant. Experimental studies in animals and clinical studies in patients showed that implants with platform-switching have demonstrated the effectiveness to prevent peri-implant bone loss and subsequent soft tissue loss.

Conclusions. The platform-switching constitute an important field for research of experimental implant dentistry and clinical implant treatment in the maintenance of peri-implant tissues.

KEY WORDS: Dental implants, platform implant, platform switching, surface implant, rough surface, osseointegration.

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Society For Biomaterials

Review Article

A systematic review and meta-analysis on the influence of biological implant surface coatings on periimplant bone formation

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Abstract: This systematic review and meta-analysis evaluated the influence of biological implant surface coatings on periimplant bone formation in comparison to an uncoated titanium reference surface in experimental large animal models. The analysis was structured according to the PRISMA criteriae. Of the1077 studies, 30 studies met the inclusion criteriae. Nineteen studies examined the bone implant contact (BIC) and were included in the meta-analysis. Overall, the mean increase in BIC for the test surfaces compared to the reference surfaces was 3.7 percentage points (pp) (95% CI −3.9–11.2, $p = 0.339$). Analyzing the increase in BIC for specific coated surfaces in comparison to uncoated reference surfaces, inorganic surface coatings showed a significant mean increase in BIC of 14.7 pp (95% CI 10.6–18.9, $p < 0.01$), extracellular matrix (ECM) surface coatings showed an increase of 10.0 pp (95% CI 4.4–15.6, $p < 0.001$), and peptide coatings showed a statistical trend with 7.1 pp BIC increase (95% CI −0.8–15.0, $p = 0.08$). In this review, no statistically significant difference could be found for growth factor surface coatings (observed difference −3.3 pp, 95% CI −16.5–9.9, $p = 0.6$). All analyses are exploratory in nature. The results show a statistically significant effect of inorganic and ECM coatings on periimplant bone formation. © 2016 Wiley Periodicals, Inc. J Biomed Mater Res Part A: 104A: 2898–2910, 2016.

Key Words: animal experiments, bone implant interactions, dental implant, histomorphometry, surface coatings complexes

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INTRODUCTION

The application of dental implants for the replacement of missing teeth increased strongly throughout the last 30 years. Innovations in implant material, design, and surface structure improved implant stability and shortened healing periods.[1,2] Following implant placement, especially the initial interaction with proteins and cells is influenced by the implant surface.[3,4] Most implant surface treatments aim at enhancing the activity of bone-forming cells and their mediators to increase new bone formation and promote earlier osseointegration and higher secondary implant stability. Microstructured implant surfaces showed advantageous characteristics for bone formation and are the current standard of surface treatment.[5] Besides microtopography, other biophysical factors such as surface chemistry, surface charge, and wettability also have an influence on bone formation.[6]

Yet another surface modification to further stimulate osseointegration is the coating of implant surfaces with biological components.[7–9] For bone, these may be organic as well as inorganic in nature, and both can potentially influence cellular activity during periimplant healing. In this context, many different types of surface coatings have been analyzed in recent years. These include coatings with extracellular matrix (ECM) proteins, peptides, growth factors, calcium phosphate phases, lipids, and so on. In animal studies, the application of high dosages of the growth factor BMP-2[10] as well as other approaches using ECM components like collagen and glycosminoglycans[9,11] or peptides derived from ECM proteins like RGD peptide[12] have been reported to show an effect on bone healing.

While these physiological approaches for enhancing bone healing hold great appeal as the next generation of surface modifications and while numerous studies have

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Antibacterial and bioactive coatings on titanium implant surfaces

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Abstract: Various surface modifications have been tried for enhancing osseointegration of the dental implants like mechanical and/or chemical treatments and deposition of calcium phosphate coatings. The objective of this research was to develop calcium-phosphate based thin coatings with antibacterial and bioactive properties for potential application in dental implants. Titanium (Ti) discs were immersed in different calcifying solutions: CaP (positive control), F-CaP, Zn-CaP, and FZn-CaP and incubated for 24 h. Negative control was uncoated Ti discs. Coated surfaces were characterized using X-ray diffraction, scanning electron microscopy and energy dispersive spectroscopy. Antibacterial properties were tested using *Porphyromonas gingivalis* because of its strong association with periodontal and peri-implant infections. Bacterial adhesion and colonization were studied at different time-points. The coated surfaces had compositional characteristics similar to that of bone mineral and they inhibited the growth, colonization and adherence of *P. gingivalis,* resulted in reduced thickness of biofilms and bacterial inhibition in the culture medium as compared to the positive and negative controls ($p < 0.05$). There was no significant difference between the experimental groups ($p > 0.05$). It has been previously demonstrated that these coatings have excellent *in vitro* bioactivity (formed carbonate hydroxyapatite when immersed in a simulated body fluid). Such coatings can enhance osseointegration and prevent infection in implants, thereby improving the success rates of implants. © 2017 Wiley Periodicals, Inc. J Biomed Mater Res Part A: 105A: 2218–2227, 2017.

Key Words: dental implant, implant coatings, *Porphyromonas gingivalis*, antibacterial, bioactivity

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INTRODUCTION

Dental implants have become the treatment of choice for replacement of missing teeth with increasing success rates. Commercially pure titanium (CP-Ti) and Ti-alloy (Ti_6Al_4V) are the most commonly used metals for implants in dentistry, because of their desirable properties like resistance to corrosion, biocompatibility, high strength-to-weight ratio, good tolerance by biological environment and presence of reactive titanium oxide surface layer.[1]

Despite the high success rates, the two main areas of concern in dental implant therapy are biomaterial centered infection and successful tissue integration. Infection after implant placement still remains one of the major complications in dental implants even though optimal aseptic surgical practices are followed and modern antibiotic regimes are used.[2] It accounts for about 14% of the total implant failures.[3] In the competition for colonization of the implant surface, the probability of successful tissue integration would be greatly enhanced if tissue integration occurs before bacterial adhesion could take place.[4,5] To enhance osseointegration of the metal implants with bone tissue, various surface modifications have been used including: mechanical and/or chemical treatments and deposition of calcium phosphate coatings.[6] Thus, an ideal implant/implant coating should have both osseointegrative and antibacterial properties.

Different types of dental implant surface coatings containing silver,[7,8] copper,[9] fluoride,[10,11] zinc,[12,13] chlorhexidine,[14] and antibiotics like gentamycin, cephalothin, amoxicillin, etc[9] have been tried to provide antibacterial properties. Many studies have focused on modifying the implant surface to enhance bone anchorage.[15,16] But, very few studies are available on implant surface treatments that would prevent bacterial adhesion, growth and colonization as well as promote rapid

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Conical connection adjustment in prosthetic abutments obtained by different techniques

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Abstract

Background: The goal of this study is to compare the misfit (>150µm) generated once the restoration, made by different techniques, is retained to a single conical implant.

Material and Methods: 15 internal connection implants (MIS C1 4'20x10mm) are embedded each one perpendicularly to an horizontal surface of the 1x1x2cm poliuretan resin model. The 15 samples obtained are divided in 5 groups depending on the framework process (n=3): 1/casting, 2/overcasting, 3/Ti-base, 4/milling and 5/laser sintering. The cobalt-chromium alloy frameworks are screw-retained to their respective implants to a 30-Ncm torque. Once it is retained the framework to the implant, the next step is to section the sample in half with a diamond saw and verify the correct fit with a stereomicroscope, measuring 4 distances in each side (A, B, C and D). Data is submitted to one-way analysis of variance (ANOVA).

Results: According to equality of variances, significant differences are found in A and B measures (p=0,000 in left side in both groups and, p=0,007 and p=0,001 in right side). In C and D, there are not statistical differences (p=0,586 and p=0,110 in left side and, p=0,101 and p=0,089 in right side). However, once it has realized ANOVA test, only C retains the hypothesis and accepts independence.

Conclusions: More samples are needed to conclude reliable statements. However, what it is observed is that milled group presents the best marginal fit. Overcasted and Ti-Base abutments also have good results above casted ones, and, sintered groups has the lowest result. Although, all systems have gaps below 150 µm, so all of them are good options for prosthetic rehabilitation.

Key words: *Conical implants, abutment connection, misfit.*

COMPLICACIONES BIOMECÁNICAS DE LOS IMPLANTES: FRACTURA Y AFLOJAMIENTO DE TORNILLOS

TRABAJO FIN DE GRADO

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Influences of microgap and micromotion of implant–abutment interface on marginal bone loss around implant neck

Running title: Microgap and micromotion of IAI

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Conflicts of interest: none

"LA IMPORTANCIA DE LA OCLUSIÓN SOBRE LA PRÓTESIS IMPLANTOSOPORTADA"

TRABAJO FIN DE MÁSTER 2016-2017

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TÍTULO PROPIO MÁSTER DE IMPLANTOPRÓTESIS.

The Role of Occlusion in Implant Therapy: A Comprehensive Updated Review

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Although occlusion and occlusal trauma on natural teeth have been studied extensively, there is limited literature regarding implant occlusion. The biophysiologic differences between a tooth and an implant make application of the occlusion literature for natural teeth to endosseous dental implants nearly impossible. Additionally, several challenges exist in studying implant occlusion, including its feasibility and the ethics of studying occlusion in human clinical studies. Thus, the majority of the available information regarding implant occlusion relies on the principles of engineering and mechanics to understand implant occlusion. The purpose of this systematic literature review was to describe the way occlusal forces may impact dental implants and their surrounding bone, to describe occlusal overload on implants and possible resulting complications, and to provide clinical recommendations for implant occlusion.

Purpose: *Occlusal overload may cause implant biomechanical failures, marginal bone loss, or even complete loss of osseointegration. Thus, it is important for clinicians to understand the role of occlusion in implant long-term stability. This systematic review updates the understanding of occlusion on dental implants, the impact on the surrounding peri-implant tissues, and the effects of occlusal overload on implants. Additionally, recommendations of occlusal scheme for implant prostheses and designs were formulated.*

Materials and Methods: *Two reviewers completed a literature search using the PubMed database and a manual search of relevant journals. Relevant articles from January 1950 to September 20, 2015 published in the English language were considered.*

Results: *Recommendations for implant occlusion are lacking in the literature. Despite this, implant occlusion should be carefully addressed.*

Conclusion: *Recommendations for occlusal schemes for single implants or fixed partial denture supported by implants include a mutually protected occlusion with anterior guidance and evenly distributed contacts with wide freedom in centric relation. Suggestions to reduce occlusal overload include reducing cantilevers, increasing the number of implants, increasing contact points, monitoring for parafunctional habits, narrowing the occlusal table, decreasing cuspal inclines, and using progressive loading in patients with poor bone quality. Protecting the implant and surrounding peri-implant bone requires an understanding of how occlusion plays a role in influencing long-term implant stability. (Implant Dent 2016;25:829–838)*

Key Words: dental implant, implant occlusion, occlusal overload

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MATERIALS AND METHODS

A literature search was completed using the PubMed database to create a systematic literature review that updates the understanding of occlusion on dental implants, the impact on the surrounding peri-implant tissues, and the effects of occlusal overload on implants. Additionally, information from the literature was used for the development of recommendations for occlusal schemes for various implant prostheses and designs. Two reviewers (R.S. and A.D.) searched the PubMed database manually using the terms "dental" and "occlusion" and several search terms and pairs of search terms, including, but not limited to, the words "implant occlusion," "implant biomechanics," "occlusal scheme," and "occlusal overload." In addition, a manual search of the following journals was conducted: *The International Journal of Oral & Maxillofacial Implants*, *Clinical*

Diagnosis of Periimplant Disease

Hideaki Hirooka, DDS, MS* and Stefan Renvert, DDS, PhD†

Purpose: *The aim of this review is to describe the current guidelines for the differential diagnosis of periimplant diseases.*

Materials and Methods: *Synopsis reviews were conducted to define the differential diagnosis of periimplant disease through an electronic literature search in MEDLINE up to February 2018.*

Discussion: *Periimplant mucositis is defined by the presence of bleeding and/or suppuration on gentle probing with or without an increased probing depth compared with previous examinations and by the absence of bone loss beyond crestal bone–level changes resulting from initial bone remodeling. Periimplantitis is defined by the presence of bleeding and/or suppuration on gentle probing with an increased probing depth compared with previous examinations and by the presence of bone loss beyond crestal bone–level changes resulting from initial bone remodeling. Thus, a combination of clinical registrations (probing pocket depth, bleeding on probing, and presence of pus) combined with radiographic signs of possible bone loss is needed for differential diagnosis.*

Conclusions: *An accurate baseline registration at the time of placement of the prosthesis (probing pocket depth and bone level) with ongoing yearly monitoring is essential for diagnosis and appropriate disease management. (Implant Dent 2019;28:144–149)*

Key Words: periimplant health, periimplant mucositis, periimplantitis

Dental implants have been widely used to replace missing teeth. Data from systematic reviews suggest that 10 years after insertion of implants, the success rate is very high, and most implants placed remain functional. Biological complications for these remaining implants are, however, frequently found.[1] Current systematic reviews suggest that the prevalence of periimplant mucositis is approximately 43% (range: 19%–65%), and the prevalence of periimplantitis is approximately 22% (range: 1%–47%).[2] The wide range can partly be explained by the diagnostic criteria used.[3] Other complications typically involve mechanical problems with either the implant device itself or the prosthetic reconstruction.

The appropriate diagnosis of periimplant conditions (periimplant health, periimplant mucositis, and periimplantitis) is important to prevent and properly handle biological complications. Routine and regular examinations of patients with dental implants are currently recommended and consistent with well-established procedures to maintain periodontal health. Detection of biological complications at an early and reversible stage will facilitate successful interception and prevention of the progression of periimplant biological complications.

Biological complications at dental implants are composed of plaque-induced (eg, periimplant mucositis and periimplantitis) and non–plaque-associated conditions adjacent to dental implants such as implant mucosal recession, mucosal hyperplasia, lesions due to trauma, and other nonspecific clinical conditions. The diagnoses of these plaque-associated and non–plaque-associated periimplant diseases are largely dependent on whether there is plaque-induced active infection (eg, bleeding on probing [BoP], exudate/suppuration, radiographic bone loss, and increasing probing pocket depth).

The aim of this review is to describe the current practice and guidelines for the diagnosis of plaque-induced periimplant diseases. This review is specifically intended to support oral health practitioners in the diagnosis, prevention, and subsequent treatment of disease of dental implants.

MATERIALS AND METHODS

An electronic literature search was performed in MEDLINE via the PubMed database of the US National Library of Medicine for articles published through February 2018 containing the terms "peri-implantitis" OR "peri-implant mucositis" OR "peri-implant diseases" OR "peri-implant complications" AND "diagnosis" OR "classification". The search was limited

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Review

Smoking and dental implants: A systematic review and meta-analysis

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ABSTRACT

Objective: Recent studies implicate smoking as a significant factor in the failure of dental implants. This review aims to test the null hypothesis of no difference in the implant failure rates, risk of postoperative infection, and marginal bone loss for smokers versus non-smokers, against the alternative hypothesis of a difference.
Data: Main search terms used in combination: dental implant, oral implant, smoking, tobacco, nicotine, smoker, and non-smoker.
Sources: An electronic search was undertaken in September/2014 in PubMed/Medline, Web of Science, Cochrane Oral Health Group Trials Register plus hand-searching.
Study selection: Eligibility criteria included clinical human studies, either randomized or not. The search strategy resulted in 1432 publications, of which 107 were eligible, with 19,836 implants placed in smokers, with 1259 failures (6.35%), and 60,464 implants placed in non-smokers, with 1923 failures (3.18%).
Conclusions: The insertion of implants in smokers significantly affected the failure rates, the risk of postoperative infections as well as the marginal bone loss. The results should be interpreted with caution due to the presence of uncontrolled confounding factors in the included studies.
Clinical significance: Smoking is a factor that has the potential to negatively affect healing and the outcome of implant treatment. It is important to perform an updated periodic review to synthesize the clinical research evidence relevant to the matter.

1. Introduction

Q2 Nicotine is the most important constituent among more than 4000 potentially toxic substances in tobacco products. It is the main chemical component responsible for tobacco addiction, appears to mediate the haemodynamic effects of smoking, and has been implicated in the pathogenesis of numerous diseases.[1] Studies have also demonstrated the detrimental effects of smoking on oral health. A clinical study[2] observed that smokers had a higher prevalence of moderate and severe periodontitis and higher prevalence and extent of attachment loss and gingival recession than non-smokers, suggesting poorer periodontal health in smokers. In addition, smokers had a higher number of missing teeth than non-smokers. Concerning the bone-implant interface, the deleterious effects

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Incidencia de osteonecrosis de los maxilares por el uso de inhibidores de osteoclastos en pacientes con metástasis óseas: estudio de cohorte retrospectivo

Incidence of osteonecrosis of the jaw by the use of osteoclast inhibitors in patients with bone metastases: a retrospective cohort study

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Resumen

Antecedentes: *El uso de inhibidores de osteoclastos en la enfermedad metastasica ósea tiene como objetivo aumentar la densidad mineral ósea y reducir el riesgo de fractura. Se han reportado pacientes con osteonecrosis de los maxilares tras el uso crónico de estos inhibidores. En nuestro país, los inhibidores de osteoclastos se usan en el contexto de osteoporosis y de metástasis óseas, por lo que es importante describir la incidencia de esta complicación en población mexicana.* **Objetivo:** *Describir la incidencia de osteonecrosis de los maxilares en el Centro Médico Nacional 20 de Noviembre, durante el periodo del 1 de enero del 2010 al 1 de junio de 2016.* **Método:** *Estudio de cohorte retrospectiva desarrollado en el Centro Médico Nacional 20 de Noviembre, del Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado, en Ciudad de México. Se incluyeron todos los pacientes que recibieron bisfosfonatos o denosumab con enfermedad metastasica ósea por tumores sólidos, y que presentaron osteonecrosis de mandíbula.* **Resultados:** *Se analizaron 802 pacientes que recibieron bisfosfonatos o denosumab en enfermedad metastasica ósea (699 bifosfonatos y 103 denosumab). De ellos, 28 (3.5%) presentaron osteonecrosis. La mediana de uso de ácido zoledrónico para la presencia de osteonecrosis fue de 25 meses (15-49 meses), y para denosumab fue de 16 meses (11-35 meses), sin encontrar diferencias significativas entre ellos (p = 0.511) y el riesgo de osteonecrosis.* **Conclusiones:** *La osteonecrosis inducida por medicamentos tiene una baja incidencia en población mexicana. El denosumab no muestra un mayor número de casos de osteonecrosis en comparación con los bisfosfonatos. No se encontró asociación entre el estado funcional, el número de sitios óseos metastásicos ni el uso de antiangiogénicos o de inhibidores de la tirosina cinasa como factor asociado a osteonecrosis de los maxilares.*

PALABRAS CLAVE: *Denosumab. Inhibidores de osteoclastos. Osteonecrosis maxilar.*

Abstract

Background: *The use of osteoclast inhibitors in metastatic bone disease, increase bone mineral density and reduce the risk of fracture, patients with osteonecrosis have been reported after the chronic use of these inhibitors. In our country, the use of osteoclast inhibitors is in the context of osteoporosis and bone metastases, so it is important to describe the incidence of this complication in Mexican population.* **Objective:** *To describe the incidence of osteonecrosis of the jaws at the Centro Médico Nacional 20 de Noviembre, during the period from January 1st, 2010 to June 1st, 2016.* **Methods:** *This is a retrospective cohort study developed at the Centro Medico Nacional 20 Noviembre, ISSSTE, Mexico. We included all patients who received bisphosphonates or denosumab in the context of metastatic bone disease due to solid tumors and who had osteonecrosis of*

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PERIIMPLANTITIS: DIAGNÓSTICO CLÍNICO Y FACTORES ASOCIADOS A LA PATOLOGÍA.

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RESUMEN

ARTÍCULOS CIENTÍFICOS señalan que aproximadamente 2 de cada 10 españoles portadores de implantes podrían padecer periimplantitis. En efecto, la periimplantitis es una patología inflamatoria de origen infeccioso que cursa con pérdida ósea alrededor de implantes dentales. Es una entidad condicionada, en parte, por la presencia de algunos factores locales predisponentes que pueden tener un papel fundamental en el desarrollo y resolución de la enfermedad. Por ello, el diagnóstico precoz es clave para el éxito terapéutico. Esta revisión de la literatura tiene como objetivo repasar la exactitud de los métodos diagnósticos primarios, así como los factores locales, sistémicos y hábitos asociados a la patología. Su lectura y correcta interpretación permitirá al clínico e higienista dental prevenir y manejar de un correcto modo estos escenarios de relativa frecuencia e indeseados.

INTRODUCCIÓN

EL CRITERIO MÁS EMPLEADO hasta la actualidad para valorar el éxito de los implantes fue redactado por Albrektsson y cols. en una revisión narrativa. Aquí se subrayó que el éxito se corresponde con las siguientes características: (1) ausencia de movilidad o radiolucidez apical, (2) ausencia de infección o dolor, (3) pérdida de hueso periimplantar < 1,5 mm durante el primer año, y (4) pérdida de hueso progresiva < 0,2 mm/año (Albrektsson y cols. 1986). Durante la última década del siglo XX, los esfuerzos fueron puestos en la obtención de resultados más estéticos, en la inmediatez en relación con la colocación de implantes y la restauración de estos, y en las soluciones terapéuticas para rehabilitar zonas con deficiencias óseas y mucosas.

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Peri-implantitis Update: Risk Indicators, Diagnosis, and Treatment

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Eur J Dent

Abstract

Despite the success rates of dental implants, peri-implantitis presents as the most common complication in implant dentistry. This review discusses various factors associated with peri-implantitis and various available treatments, highlighting their advantages and disadvantages. Relevant articles on peri-implantitis published in English were reviewed from August 2010 to April 2020 in MEDLINE/PubMed, Scopus, and ScienceDirect. The identified risk indicators of peri-implant diseases are plaque, smoking, history of periodontitis, surface roughness, residual cement, emergence angle >30 degrees, radiation therapy, keratinized tissue width, and function time of the implant, sex, and diabetes. Peri-implantitis treatments can be divided into non-surgical (mechanical, antiseptic, and antibiotics), surface decontamination (chemical and laser), and surgical (air powder abrasive, resective, and regenerative). However, mechanical debridement alone may fail to eliminate the causative bacteria, and this treatment should be combined with other treatments (antiseptics and surgical treatment). Surface decontamination using chemical agents may be used as an adjuvant treatment; however, the definitive clinical benefit is yet not proven. Laser treatment may result in a short-term decrease in periodontal pocket depth, while air powder abrasive is effective in cleaning a previously contaminated implant surface. Surgical elimination of a pocket, bone recontouring and plaque control are also effective for treating peri-implantitis. The current evidence indicates that regenerative approaches to treat peri-implant defects are unpredictable.

Keywords
- dental implants
- peri-implantitis
- implant complications
- decontamination
- anti-infective agents
- periodontal debridement
- bone regeneration

Introduction

The dental implant has revolutionized oral rehabilitation and become a part of routine treatment in prosthetic rehabilitation.[1] There has been marked advancement in implant design, materials used, and surgical protocols. A high implant survival rate (94.6%) has been reported over a 13.4-year follow-up.[2] Approximately 90% of patients who received an implant were satisfied with their chewing ability and

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ORIGINAL RESEARCH

CLINICAL ORAL IMPLANTS RESEARCH WILEY

Influence of periodontal maintenance and periodontitis susceptibility on implant success: A 5-year retrospective cohort on moderately rough surfaced implants

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Abstract

Objectives: To investigate the effect of defined versus undefined periodontal maintenance after implant therapy on the prevalence of peri-implant complications.

Material and Methods: Two hundred patients who underwent dental implant therapy in the National Dental Centre Singapore (NDCS) from 2005 to 2012 were recruited. One hundred patients had regular periodontal maintenance (defined maintenance programme group, DMP), and the other 100 patients had no documentation of periodontal maintenance (undefined maintenance programme group, UMP). Full-mouth bleeding scores (FMBS), periodontal probing depths (PPD) and peri-implant probing depths (PiPD) were evaluated within 6 months of prostheses delivery (T_0) and at re-examination (T_1). Peri-implant bone level changes were analysed radiographically.

Results: The mean follow-up time was 6.8 years. Five out of 289 implants were lost (cumulative survival rate = 98.3%). 6.0% of DMP patients and 20.0% of UMP patients had peri-implantitis (p = .003). Peri-implantitis was defined as bleeding on probing, increase in PiPD and peri-implant bone loss ≥ 0.5 mm. At the implant level, 4.0% of the DMP group implants and 17.2% of the UMP group implants were diagnosed with peri-implantitis (p = .0003). One implant in the DMP group and 13 implants in the UMP group had bone loss ≥ 2 mm (p < .0001). Multivariate regression showed that absence of regular maintenance (OR = 0.24, p = .003) was significantly associated with peri-implantitis.

Conclusions: Regular periodontal maintenance was associated with a lower prevalence of peri-implantitis and peri-implant bone loss. Patients with treated periodontitis without regular maintenance after implant placement were at higher risk for developing peri-implantitis.

KEYWORDS

compliance, Implant dentistry, maintenance, periodontally healthy subjects, periodontally susceptible patients

CLINICAL ORAL IMPLANTS RESEARCH

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Periodontitis, implant loss and peri-implantitis. A meta-analysis

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Key words: aggressive periodontitis, chronic periodontitis, dental implants, meta-analysis peri-implantitis, periodontitis

Abstract

Objective: The aim of the present systematic review and meta-analysis was to assess the role of periodontal disease as a risk factor for implant loss, peri-implantitis and implant-bone loss.

Materials and methods: Six electronic database and a manual search resulted in 7391 unique publications; after selection only 16 studies were included in systematic review. Dichotomous data were expressed as risk ratio (RR) and 95% confidence interval (CI), while continuous data were expressed as standardized mean difference (SMD). Due to the expected inter-study heterogeneity, a random effect model was used for both type of data. The pooled effect was considered significant for a $P < 0.05$.

Results: Meta-analysis revealed that an higher and significant risk for implant loss was present in patients affected by PD (RR: 1.69, 95% CI: 1.31–2.17, $P < 0.0001$). A higher and significant IBL was present in patients with periodontal disease, when compared with patients periodontally healthy (SMD: 0.38, 95% CI: 0.18–0.58, $P = 0.0002$). Patients periodontally compromised showed an increased risk of PI, when compared with patients without periodontitis (RR: 2.17, 95% CI: 1.51–3.12, $P < 0.0001$) No evidence of significant heterogeneity was detected for the three outcomes.

Conclusion: Strong evidence suggests that periodontitis is a risk factor for implant loss; moderate evidence revealed that periodontitis is a risk factor for peri-implantitis and that patients with periodontitis have higher implant-bone loss.

Osseointegrated implants are increasingly being used as supports for prosthetic rehabilitations in partially or totally edentulous patients. Implant therapy has been identified as a successful and predictable treatment strategy (Esposito et al. 2005; Levin et al. 2011). Despite its predictability, some risk factors could negatively influence the success of implant therapy, leading to implant loss and/or increasing the occurrence of implant complications, such as peri-implantitis (Pjetursson et al. 2004). Among these risk factors, periodontal disease (PD) has often been mentioned, but there is no general consensus regarding its influence on implant therapy outcomes. Several systematic reviews have been conducted on this issue, but with no definitive conclusions.

A recent meta-analysis (Safii et al. 2010) seemed to show a possible increased risk of implant loss in patients with PD compared with periodontally healthy patients. However, beyond the small number of included studies, the meta-analysis included retrospective studies, which are potentially biased. Furthermore, the meta-analysis did not consider the potentially increased risk of peri-implantitis in periodontally compromised patients compared with periodontally healthy ones. Thus, there is a substantial need for further assessment of the scientific evidence. In addition, the influences of the type and severity of PD on implant loss, peri-implantitis, and implant bone loss remain to be defined. Therefore, the aim of the present systematic review and meta-analysis was to assess the scientific evidence regarding the risks of implant loss, implant bone loss, and peri-implantitis incidence in subjects with a history of PD, compared with patients without PD.

Material and methods

Protocol

A systematic review was conducted according to the recommendations of the Cochrane Collaboration (Higgins & Green 2011) and the principles of the PRISMA statement (Moher et al. 2009).

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ORIGINAL RESEARCH

CLINICAL ORAL IMPLANTS RESEARCH WILEY

The effect of factors related to periodontal status toward peri-implantitis

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Abstract

Objective: To investigate the association between periodontal status and peri-implant diseases in patients with osseointegrated dental implants of different implant systems.

Materials and methods: This cross-sectional study evaluated 200 consecutive implant patients using clinical and radiographic examinations during periodontal maintenance visits. The demographic data and treatment history were obtained from history taking and chart record review. The association between periodontal status and peri-implant diseases was analyzed using chi-square and logistic regression analysis.

Results: Patients with a history of chronic periodontitis had a significantly higher prevalence of peri-implantitis compared with those without a history of periodontal disease (25% vs. 10.9%). The highest prevalence of peri-implantitis was observed in patients with a history of severe chronic periodontitis. Data analysis revealed that peri-implant health status was significantly associated with past periodontal status, maintenance status, and present periodontal status. However, multivariate analysis indicated that only a history of chronic periodontitis was significantly associated with peri-implantitis (adjusted OR = 2.55, 95% CI 1.14–5.70, p = 0.02).

Conclusions: Patients with a history of chronic periodontitis, especially those with severe periodontal disease had a 2.5-fold increased risk of peri-implantitis.

KEYWORDS
dental implants, peri-implant mucositis, peri-implantitis, periodontal status, periodontitis

1 | INTRODUCTION

Dental implants are an alternative treatment to removable prosthodontics with a high survival rate for replacing missing teeth in patients with a fully or partially edentulous area (Adell, Eriksson, Lekholm, Branemark, & Jemt, 1990; Branemark et al., 1977; Buser, Weber, Bragger, & Balsiger, 1991). Peri-implant diseases are a major biological complication of implant therapy, which impair their long-term success (Fransson, Lekholm, Jemt, & Berglundh, 2005; Karoussis et al., 2003; Pjetursson et al., 2012; Roos-Jansaker, Lindahl, Renvert, & Renvert, 2006). The latest 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions defined the diagnosis of peri-implant diseases into two categories: peri-implant mucositis and peri-implantitis (Renvert, Persson, Pirih, & Camargo, 2018a, 2018b). In peri-implant mucositis, signs of inflammation are found in the soft tissue around the dental implant, for example, redness, swelling, or bleeding within 30 s after probing, with no further bone loss after initial healing. In peri-implantitis, peri-implant signs of inflammation are found in the soft tissue, with radiographic bone loss after

Microbiologic and Clinical Findings of Implants in Healthy Condition and with Peri-Implantitis

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Purpose: *To compare implants in healthy conditions and implants with peri-implantitis with regard to their clinical parameters and the microbiologic composition at the peri-implant sulcus, inside the implant connection, and the gingival sulcus of neighboring teeth.* ***Materials and Methods:*** *A cross-sectional study was performed including consecutive patients with implants in healthy conditions and with peri-implantitis. Clinical parameters for which patients were screened included bleeding on probing, pocket depth, and plaque index at six sites. Samples for microbiologic analysis were obtained from three locations: the peri-implant sulcus, inside the implant connection, and the gingival sulcus of neighboring teeth. Quantitative real-time polymerase chain reaction (PCR) was carried out for total counts of 10 microorganisms:* Aggregatibacter actinomycetemcomitans, Porphyromona gingivalis, Tanerella forsythia, Tanerella denticola, Prevotela intermedia, Peptostreptococcus micros, Fusobacterium nucleatum, Campylobacter rectus, Eikenella corrodens, *and* Candida albicans. *The response variables were the percentage of positive sites and total bacterial counts.* ***Results:*** *One hundred twenty-two implants in 57 patients were analyzed in the healthy group and 113 implants in 53 patients in the peri-implantitis group. Differences between the groups were statistically significant for bruxism, probing pocket depth, bleeding on probing, and radiographic bone level. Orange complex species (*P intermedia, P micros, F nucleatum*) were the most prevalent in the three types of sites for both groups, and prevalence values were higher in the peri-implantitis group. Differences in prevalence between groups were more marked inside the connection than in the peri-implant sulcus. Absolute loads of most microbes and total bacterial counts were higher for the peri-implantitis group in the three locations. Again, differences were bigger inside the connection than at the peri-implant sulcus. Significant interactions were found for prevalence and absolute microbial loads between groups and locations, and for the interaction of group × location.* ***Conclusion:*** *Clinical and microbiologic differences were observed between healthy subjects and those with peri-implantitis. Microbiologic differences between groups were more marked inside the connection than in the peri-implant sulcus. The potential role of the implant connection as a microbial reservoir for peri-implant diseases and in the outcome of their treatment should be confirmed with further studies.* Int J Oral Maxillofac Implants 2015;30:834–842. doi: 10.11607/jomi.3947

Key words: *contamination of the implant connection, microbiologic contamination, peri-implantitis, periopathogen bacteria, RT-PCR*

Compared to natural periodontal/tooth interface, peri-implant tissues present an "open wound conformation" more susceptible to endogenous infection.[1] Clinically, it has been demonstrated that the host response at the gingival tissue of patients with peri-implantitis (peri-mucositis) is more pronounced than in individuals with periodontitis.[2] Also, human biopsy material has revealed more apical extension of the inflammatory cell infiltrate, with neutrophils and granulocytes found in great proportions.[3] Besides suppuration, increased bleeding, and pocket depth alterations, the clinical consequence of peri-implantitis is circumferential bone loss, still not completely resolved with the single or combined treatment strategies[4] described in the literature, with obvious implications for esthetics and patient satisfaction.

Once present, peri-implantitis has an infectious pattern. Thus, to understand how health and disease states are balanced over time, it is necessary to consider the

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Does Bruxism Contribute to Dental Implant Failure? A Systematic Review and Meta-Analysis

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ABSTRACT

Background: Bruxism was usually considered as a contraindication for oral implanting. The causal relationship between bruxism and dental implant failure was remained controversial in existing literatures.

Purpose: This meta-analysis was performed to investigate the relationship between them.

Materials and Methods: This review conducted an electronic systematic literature search in MEDLINE (PubMed) and EmBase in Novermber 2013 without time and language restrictions. Meanwhile, a hand searching for all the relevant references of included studies was also conducted. Study information extraction and methodological quality assessments were accomplished by two reviewers independently. A discussion ensued if any disagreement occurred, and unresolved issues were solved by consulting a third reviewer. Methodological quality was assessed by using the Newcastle-Ottawa Scale tool. Odds ratio (OR) with 95% confidence interval (CI) was pooled to estimate the relative effect of bruxism on dental implant failures. Fixed effects model was used initially; if the heterogeneity was high, random effects model was chosen for meta-analysis. Statistical analyses were carried out by using Review Manager 5.1.

Results: In this meta-analysis review, extracted data were classified into two groups based on different units. Units were based on the number of prostheses (group A) and the number of patients (group B). In group A, the total pooled OR of bruxers versus nonbruxers for all subgroups was 4.72 (95% CI: 2.66–8.36, $p = .07$). In group B, the total pooled OR of bruxers versus nonbruxers for all subgroups was 3.83 (95% CI: 2.12–6.94, $p = .22$).

Conclusions: This meta-analysis was performed to evaluate the relationship between bruxism and dental implant failure. In contrast to nonbruxers, prostheses in bruxers had a higher failure rate. It suggests that bruxism is a contributing factor of causing the occurrence of dental implant technical/biological complications and plays a role in dental implant failure.

KEY WORDS: bruxism, complication, dental implant, implant failure, teeth grinding

INTRODUCTION

Endosseous dental implant has become a promising treatment method to replace the missing teeth in completely and partially edentulous patients as documented by systematic reviews in recent decades.[1,2] The scope of dental implantation indications is expanded by continuous efforts and improvements, which greatly improved the quality of life of patients. Despite of the high success rates, dental implant complications and even complete failure are still the problems that every implantologist has to face in clinical practice. Only 66.4% of patients are completely free from any type of reported complications following the restoration of the implant-supported fixed prostheses.[3] According to clinical studies, dental implant complications include biological (marginal bone loss, peri-implantitis) and/or technical complications (superstructures fracture, losing of reten-

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An Evaluation of the Relationship Between Peri-implant Soft Tissue Biotype and the Severity of Peri-implantitis: A Cross-Sectional Study

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Purpose: *This cross-sectional study aimed to analyze the relation between peri-implant soft tissue biotype (STB) and different levels of peri-implantitis severity, and to identify the possible risk indicators that affect the severity of peri-implantitis with regard to STB around dental implants.* ***Materials and Methods:*** *Eighty-seven patients with 229 implants were diagnosed with peri-implantitis and recruited to the study. Clinical and radiographic parameters including Plaque Index (PI), probing depth (PD), bleeding on probing (BOP), gingival/mucosal recession (GR/MR), clinical attachment level (CAL), and marginal bone loss (BL) were analyzed. The periodontal status was assessed, and the levels of peri-implantitis severity were defined. These parameters were compared among the peri-implant STB groups (thick and thin biotype). To evaluate the effect of possible risk indicators on the levels of severity of peri-implantitis, univariate and multivariate logistic regression analyses were conducted for thick and thin biotype groups.* ***Results:*** *The mean values of BOP, MR, CAL, and marginal BL were significantly lower for the thick group compared with the thin group ($P < .05$). For PI and PD values, no significant differences were found between the groups ($P > .05$). Moreover, multivariate analysis revealed statistically significant associations between peri-implantitis severity and the risk indicators of maintenance therapy compliance and current periodontitis for the thin group ($P < .05$).* ***Conclusion:*** *The thin biotype could be more prone to an increase in the severity of peri-implantitis. Maintenance therapy compliance and current periodontitis could be important risk indicators that affect the progression of the severity of peri-implantitis for implants where keratinized mucosa is thin or absent.* Int J Oral Maxillofac Implants 2019;34:187–196. doi: 10.11607/jomi.6958

Keywords: *keratinized mucosa thickness, maintenance, peri-implantitis, periodontitis, risk factors*

Implant therapy is characterized as a successful and predictable approach with high survival rates of the dental implants in most cases.[1–3] Biologic complications of implants were identified as the main reason for the failure of implant therapy.[4] Various risk indicators that give rise to an increase in the occurrence of implant complications, such as peri-mucositis, peri-implant marginal bone loss (BL), and peri-implantitis, can negatively influence the success of implant therapy.[5] A number of studies evaluated the possible risk indicators related to the progression of peri-implantitis, such as biomechanical stress,[6] poor oral hygiene,[7] smoking habits,[8] history of periodontal disease,[9] maintenance therapy compliance,[10] surgery-related factors[11] and prosthetic factors including poor marginal fit and overcontouring of the suprastructure,[12] and cement remnants.[13] These factors have been reported to also affect the severity of peri-implantitis.[14] However, they have not been thoroughly identified due to the lack of adequate evidence about the possible risk indicators influencing the severity of peri-implantitis.

Periodontal biotype is an important morphologic feature of soft tissues, and it is associated with the outcomes of periodontal treatment, mucogingival surgery, and implant therapy.[15] Peri-implant soft tissue biotype (STB) has been highlighted to have a crucial role in the success and predictability of implant treatment, and it is mostly categorized as thin and thick tissue thickness.[16] A thin biotype has been indicated to

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CLINICAL ORAL IMPLANTS RESEARCH

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Risk indicators for Peri-implantitis. A cross-sectional study with 916 implants

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Key words: clinical assessment, clinical research, clinical trials, diagnosis, epidemiology

Abstract

Objectives: The aim of this study was to identify systemic and local risk indicators associated with peri-implantitis.

Material and methods: One hundred eighty-three patients treated with 916 osseointegrated titanium implants, in function for at least 1 year, were included in the present study. The implants were installed at the Foundation for Scientific and Technological Development of Dentistry (FUNDECTO) - University of Sao Paulo (USP) - from 1998 to 2012. Factors related to patient's systemic conditions (heart disorders, hypertension, smoking habits, alcoholism, liver disorders, hepatitis, gastrointestinal disease, diabetes mellitus I and II, hyperthyroidism or hypothyroidism, radiation therapy, chemotherapy, menopause, osteoporosis, active periodontal disease, history of periodontal disease and bruxism), implant's characteristics (location, diameter, length, connection, shape, and antagonist), and clinical parameters (wear facets, periodontal status on the adjacent tooth, plaque accumulation on the adjacent tooth, modified plaque index, sulcus bleeding index, probing depth, bleeding on probing, width of keratinized tissue and marginal recession).

Results: An increased risk of 2.2 times for history of periodontal disease (PD), 3.6 times for cemented restorations compared to screw-retained prostheses, 2.4 times when wear facets were displayed on the prosthetic crown and 16.1 times for total rehabilitations when compared to single rehabilitations were found. Logistic regression analysis did not show any association between the implant's characteristics and peri-implantitis.

Conclusions: A history of periodontal disease, cemented prostheses, presences of wear facets on the prosthetic crown and full mouth rehabilitations were identified as risk indicators for peri-implantitis. Implants' characteristics were not related to the presence of peri-implantitis.

The word peri-implantitis is used to describe destructive infectious pathologies in the soft tissues around dental implants resulting in bone loss (Lindhe & Meyle 2008). Bone remodeling after implant placement should be distinguished from bone loss due to subsequent infection. The presence of bacteria at the implant-abutment interface and its proximity to the bone may result in bone loss (Berglundh et al. 1991; Quirynen & van Steenberghe 1993; Jansen et al. 1997). The microbiota adhering to the implant surface results in an inflammatory response. The marginal bone is affected, which may be due to the absence of a periodontal ligament and a reduced number of fibroblasts and blood vessels (Zeza & Pilloni 2012; Wilson 2013).

Current guidelines for the diagnosis of peri-implantitis were determined in the seventh (Lang & Berglundh 2011) and eighth (Sanz & Chapple 2012) European Workshop on Periodontology. Peri-implantitis is characterized by increased depth of the peri-implant sulcus >4 mm; bleeding and/or suppuration on probing and marginal bone loss ≥2 mm, very often detected accidentally in radiographs during professional maintenance care, since pain does not seem to be a common phenomenon (Mombelli 1999; Lindhe et al. 2008; Lang & Berglundh 2011). If the apical osseointegration is maintained, the disease can progress without any notable signs of implant mobility (Mombelli & Lang 1998).

It is assumed that risk indicators associated with periodontal disease actively contribute to peri-implantitis, thus patients with increased susceptibility to periodontal disease, poor oral hygiene and smoking habits

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ORIGINAL RESEARCH

CLINICAL ORAL IMPLANTS RESEARCH WILEY

Prevalence and risk/protective indicators of peri-implant diseases: A university-representative cross-sectional study

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Abstract

Aim: To evaluate the prevalence of peri-implant diseases and to identify risk/protective indicators of peri-implantitis.

Materials and Methods: Two hundred and forty randomly selected patients from a university clinic database were invited to participate. Those who accepted, once data from their medical and dental history were collected, were examined clinically and radiographically to assess the prevalence of peri-implant health and diseases. Peri-implantitis was defined as the presence of BoP/SoP together with radiographic bone levels (BL) ≧2 mm. An intermediate peri-implant health category between peri-implant mucositis and peri-implantitis was also identified, defined by the presence of BoP/SoP together with 1 mm ≦BL < 2 mm. A multilevel multivariate logistic regression analysis was carried out to identify those factors associated either positively (risk) or negatively (protective) with peri-implantitis.

Results: Ninety-nine patients with a total of 458 dental implants were analyzed. The prevalences of pre-periimplantitis and of peri-implantitis were, respectively, 31.3% and 56.6% at patient-level, while 31.7% and 27.9% at implant level. The following factors were identified as risk indicators for peri-implantitis: smoking (OR = 3.59; 95% CI: 1.52–8.45), moderate/severe periodontitis (OR = 2.77; 95% CI: 1.20–6.36), <16 remaining teeth (OR = 2.23; 95% CI: 1.05–4.73), plaque (OR = 3.49; 95% CI: 1.13–10.75), implant malposition (too vestibular: OR = 2.85; 95% CI: 1.17–6.93), implant brand (Nobel vs. Straumann: OR = 4.41;95% CI: 1.76–11.09), restoration type (bridge vs. single crown: OR = 2.47; 95% CI: 1.19–5.12), and trauma as reason of tooth loss (vs. caries: OR = 6.51; 95% CI: 1.45–29.26). Conversely, the following factors were identified as protective indicators: interproximal flossing/brushing (OR = 0.27; 95% CI: 0.11–0.68), proton pump inhibitors (OR = 0.08; 95% CI: 0.01–0.90), and anticoagulants (OR = 0.08; 95% CI: 0.01–0.56).

Conclusions: Peri-implant diseases are highly prevalent among patients with dental implants in this university-based population. Several factors were identified as risk- and protective- indicators of peri-implantitis.

Prevalence and Predictive Factors for Peri-Implant Disease and Implant Failure: A Cross-Sectional Analysis

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Background: Long-term studies worldwide indicate that peri-implant inflammation is a frequent finding and that the prevalence of peri-implantitis correlates with loading time. Implant loss, although less frequent, has serious oral health and economic consequences. An understanding of predictive factors for peri-implant disease and implant loss would help providers and patients make informed decisions.

Methods: A cross-sectional study was performed on 96 patients with 225 implants that were placed between 1998 and 2003. Implant placement data were collected from patient records, and patients presented for a clinical and radiographic follow-up examination. Implant status and periodontal status were determined, the data were analyzed to determine the prevalence of peri-implant disease or implant loss, and a predictive model was tested.

Results: The mean follow-up time for the patients was 10.9 years. The implant survival rate was 91.6%. Peri-implant mucositis was found in 33% of the implants and 48% of the patients, and peri-implantitis occurred in 16% of the implants and 26% of the patients. Individuals with peri-implantitis were twice as likely to report a problem with an implant as individuals with healthy implants. Peri-implantitis is associated with younger ages and diabetes at the time of placement and with periodontal status at the time of follow-up. Implant loss is associated with diabetes, immediate placement, and larger-diameter implants.

Conclusions: One in four patients and one in six implants have peri-implantitis after 11 years. The data suggest that periodontal and diabetes status of the patient may be useful for predicting implant outcomes. *J Periodontol 2015;86:337-347.*

KEY WORDS

Dental implants; diabetes mellitus; follow-up studies; peri-implantitis; periodontitis; risk factors.

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With >2 million dental implants placed annually in the United States,[1] characterization of long-term dental implant outcomes is essential. The long-term survival rate of dental implants was reported recently to be 97%,[2] and yet there is no clear predictive model for implant survival. In addition, survival rates do not take into account the presence of biologic complications, and, despite the remarkably high survival rate of dental implants, there are increasing numbers of patients presenting with peri-implant diseases.[3] Given the possible systemic ramifications of chronic inflammation, it is essential to better understand peri-implant disease prevalence and risk factors so that peri-implant inflammation can be prevented or treated. These peri-implant diseases may lead to discomfort, surgical and non-surgical treatment and their associated costs,[4] negative effects on systemic health, or eventual loss of the implant.[5] Determining the future burden of peri-implant diseases is necessary for patient consent, clinician decision-making, and allocation of resources.

Peri-implant diseases have been classified as either peri-implant mucositis or peri-implantitis, with both described as infectious diseases. Peri-implant mucositis has been defined as soft tissue inflammation around a functioning dental implant with bleeding on probing (BOP), and peri-implantitis is distinguished by accompanying loss of supporting marginal

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PROF SCULLY MEMORIAL ISSUE

WILEY ORAL DISEASES

Smokers have a higher risk of inflammatory peri-implant disease than non-smokers

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Aim: To comparatively evaluate peri-implant health status in smokers and non-smokers.

Materials and Methods: A total of 142 implants (74 implants in non-smokers, 68 in smokers) in 43 smoker or non-smoker systemically healthy patients were included in the study. Demographic and clinical periodontal data were recorded and analysed by chi-square and Mann–Whitney U tests.

Results: Peri-implantitis and mucositis cases were significantly more frequent in the smokers than non-smokers ($p = .001$). Suppuration, bleeding and plaque scores around the implants were significantly higher in smokers than non-smokers ($p = .001$; $p = .002$; $p < .0001$, respectively).

Conclusion: The present findings indicate that smokers have a higher risk of inflammatory peri-implant diseases. Therefore, more frequent recalls may be recommended in smokers with dental implants.

KEYWORDS
dental implant, mucositis, peri-implantitis, smokers

1 | INTRODUCTION

Dental implants are widely used for rehabilitation of fully or partially edentulous ridges with high survival and success rates (Moraschini, Poubel, Ferreira, & Barboza, 2015). Inflammatory reactions around dental implants vary from peri-implant mucositis to peri-implantitis (Atieh, Alsabeeha, Faggion, & Duncan, 2013; Mombelli, Müller, & Cionca, 2012). Peri-implantitis may disturb function of the implants, and progressive bone loss may eventually lead to implant failure. Smoking is an important risk factor for periodontitis-associated tooth loss (Albandar, 2002; Warnakulasuriya et al., 2010). It has also been related to peri-implant bone loss and implant failure (Heitz-Mayfield, 2008; Saaby, Karring, Schou, & Isidor, 2016). A recent systematic review suggested higher postoperative infection risk, marginal bone loss and implant failure rate in smokers (Cheng, 2015). The purpose of this study was to compare clinical findings in smokers and non-smokers with dental implants that were in function for 1 year or more.

2 | MATERIALS AND METHODS

Forty-three systemically healthy patients (22 males and 21 females, aged 44–62 years; mean age: 51.2 years) were recruited in this study at the Department of Periodontology, School of Dentistry, Ege University, İzmir, Turkey, between January 2016 and January 2017. Twenty patients were heavy smokers, smoking ≥10 cigarettes/day for ≥10 years, and 23 were non-smokers, who had never smoked (Schwartz-Arad, Samet, Samet, & Mamlider, 2002). The inclusion criteria were as follows: being systemically healthy and having an implant-supported fixed prosthesis in function for at least 1 year. The diagnosis of peri-implantitis was assigned if there was at least one site with probing depth (PD) > 4 mm, bleeding on probing (BOP) and/or suppuration and radiographic evidence of bone loss ≥ 2 mm. Peri-implant mucositis was diagnosed when there was BOP without loss of supporting bone (Lindhe & Meyle, 2008; Tomasi & Derks, 2012). The healthy implants had no BOP and no clinical sign of alveolar bone loss. The exclusion criteria were as follows: presence of any known

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Pathological mandibular fracture: A severe complication of periimplantitis

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Abstract

Nowadays, dental implant treatment is a very common option for patients even in medical compromised conditions. Some complications related to them have been described. Periimplantitis (PI) is one of the biggest concerns of these kind of treatments, probably has a multifactorial aethiology. Usually the consequences of PI are the loss of the implants and prostheses, expenses of money and time for dentists and patients. Very often PI implies the necesity of repeating the treatment .

Pathological mandibular fracture due to PI is a severe but infrequent complication after dental implant treatment, especially after PI. In this study we present three cases of mandibular pathologic fractures among patients with different medical and dental records but similar management: two of them had been treated years ago of oral squamous cell carcinoma with surgery and radiotherapy, the other patient received oral bisphosphonates for osteoporosis some years after implantation.

We analized the causes, consequences and posible prevention of these fractures as well as the special features of this kind of mandibular fractures and the different existing treatments.

Key words: *Periimplantitis, pathological mandibular fracture, mandibular atrophy, bicortical implants.*

Introduction

Osseointegrated dental implant for restoring oral aesthetics and function in atrophic mandible is highly successful and predictible procedure even in medical compromised patients. However, this treatment is not exempt of complications(1). Side effects like wound infection, hemorrhage, neurosensory disturbance, prosthetic problems, periimplant mucositis or periimplantitis and mandibular fracture have been reported (2-6). Mandibular fracture associated with dental implants treatment is related with dental implant instalation procedures, after inferior alveolar nerve transposition technique or mandibular distraction before implant procedure. Very few cases have been reported relating periimplantitis. The authors report three cases of pathological mandibular fracture in patients presenting severe periimplant disease.

Case Report

-CASE 1

A 72 years-old woman presented history of oral squa-

The Link Between Periodontitis/Peri-implantitis and Cardiovascular Disease: A Systematic Literature Review

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Kuan-You Liu, DDS[3]/Panpicha Maketone, DDS[4]
Viraj Patel, BDS (Hons)[2]
Ye Shi, DDS, MS[2]

A link between periodontitis and cardiovascular disease has been reported in the literature. For this systematic review, the keywords "cardiovascular disease" (CVD) were combined with "periodontitis" and "peri-implantitis" and were used to search for literature published on MEDLINE and PubMed between 1990 and 2020. Hand searching was also performed. A total of 206 articles were identified, 51 of which were reviewed. A link between periodontal disease and CVD can be explained by both the infection and inflammatory pathways. Interventional studies on the treatment of periodontal disease related to CVD have shown conflicting results. Therefore, based on published studies, CVD should presently be considered a comorbidity of periodontitis (with an association but no direct cause and effect documented). The association of CVD with peri-implantitis has too few studies to draw any conclusions. More studies are necessary before any conclusions can be made between CVD and periodontitis and CVD and peri-implantitis regarding possible links and the extent of association. Int J Periodontics Restorative Dent 2020;40:e229–e233. doi: 10.11607/prd.4591

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Periodontitis has been defined as an inflammatory disease of the supporting tissues of the teeth that is characterized by "an extension of inflammation from the gingiva into the adjacent bone with lysis of the gingival fibers, formation of periodontal pockets, and resorption of bone."[1] The 1993 European Workshop on Periodontology determined that the classification of periodontitis should be grouped into two major headings: adult and early onset periodontitis.[2] For years, periodontitis was recognized as a localized disease, the etiology of which was demonstrated as bacterial plaque (biofilm) residing in the oral cavity.[3–5] At a recent consensus conference, a new classification of periodontitis has been proposed that includes designations for disease type and speed of progression.[6] However, much of the literature mentioned in the present review was published prior to the new classification and thus refer to the original periodontitis definition.[1]

Over the last several decades, many studies have established an association between cardiovascular disease (CVD) and periodontitis. According to a number of authors, periodontitis has been demonstrated as more prevalent in patients with CVDs; conversely, many patients with periodontitis have been shown to be more likely to develop

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RESEARCH Open Access

Relationship between risk markers for cardiovascular disease and peri-implant diseases

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Abstract

Background: The aim of this paper is to explore the serum biochemical parameters also known as risk markers for cardiovascular system, in individuals who have received dental implant treatment, and to reveal risk factors for peri-implant diseases.

Methods: The study included 58 subjects with peri-implantitis, 49 subjects with peri-implant mucositis, and 49 healthy subjects. All the subjects were assessed in terms of both peri-implant clinical parameters—probing depth (PD), bleeding on probing (BOP), the type of prosthesis, gingival index (GI), keratinized mucosa width (KMW), and plaque index (PI)—and serum biochemical parameters (e.g., LDL cholesterol, HDL cholesterol, triglyceride, total cholesterol, vitamin D, uric acid, white blood cell (WBC), neutrophil, hemoglobin (Hb), and platelet counts).

Results: KMW was the lowest in the peri-implantitis group. Compared with the other groups, the peri-implantitis group showed significantly higher levels of triglyceride, uric acid, and WBC. The peri-implantitis group had the lowest level of vitamin D. Triglyceride and uric acid levels had positive correlations with peri-implant clinical parameters.

Conclusion: High levels of triglyceride and uric acid may pose a risk for both peri-implant diseases and cardiovascular diseases. Prior to dental implant surgery, patients' serum biochemical parameters should be checked.

Keywords: Peri-implantitis, Risk factors, Triglycerides, Uric acid, Vitamin D

Introduction

Currently, dental implants have many applications in the treatment of patients with either partial or complete edentulism. Despite the success of implants and their high survival rate, the prevalence of peri-implant diseases has increased [1]. Infectious peri-implant diseases are classified in two groups, namely, peri-implant mucositis and peri-implantitis. While the former (also known as implant gingivitis) can be defined as a reversible inflammation of the soft tissues embracing an implant, the latter (i.e., periodontitis) is an inflammation leading to loss of supporting bone around an implant [2]. No predictable approach is currently available for treating peri-implant diseases. Hence, preventive measures before the occurrence of any peri-implant disease become crucial. Accordingly, the first steps to establish successful strategies for prevention involve the identification of risk factors [3]. A number of risk factors/indicators may directly increase the likelihood of peri-implant mucositis and peri-implantitis [4]. Potential risk factors for developing peri-implant diseases include smoking, a history of periodontitis, poor oral hygiene, diabetes mellitus, alcohol consumption, genetics, and related factors for prosthetic and implant surface characteristics [5, 6].

Over the years, some papers have focused on the coexistence of medical conditions with peri-implantitis [7–9]. Evidence suggests that bone tissues may alter as a result of high levels of triglycerides and cholesterol as well as

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Peri-implant diseases and metabolic syndrome components: a systematic review

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Abstract. – OBJECTIVE: Metabolic syndrome (MetS) is defined as a spectrum of conditions associated with an increased risk of developing CVD and type 2 diabetes.

MetS include: hyperglycemia, hypertension, visceral obesity, dyslipidemia with elevated values of triglycerides (TG) and low levels of HDL.

The aim of this review is to provide current knowledge of the relationship between MetS, its components and peri-implant diseases.

MATERIALS AND METHODS: An electronic literature search was conducted in the English language in several databases.

The Newcastle-Ottawa Scale was used for quality assessment of cohort and cross-sectional studies; while systematic reviews were evaluated through AMSTAR; results were reported according to the PRISMA Statement.

RESULTS: A total of 272 records were identified through database searching, six studies were included for qualitative analysis. No study directly related to MetS was found, there was inconsistent and controversial evidence regarding association with cardiovascular disease. A higher risk of peri-implantitis was detected in people with hyperglycemia.

CONCLUSIONS: Future research should be orientated in assessing the risk of peri-implant diseases, evaluating patient's therapeutic response, analyzing directionality of the relationship between MetS, its components and biologic implant complications.

Key Words
Peri-implantitis, Mucositis, Peri-implant diseases, Metabolic syndrome, Cardiovascular disease, Hyperglycemia.

Introduction

High life expectancy and demographic trends, as well as widespread diffusion and reliability of modern implant dentistry, are all factors that have contributed to the increased number of dental implants in elderly patients (age > 65 years)[1-3].

Compton et al[2], in 2017, retrospectively reviewed a cohort of 245 geriatric patients and reported an implant survival rate of 92.9%, with marginal bone loss present in 23.3% of implants.

Schimmel et al[3], in 2017, concluded that placement of dental implants in elderly patients had become routine practice and clinicians should carefully take into account coexisting systemic risk factors.

Geriatric patients usually report, in their medical history, several comorbidities, with the most common ones as cardiovascular disease (CVD), hypertension, diabetes mellitus, hyperglycemia, osteoporosis and consequent assumption of anti-resorptive medications, dyslipidemia and temporomandibular disorders[2-7].

Several authors[8-11] referred a positive correlation and a direct relationship between periodontitis and systemic diseases over the years: CVD, hypertension, dyslipidemia and mostly diabetes mellitus and hyperglycemia.

Shimazaki et al[12] and D'Aiuto et al[13] reported, for the first time, a correlation between metabolic syndrome and periodontal disease in two cross-sectional studies.

Overview of the Metabolic Syndrome

The Metabolic syndrome (MetS) is defined as a spectrum of conditions associated with an increased risk of developing CVD and type II diabetes[14,15].

MetS include: hyperglycemia, hypertension, visceral obesity, dyslipidemia with elevated values of triglycerides (TG) and low levels of HDL.

Prevalence of metabolic syndrome has been reported steadily rising over last decade: according to the most recent survey of the National Health and Nutrition Examination Survey

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ORIGINAL ARTICLE

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Non-surgical peri-implantitis treatment using a pocket irrigator device; clinical, microbiological, radiographical and patient-centred outcomes—A pilot study

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AJ van Winkelhoff is co-owner of Laboral Diagnostics, a company that provides clinical oral microbiology for dental professionals.

Abstract

Aim: The aim of this prospective cohort study was to assess the effect of a pocket irrigator/evacuator device (IED) in the non-surgical treatment of peri-implantitis.

Material and Methods: In total 24 patients having 38 implants diagnosed with peri-implantitis were included in this study. Peri-implant pockets were irrigated six times in three consecutive weeks. The primary outcome was bleeding on probing (BoP). Secondary outcome parameters included plaque index (PI), suppuration on probing (SoP), probing pocket depth (PPD), marginal bone loss (MBL), presence and numbers of periodontal pathogens. Parameters were assessed at baseline and 3 months after the last treatment. Treatment pain perception was scored using the visual analog scale (VAS) after the first and last treatment.

Results: At 3 months, IED treatment revealed significant reduction of peri-implant BoP (71% [±20] vs 57% [±28] [$P = .014$]) and peri-implant plaque scores (10 [±14] to 5 [±9] [$P = .039$] [T0 vs T3 respectively]). Significant reduction in mean peri-implant PPD from 4.92 mm (SD ± 1.28) to 4.66 mm (SD ± 1.35) ($P = .041$) was observed. In addition, a reduction in VAS pain score between the first and the last (6th) treatment was found ($P = .039$). No reduction in SoP ($P = .088$) was found. No changes in mean periodontal full mouth plaque, BOP, SOP and PPD levels, MBL and microbiological outcomes were found.

Conclusion: Beneficial clinical effects in terms of BoP, PPD and PI were found at 3 months after IED treatment. However, the IED does not seem to effectively treat peri-implantitis in terms of disease resolution.

KEYWORDS

clinical trial, dental implants, microbiology, peri-implantitis, pocket irrigation

Clinical trial registration was done at the Netherlands National Trial Register (www.trialregister.nl, trial number NL6806).

SUPPLEMENT ARTICLE

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Diagnosis and non-surgical treatment of peri-implant diseases and maintenance care of patients with dental implants – Consensus report of working group 3

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Abstract: The following consensus report is based on four background reviews. The frequency of maintenance visits is based on patient risk indicators, homecare compliance and prosthetic design. Generally, a 6-month visit interval or shorter is preferred. At these visits, peri-implant probing, assessment of bleeding on probing and, if warranted, a radiographic examination is performed. Diagnosis of peri-implant mucositis requires: (i) bleeding or suppuration on gentle probing with or without increased probing depth compared with previous examinations; and (ii) no bone loss beyond crestal bone level changes resulting from initial bone remodelling. Diagnosis of peri-implantitis requires: (i) bleeding and/or suppuration on gentle probing; (ii) an increased probing depth compared with previous examinations; and (iii) bone loss beyond crestal bone level changes resulting from initial bone remodelling. If diagnosis of disease is established, the inflammation should be resolved. Non-surgical therapy is always the first choice. Access and motivation for optimal oral hygiene are key. The patient should have a course of mechanical therapy and, if a smoker, be encouraged not to smoke. Non-surgical mechanical therapy and oral hygiene reinforcement are useful in treating peri-implant mucositis. Power-driven subgingival air-polishing devices, Er: YAG lasers, metal curettes or ultrasonic curettes with or without plastic sleeves can be used to treat peri-implantitis. Such treatment usually provides clinical improvements such as reduced bleeding tendency, and in some cases a pocket-depth reduction of ≤ 1 mm. In advanced cases, however, complete resolution of the disease is unlikely.

Key words: *Peri-implant diseases, peri-implantitis, peri-implant mucositis, non-surgical therapy, maintenance, supportive care*

INTRODUCTION

Dental implants have long been used to replace missing teeth. Initially, it was believed that the possible drawbacks of dental implant treatment were minimal if the implants were fully integrated into the bone. Over the years, however, it has become clear that biological complications frequently occur. Biological complications associated with dental implants are mostly infections induced by a bacterial biofilm, resulting in an inflammatory response in the soft tissues and bone surrounding implants. The inflammatory lesions located in the soft tissues have been referred to as peri-implant mucositis. If the inflammatory response progresses further and results in a loss of the bone beyond the initial bone remodelling, it is referred to as peri-implantitis[1,2].

The prevalence of peri-implant mucositis has, in a recent systematic review, been reported in the range of 19%–65% and the prevalence of peri-implantitis in the range of 1%–47%[3]. The wide range may be dependent on the different patient populations investigated in the studies included in the review, but it may also reflect differences in diagnostic criteria. In a paper using different levels of severity, a substantial variance in disease prevalence was highlighted[4]. The differences in criteria used to characterise peri-implant

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ORIGINAL ARTICLE

Clinical and Experimental Dental Research Open Access WILEY

A nonsurgical treatment of peri-implantitis using mechanic, antiseptic and anti-inflammatory treatment: 1 year follow-up

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Abstract

Aims: The study's aim was to assess the clinical outcome 6 and 12 months after a nonsurgical treatment of peri-implantitis per se or in conjunction with a combination of local antiseptic and anti-inflammatory treatment.

Materials and methods: Included were 69 patients with periodontitis, with 106 implants, diagnosed with peri-implantitis. Peri-implantitis was defined as radiographic bone loss ≥3 mm, probing depth (PD) ≥ 6 mm, with bleeding on probing. Group M peri-implantitis was treated with ultrasonic debridement and soft tissue curettage. Group P had additional implant surface treatment with rotatory hand piece composed of chitosan bristle, soft tissue curettage combined with application of 0.95% hypochlorite and 1 mg minocycline HCl.

Results: After 6 months, both groups demonstrated significant reduction of mean plaque index, PD, and clinical attachment level (0.71 ± 0.57, 0.81 ± 0.55; 4.77 ± 0.73 mm, 4.42 ± 0.5 mm; 5.03 ± 0.86 mm, 5.13 ± 0.73 mm; respectively) and bleeding on probing. After 6 and 12 months, group P showed significantly better PD results compared to group M. The bleeding was significantly less in group P after 12 months (15.3% ± 6.2, 25.1% ± 8.2, respectively).

Conclusions: Adjunctive treatment with local antiseptic and anti-inflammatories during mechanical phase was positively associated with inflammation reduction and connective tissue reattachment.

KEYWORDS

anti-inflammatory, chitosan, minocycline, nonsurgical treatment, peri-implantitis, slow release device

1 | INTRODUCTION

Dental implants are valid choice for lost tooth replacement due to the high survival rate; however, biological complications are not rare. The main biological complication is peri-implantitis, a plaque-associated pathological condition that occurs in tissues around dental implants, which is characterized by inflammation in the peri-implant mucosa and loss of supporting bone (Berglundh et al., 2018). Extensive bone loss might require implant explanation. The prevalence of peri-implantitis is significant, as assessed in several meta-analyses: Rakic et al. (2018) reported a rate of 18.5% at patient level and 12.8% at implant level (Rakic et al., 2018); Muñoz, Duque, Giraldo, and Manrique (2018) showed similar results with 17% at patient level and 11% at implant level (Muñoz et al., 2018); while Hashim, Cionca, Combescure, and Mombelli (2018) reported a wider range with 0–62.1% at implant level and 9.1–69% at patient level (Hashim et al., 2018).

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REVIEW Open Access

Efficacy of alternative or adjunctive measures to conventional treatment of peri-implant mucositis and peri-implantitis: a systematic review and meta-analysis

Frank Schwarz*, Andrea Schmucker and Jürgen Becker

Abstract

In patients with peri-implant mucositis and peri-implantitis, what is the efficacy of nonsurgical (i.e. referring to peri-implant mucositis and peri-implantitis) and surgical (i.e. referring to peri-implantitis) treatments with alternative or adjunctive measures on changing signs of inflammation compared with conventional nonsurgical (i.e. mechanical/ultrasonic debridement) and surgical (i.e. open flap debridement) treatments alone? After electronic database and hand search, a total of 40 publications (reporting on 32 studies) were finally considered for the qualitative and quantitative assessment. The weighted mean changes (WM)/ and WM differences (WMD) were estimated for bleeding on probing scores (BOP) and probing pocket depths (PD) (random effect model). Peri-implant mucositis: WMD in BOP and PD reductions amounted to −8.16 % [SE = 4.61] and −0.15 mm [SE = 0.13], not favouring adjunctive antiseptics/antibiotics (local and systemic) over control measures ($p > 0.05$). Peri-implantitis (nonsurgical): WMD in BOP scores amounted to −23.12 % [SE = 4.81] and −16.53 % [SE = 4.41], favouring alternative measures (glycine powder air polishing, Er:YAG laser) for plaque removal and adjunctive local antibiotics over control measures ($p < 0.001$), respectively. Peri-implantitis (surgical): WMD in BOP and PD reductions did not favour alternative over control measures for surface decontamination. WM reductions following open flap surgery (±resective therapy) and adjunctive augmentative therapy amounted to 34.81 and 50.73 % for BOP and 1.75 and 2.20 mm for PD, respectively. While mechanical debridement alone was found to be effective for the management of peri-implant mucositis, alternative/adjunctive measures may improve the efficacy over/of conventional nonsurgical treatments at peri-implantitis sites. Adjunctive resective and/or augmentative measures are promising; however, their beneficial effect on the clinical outcome of surgical treatments needs to be further investigated.

Review

Background

Peri-implant mucositis describes an inflammatory lesion that resides in the soft tissues compartment, while at peri-implantitis sites, this lesion has extended and also affects the implant supporting bone [1]. The 11th European Workshop on Periodontology has pointed to an "estimated weighted mean prevalence of peri-implant mucositis and peri-implantitis of 43 and 22 %, respectively" [2].

The main etiology of peri-implant mucositis refers to plaque accumulation [3, 4], and the conversion from mucositis to peri-implantitis was, particularly in the absence of a supportive maintenance care [5], positively correlated with the function time [2]. However, the presence of some independent systemic/patient-related (i.e. smoking) and local (i.e. residual cement, dimension of the keratinized tissue, surface roughness) risk indicators may increase the probability of the disease occurring [3].

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Research Article

Check for updates

Simplified nonsurgical treatment of peri-implantitis using chlorhexidine and minocycline hydrochloride

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Author Contributions
Conceptualization: SunJin Heo, Jeomil Choi; Data curation: SunJin Heo, Hyun-Joo Kim,

ABSTRACT

Purpose: The present study investigated the outcomes of a newly-developed, simple, and practical nonsurgical treatment modality suitable for most forms of intrabony defects around failing dental implants using intrasulcular delivery of chlorhexidine solution and minocycline hydrochloride (HCl).
Methods: Forty-five dental implants in 20 patients diagnosed with peri-implantitis were included. At baseline and the study endpoint, the probing pocket depth (PPD), clinical attachment level (CAL), and the presence of bleeding on probing (BOP) at 6 sites around each implant were recorded. The radiographic osseous defect morphology at the mesial or distal proximal aspect of each implant was classified as 1) narrow or wide and 2) shallow or deep. For a comparative analysis of bone changes according to the defect morphology, the distance from the implant shoulder to the most coronal bone-to-implant contact point (DIB) at the mesial and distal aspects of each implant was measured at baseline and the endpoint. Patients were scheduled to visit the clinic every 2–4 weeks for intrasulcular irrigation of chlorhexidine and delivery of minocycline HCl.
Results: We observed statistically significant decreases in PPD, CAL, and BOP after treatment. At the endpoint, bone levels increased in all defects, regardless of the osseous morphology of the intrabony defect. The mean DIB change in deep defects was significantly greater than that in shallow defects. Although the mean bone gain in narrow defects was greater than in wide defects, the difference was not statistically significant.
Conclusions: We propose that significant and sustainable improvements in both clinical and radiographic parameters can be expected when intrabony defects around dental implants are managed through a simple nonsurgical approach involving combined intrasulcular chlorhexidine irrigation and local delivery of minocycline HCl.

Keywords: Anti-bacterial agents; Bone regeneration; Dental implants; Peri-implantitis

INTRODUCTION

Peri-implantitis is an inflammatory process that affects tissues around osseointegrated implants, resulting in the loss of supporting bone [1]. It is caused by the same bacteriological factors as those involved in the onset of inflammatory periodontal disease [2]. Hultin

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ORIGINAL ARTICLE

Nonsurgical treatment of peri-implantitis using an air-abrasive device or mechanical debridement and local application of chlorhexidine. Twelve-month follow-up of a prospective, randomized, controlled clinical study

Gordon John · Narja Sahm · Jürgen Becker · Frank Schwarz

Received: 14 February 2014 / Accepted: 12 January 2015 / Published online: 22 January 2015

Abstract
Objectives The purpose of this prospective, parallel group-designed, randomized controlled clinical study was the evaluation of the effectiveness of an air-abrasive device (AAD) for nonsurgical treatment of peri-implantitis.
Material and methods Twenty five patients, showing at least one implant with initial to moderate peri-implantitis, underwent an oral hygiene programme and were randomly treated using either (1) AAD (amino acid glycine powder) or (2) mechanical debridement using carbon curettes and antiseptic therapy with chlorhexidine digluconate (mechanical debridement (MDA)). Clinical parameters were measured at baseline and 12 months after treatment (e.g. bleeding on probing (BOP), probing depth (PD), clinical attachment level (CAL)).
Results At 12 months, the AAD group revealed significantly higher ($p<0.05$; unpaired t test) decrease in mean BOP scores when compared with MDA-treated sites (41.2±29.5 vs. 16.6 ±33.4 %). Both groups exhibited comparable PD reductions (AAD=0.5±0.9 mm vs. MDA=0.4±0.9 mm) and CAL gains (AAD=0.6±1.3 mm vs. MDA=0.5±1.1 mm) ($p>0.05$; Mann-Whitney test, respectively).
Conclusions Within its limitations, the present study has indicated that both treatment procedures resulted in comparable but limited CAL gains at 12 months. Furthermore, it could be detected that AAD was associated with significantly higher BOP decrease than MDA.
Clinical relevance The present results have indicated that nonsurgical therapy of peri-implantitis using both AAD and MDA resulted in comparable PD reductions and CAL gains after 12 months of healing. The BOP reductions were significantly higher in the AAD in comparison to the MDA group. So, AAD may be more effective for nonsurgical therapy of peri-implantitis than MDA.

Keywords Peri-implantitis · Nonsurgical · Air-powder flow · Air-abrasive device · Amino acid glycine powder · Plastic curettes

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Introduction

Peri-implant infections depict an increasing focus in dental implantology [1]. The demographic change additionally enhances this issue [2]. A distinction is made between peri-implant mucositis and peri-implantitis. Whereas peri-implant mucositis is the term for reversible inflammation of the soft tissue surrounding the implants [3], peri-implantitis characterizes the nonreversible inflammation of the implant surrounding tissues and leads to a decrease of the bony basement of the implants [4]. The prevalence of peri-implant mucositis is about 80 % in the implant sites and in about 50 % in patients [1], while peri-implantitis occurs in up to 56 % in the implant sites and 43 % in patients [5]. Without any successful treatment, peri-implantitis can lead to implant loss [6–8]. The main factor for establishment of peri-implant infections is the formation and maturation of bacterial biofilm [7]. Directly after being inserted to the oral cavity, the implant surface is covered

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Journal of Clinical Periodontology

Systematic Review

Efficacy of air polishing for the non-surgical treatment of peri-implant diseases: a systematic review

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Schwarz F, Becker K, Renvert S. Efficacy of air polishing for the non-surgical treatment of peri-implant diseases: a systematic review. J Clin Periodontol 2015; 42: 951–959. doi:10.1111/jcpe.12454.

Abstract

Focused Question: In patients suffering from peri-implant diseases, what is the efficacy of air polishing on changing signs of inflammation compared with control treatments (i.e. alternative measures for plaque removal with or without adjunctive antiseptic and/ or antibiotic therapy)?

Material & Methods: After electronic database and hand search, 10 full-text articles were independently screened by two reviewers. Finally, a total of five studies (six publications) fulfilled the inclusion criteria. The weighted mean difference (WMD) [*p*; 95% CI] in bleeding on probing- (BOP) (primary outcome) and probing pocket depth- (PD) reductions was estimated using a random effect model.

Results: All studies reported on residual BOP scores after therapy. A narrative data synthesis did not reveal any major improvement of bleeding index/ BOP or disease resolution following air polishing over mechanical debridement at mucositis sites. At peri-implantitis sites, WMD in BOP reduction between test and control (mechanical debridement with or without local antiseptic therapy, Er:YAG laser) groups was −23.83% [$p = 0.048$; 95% CI (−47.47, −0.20)] favouring air polishing over control measures.

Conclusions: While glycine powder air polishing is as effective as the control treatments at mucositis sites, it may improve the efficacy of non-surgical treatment of peri-implantitis over the control measures investigated. A complete disease resolution was commonly not obtained.

Key words: air abrasion; clinical studies; peri-implant mucositis; peri-implantitis; systematic review

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Conflict of interest and source of funding statement

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Plaque accumulation is the major etiological factor in the development of peri-implant diseases (Renvert & Polyzois 2014), and the risk for a conversion from peri-implant mucositis to peri-implantitis increases in the absence of a proper maintenance care (Costa et al. 2012). Accordingly, the management of peri-implant mucositis is considered to be a key strategy for the prevention of peri-implantitis (Jepsen et al. 2015). A major objective of the cause-related concept of therapy is the disruption of the biofilm (Klinge et al. 2012). However, most of the commonly used instruments (e.g. curets) or devices (e.g. ultrasonic, erbium-doped yttrium aluminum garnet – Er:YAG laser) revealed a limited efficacy in completely eliminating the biofilm from exposed titanium implant surfaces

Original Research
Implantodontology

Microbiological and clinical effects of adjunctive systemic metronidazole and amoxicillin in the non-surgical treatment of peri-implantitis: 1 year follow-up

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Rafael Shinoske SIROMA[a]
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Abstract: The aim of this study was to evaluate the effects of adjunct systemic antibiotic treatment with metronidazole (MTZ) and amoxicillin (AMX) in patients receiving non-surgical subgingival debridement (NSD) for peri-implantitis. Forty subjects presenting with at least one implant with severe peri-implantitis were randomized into an experimental group [treated with NSD plus MTZ (400 mg) and AMX (500 mg) three times a day for 14 days] and a control group treated with NSD plus placebo. Clinical parameters and submucosal biofilm profiles were evaluated up to 1 year post-treatment. Overall, both treatments improved clinical parameters over time. At 1 year, mean probing depth (PD), mean clinical attachment (CA) level and proportions of *red complex* pathogens did not differ significantly between the two groups. In addition, mean PD and CA changes to 1-year posttreatment did not differ significantly between the two groups between baseline and 1-year post-treatment. These results suggest that the addition of MTZ and AMX to the treatment protocol of patients undergoing NSD for with severe peri-implantitis does not improve the clinical and microbiological outcomes of NSD. The fact that half of the implants in both groups did not achieve clinical success (PD < 5 mm, no BoP, no bone loss) suggest that neither of the tested protocols were effective for treating severe peri-implantitis.

Keywords: Peri-implantitis; Amoxicillin; Metronidazole; Therapeutics.

Declaration of Interests: The authors certify that they have no commercial or associative interests that represent a conflict of interest in connection with the manuscript.

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Introduction

Systemic antibiotic therapy consisting of metronidazole (MTZ) and amoxicillin (AMX) is an effective non-surgical treatment for periodontitis. Indeed, the treatment protocol consisting of MTZ+AMX and scaling and root planing (SRP) has been shown provide additional benefits to conventional non-surgical debridement for patients with severe periodontitis, including reduced levels of key periodontal pathogens, such as *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, and *Tannerella forsythia*.[1] Although the microorganisms associated with the etiopathogenesis of peri-implantitis are similar to those associated with periodontitis[2], to the best of our knowledge, the effectiveness of

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ORIGINAL RESEARCH

CLINICAL ORAL IMPLANTS RESEARCH WILEY

The usage of a lactobacilli probiotic in the non-surgical therapy of peri-implantitis: A randomized pilot study

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Abstract

Objectives: Examine the clinical and microbiological benefits of a dual-strain *Lactobacillus reuteri* probiotic on the non-surgical therapy of initial peri-implantitis.

Materials and methods: This randomized, double-blind study targeted patients with initial peri-implantitis, that is peri-implantitis with a maximum mean probing pocket depth of 6 mm and maximum 3 mm bone loss compared with loading. A full-mouth prophylaxis was performed and the peri-implantitis sites were debrided. Subsequently, local application of the study drops was carried out at the peri-implantitis sites and the study lozenges were handed out. The patients in the probiotic group received drops and lozenges containing *L. reuteri* (ATCC PTA 5289 & DSM 17938), those in the control group received placebo products. At the implant level the measurements of interest were bleeding, probing pocket depth and plaque. Full-mouth bleeding and plaque scores were also recorded. Microbiological samples were taken from the tongue, saliva and subgingivally around the implants.

Results: All clinical parameters were significantly decreased after 12 and 24 weeks. At the implant level the only statistically significant difference was a greater decrease in plaque levels in the probiotic versus the control group (p = .002 at 24 weeks). At the full-mouth level, the only intergroup difference was the greater decrease in full-mouth bleeding on probing sites in the probiotic group compared with the control group (p < .001 at 24 weeks). Concerning the microbiological outcomes, no significant differences could be found at any time point, neither intra- nor intergroup.

Conclusions: No adjunctive effects of the use of *L. reuteri* probiotics in the treatment of peri-implantitis were found.

KEYWORDS

debridement, dental plaque, gingival bleeding on probing, *Lactobacilli reuteri*, peri-implantitis, probiotics, therapy

1 | INTRODUCTION

Probiotics are defined as live microorganisms that, when administered in adequate amounts, confer a health benefit on the host (Hill et al., 2014). Their application is very diverse, ranging from gut to oral to even mental health. Currently, dozens of studies examining the effect of probiotics on gum health and disease are available. These showed for example that probiotics can enhance the results of scaling and root planing in periodontitis patients (Ince et al., 2015; Morales et al., 2016; Sajedinejad et al., 2018; Tekce et al., 2015; Teughels et al., 2013; Vivekananda, Vandana, & Bhat, 2010). This effect was not only seen clinically, that is as improved pocket probing depth reduction, but also microbiologically (Tekce et al., 2015; Teughels et al., 2013; Vivekananda et al., 2010) and at the level of pro-inflammatory

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REVIEW ARTICLE

Management of peri-implantitis using a diode laser (810 nm) vs conventional treatment: a systematic review

Hebatallah Mattar[1,2] · Mohamed Bahgat[3] · Amir Ezzat[4] · Bassant Bahaa El-Din[3] · Khaled Keraa[5] · Iman El Taftazany[6]

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Abstract

The purpose of this study was to systematically assess clinical studies on the effect of using a diode laser in the treatment of peri-implantitis. Study question was "In patients with peri-implantitis around functional dental implants, can treatment by a diode Laser (810 nm) versus conventional treatment be effective in reducing the probing depth?". The study included only randomized controlled clinical trials that involved patients with peri-implantitis. Included articles evaluated a diode laser (810 nm) used as monotherapy or as adjuvant therapy in the non-surgical treatment while their control group received conventional methods of treatment for peri-implantitis. Studies that involved other types of laser treatment options, surgical therapy, photodynamic therapy, case series, or case reports were excluded. Three electronic databases were searched for published articles from 2010 to 2018: PubMed/Medline, Cochrane, and Web of Science. The references were manually hand searched for relevant articles. The search initially identified 44 studies, which were filtered to yield a total of 3 eligible studies. All included studies compared laser treatment by a diode laser (810 nm) to conventional therapy by mechanical debridement for a follow-up period ranging from 6 months to 1 year, and risk of bias was assessed for each of the three included studies. A qualitative analysis of the three studies was conducted. This systematic review could not support the usage of a diode laser in the treatment of peri-implantitis. To confirm this assumption, more clinical trials with long-term follow-up periods are recommended.

Keywords Dental implants · Dental scaling · Scaling and root planning · Laser root planning · Laser scaling · Dental diodes · Lasers · Diode 810 nm · Peri-implantitis

Introduction

Bacterial biofilms formed on implant surfaces cause inflammation of the surrounding tissues and lead to complications such as mucositis and peri-implantitis [1]. Mucositis is an inflammatory lesion in the surrounding mucosa of an implant, while peri-implantitis is an inflammatory condition that is accompanied by mucosal inflammation, pocket depth (PD) ≥ 4 mm and bleeding on probing (BOP). Sometimes, pus might be present [2], and bone loss can be seen radiographically [3]. This condition is irreversible [2]. Bacterial colonization begins at the abutment surface. The implant surfaces are covered by a pellicle due to adhesion of salivary components, especially proteins, that provide linking sites for bacterial adhesion [1]. A previous review showed that peri-implant mucositis occurs in 80% of patients, that 50% of implants are affected, and that peri-implantitis affects 12 to 40% of implants after 5 years of placement [2, 4]. However, peri-implantitis has been a perplexing and controversial unresolved problem for several years [5]. The characteristics of the implant surface include implant chemistry, surface-free energy, and roughness. All of these factors affect bacterial attachment and proliferation. Surface roughness specifically has been considered the main feature promoting biofilm development, although it improves osseointegration via several surface modifications [1]. In the

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ORIGINAL ARTICLE

Non-surgical periodontal treatment of peri-implant diseases with the adjunctive use of diode laser: preliminary clinical study

Francesco Lerario[1] · Marisa Roncati[3] · Annalisa Gariffo[4] · Enrica Attorresi[5] · Alessandra Lucchese[6] · Alexandros Galanakis[2] · Gaspare Palaia[1] · Umberto Romeo[1]

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Abstract Peri-implant diseases present in two forms: peri-implant mucositis and peri-implantitis. The prevalence of peri-implant complications is significantly rising. The aim of this study was to compare conventional treatment of inflamed peri-implant tissues with conventional treatment together with diode laser application. Twenty-seven patients (age 36 to 67, 15 women and 12 men, 12 smokers and 15 non-smokers) requiring treatment for mucositis or peri-implantitis were taken into account for this preliminary study. Plaque index (PI), pocket depth (PD), and bleeding on probing (BoP) were recorded at baseline evaluation. Patients in control group (CG) received conventional non-surgical periodontal treatment. Patients in test group received conventional non-surgical periodontal treatment together with diode laser application (810 nm, 30 s, 1 W, 50 Hz, t_{on}=100 ms, t_{off}=100 ms, energy density=24.87 J/cm^2). Paired t test was used to evaluate the difference in repeated measurements of considered indexes at T_0 and T_1 (1 year) in both groups. A total of 606 sites were taken into account in the test group (TG) and 144 in the CG. PD mean variation in the TG was 2.66 mm±1.07, while mean PD variation in the CG was 0.94±1.13 mm. Paired t testing of the variation in PD in CG and TG revealed a statistically significant difference between the two groups (p<0.0001). A reduction of pathological sites from 89 % (T_0) to 14.35 % (T_1) was achieved in the TG, while reduction obtained in the CG was from 75.69 % (T_0) to 50 % (T_1); BoP scores at time T_1 had fallen below 5 % in the TG and decreased to 59.7 %, in the CG. Within the limitations of this study, diode laser seems to be an additional valuable tool for peri-implant disease treatment.

Keywords Lasers · Peri-implantitis · Periodontal debridement · Laser therapy

Introduction

Peri-implant diseases present themselves in two forms: peri-implant mucositis and peri-implantitis. Peri-implant mucositis occurs in 80 % of the subjects that have an implant in the oral cavity and in 50 % of the implant sites. Peri-implantitis was identified, respectively, in 28–56 % of subjects and in 12–43 %

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Review

Management of Peri-Implantitis Lesions without the Use of Systemic Antibiotics: A Systematic Review

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Abstract: Background: This systematic review aims to assess the current evidence on the efficacy of surgical and non-surgical debridement techniques in the treatment of peri-implantitis lesions without the use of any antimicrobials. Method: Five electronic databases (MEDLINE, Pubmed, Scopus, CINAHL and Cochrane) were used, alongside hand searches, to find relevant articles. Full-text articles that were randomised controlled trials, published in the English language from 2011 onwards without pre-operative, peri-operative and post-operative antibiotic usage were included. The study was conducted according to the latest Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-P protocols, the latest Cochrane Risk of Bias tool and each investigated intervention was evaluated using the grading of recommendation, assessment, development and evaluation (GRADE) system. Results: The search yielded 2718 results. After initial screening, 38 full-text articles were assessed for eligibility. From these, 11 studies satisfied all inclusion criteria. These 11 articles described six non-surgical and five surgical debridement therapies. Most articles were classified as having either a high risk of bias or presenting with some concerns. Small sample sizes, in combination with this risk of bias, meant that all interventions were adjudged to be of either low or very low quality of evidence. Conclusion: While all investigated modalities displayed some sort of efficacy, this review suggests that a surgical approach may be best suited to treating peri-implantitis lesions in the absence of antibiotic therapy. Despite this weak indication, further research is required in this field.

Keywords: peri-implantitis; decontamination; debridement; nonsurgical therapy

1. Introduction

Over the last four decades, dental implants (DI) have revolutionised the treatment of edentulous and partially dentate patients alike. Current practice of DI placement demonstrates high success rates [1]. Despite favourable success rates, DI are still subject to failures due to a variety of reasons. One of the leading causes of failure is biological complications. Biological complications occur when bacterial plaque accumulates around an implant, which consequently causes inflammatory changes in the tissues surrounding the implant. When this inflammatory process is limited to the soft tissues, the condition is known as peri-implant mucositis and when it spreads to the underlying alveolar bone, it is known as peri-implantitis [2–4].

In 2017, the American Academy of Periodontology and the European Federation of Periodontology collaborated to present an update on peri-implant diseases and conditions [5–7]. The workshop

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BEST EVIDENCE CONSENSUS

Antimicrobial photodynamic therapy for the treatment of periodontitis and peri-implantitis: An American Academy of Periodontology best evidence review

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Abstract

Background: This systematic review evaluates the efficacy of antimicrobial photodynamic therapy (aPDT), as an adjunct to non-surgical or surgical therapy, on clinical and patient-centered outcomes in patients with periodontitis or peri-implantitis.

Methods: Randomized controlled trials (RCTs) with a follow-up duration ≥ 3 months that evaluated mechanical root/implant surface debridement (i.e., scaling and root planing [SRP] or implant surface scaling [ISS]) versus SRP or ISS plus aPDT for the treatment of adult patients (≥ 18 years old) with moderate-to-severe chronic (CP)/aggressive periodontitis (AgP) or peri-implantitis, respectively, were considered eligible for inclusion. The MEDLINE, EMBASE, and CENTRAL databases were searched for articles published up to and including March 2017. Random-effects meta-analyses were used throughout the review using continuous data (i.e., mean changes from baseline), and pooled estimates were expressed as weighted mean differences with their associated 95% confidence intervals. Additionally, summaries are presented of the included RCTs, critical remarks of the literature, and evidence quality rating/strength of recommendation of laser procedures.

Results: Of 729 potentially eligible articles, 28 papers (26 studies) were included in the review. Individual study outcomes and four sets of meta-analysis showed potential statistical significant benefit of aPDT in improving clinical attachment level (CAL) (non-surgical treatment of AgP) and probing depth (PD) (non-surgical treatment of AgP and CP). However, the comparative differences in clinical outcomes were modest (< 1 mm), and the level of certainty for different therapies was considered low-to-moderate (i.e., more information would be necessary to allow for a reliable and definitive estimation of effect/magnitude of therapies on health outcomes). Overall, most of the strengths of clinical recommendations of aPDT were guided by the expert opinion.

Conclusions: aPDT may provide similar clinical improvements in PD and CAL when compared with conventional periodontal therapy for both periodontitis and peri-implantitis patients. The restricted base of evidence for some treatment approaches and conditions precludes additional conclusions.

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Is Antimicrobial Photodynamic Therapy Effective for Microbial Load Reduction in Peri-implantitis Treatment? A Systematic Review and Meta-Analysis

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ABSTRACT

The systematic review and meta-analysis were undertaken to evaluate the effectiveness of antimicrobial photodynamic therapy (aPDT) in the microbiological alteration beneficial to peri-implantitis treatment. This study is registered with PROSPERO, number CRD42017064215. Bibliographic databases including Cochrane Library, Web of Science, Scopus and PubMed were searched from inception to 8 January 2017. The search strategy was assembled from the following MeSH Terms: "Photochemotherapy," "Dental Implants" and "Peri-Implantitis." Unspecific free-text words and related terms were also included. The Cochrane Collaboration's tool was used to evaluate the risk of bias of included studies. The random-effect model was chosen, and heterogeneity was evaluated using the I^2 test. Three studies met the inclusion criteria. Meta-analysis demonstrated an association between aPDT and reduction in viable bacteria counts for: *Aggregatibacter actinomycetemcomitans* (OR = 1.31; confidence interval = 1.13, 1.49; $P < 0.00001$), *Porphyromonas gingivalis* (OR = 4.08; confidence interval = 3.22, 4.94; $P < 0.00001$) and *Prevotella intermedia* (OR = 1.66; confidence interval = 1.06, 2.26; $P < 0.00001$). A aPDT appears to be effective in bacterial load reduction in peri-implantitis and has a positive potential as an alternative therapy for peri-implantitis.

INTRODUCTION

Rehabilitation therapy through dental implants has been used worldwide, representing a treatment option with high success rates. Despite this, a proportion of implants are unsuccessful due to various inflammatory pathoses in peri-implant tissues (1,2). Peri-implantitis affects the tissues surrounding a dental implant in function with concomitant loss of supporting bone (3).

The European Workshop on Periodontology consensus conference reported a weighted mean prevalence of 22% of peri-implantitis. Studies have provided evidence that the primary etiological factor in peri-implant inflammation is the accumulation of biofilm around the mucosal margins of implants (2). Due to this, prevention and management of peri-implantitis are critical in long-term maintenance of implants. While biological complications associated with dental implants cannot be completely avoided, it is likely that the long-term success of implant therapy can be improved by the establishment of supportive peri-implant therapies (4,5). Microorganisms like *Prevotella intermedia*, *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, *Tannerella forsythia*, *Treponema denticola*, *Prevotella nigrescens*, *Peptostreptococcus* spp. and *Fusobacterium nucleatum* are commonly related to peri-implantitis (6–8). Gram-negative anaerobic bacteria are found predominantly around implants with peri-implantitis (6,9,10). Therefore, implant decontamination represents the objective in peri-implantitis treatment. However, the bacterial load reduction at the peri-implantitis area by mechanical debridement alone remains difficult due to the design and topography of the implant surface (11). Consequently, therapies adjunctive to mechanical debridement, like laser therapy and antimicrobial photodynamic therapy (aPDT), have been advocated (12). The application of a photosensitive chemical and its activation by a light source results in the death of periodontal pathogens. Clinical studies outcomes in subjects with chronic periodontitis were shown beneficial effects of aPDT in gingival inflammation (13,14).

Therefore, the aim of this study was to systematically review the efficacy of aPDT in the microbial load reduction in peri-implantitis treatment.

MATERIALS AND METHODS

Method. This study was conducted in accordance with the recommendations by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA statement—www.prismastatement.org) and was registered in the PROSPERO (reference no: CRD42017064215).

Focused question. Is aPDT an effective adjunct therapy for microbial load reduction in peri-implantitis treatment?

Search strategy. A systematic search of a range of databases, PubMed, Scopus, Web of Science and Cochrane Library was searched from their inception until 8 January 2017. Bibliographies of related papers were screened, and experts were contacted to identify additional published and unpublished references. The gray literature was consulted

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RANDOMIZED CLINICAL TRIAL

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Open flap debridement of peri-implantitis with or without adjunctive systemic antibiotics: A randomized clinical trial

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Abstract

Aims: To investigate clinical, radiographic and microbiological outcome over 12 months following open flap debridement of peri-implantitis with or without antibiotics.

Materials and methods: Peri-implantitis was surgically treated with or without Zithromax® in 19 control and 20 test individuals. Probing pocket depth (PPD), gingival inflammation (BOP), intra-oral radiographs and microbial samples were studied. Per protocol and intent-to-treat analyses were performed.

Results: The mean difference (reduction) in PPD values between baseline and month 12 in the test and control groups was 1.7 mm (*SD* ± 1.1, 95% CI: 1.1, 2.3, $p < .001$) and 1.6 mm (*SD* ± 1.5, 95% CI: 0.8, 2,4, $p < .001$), respectively. Data analysis failed to show study group differences for BOP, PPD, radiographic bone level and microbial load. Successful treatment (per protocol: PPD ≤ 5 mm, no BOP, no suppuration and no bone loss ≥0.5 mm) at 12 months in test and control groups was 7/15 (46.7%) and 4/16 (25.0%). Bacterial load reduction was similar in study groups with a temporary reduction following treatment.

Conclusions: Surgical treatment of peri-implantitis with adjunctive systemic azithromycin did not provide 1-year clinical benefits in comparison with those only receiving open flap debridement.

KEYWORDS

antibiotics, microbiota, peri-implantitis, surgical treatment

1 | INTRODUCTION

Peri-implantitis is an inflammatory process leading to irreversible loss of implant supporting bone. The current clinical definition of peri-implantitis was established at two European Workshops (Lang & Berglundh, 2011; Sanz & Chapple, 2012). A cluster of bacteria has been associated with peri-implantitis (Charalampakis, Rabe, Leonhardt, & Dahlen, 2011; Persson & Renvert, 2014). The development of a complex infectious microbiota represents a clinical challenge in peri-implantitis management (Renvert, Roos-Jansaker, & Claffey, 2008).

Mechanical treatment of peri-implantitis alone may not resolve the disease. Two recent meta-analyses have provided evidence that adjunctive use of azithromycin improves the efficacy of non-surgical periodontal therapy (Renatus, Herrmann, Schonfelder, Schwarzenberger, & Jentsch, 2016; Zhang, Zheng, & Bian, 2016). Few studies have assessed the outcome of systemic administration of antibiotics in combination with surgical intervention of peri-implantitis (Javed et al. 2013). Stable clinical conditions through a combination of surgery combined with regenerative procedures and systemic antibiotics can be obtained (Roos-Jansaker, Lindahl, Persson, & Renvert, 2011; Roos-Jansaker, Persson, Lindahl, & Renvert, 2014). Carcuac et al. (2016) have demonstrated that adjunctive systemic antibiotics did not influence the treatment success at implants with a non-modified surface, whereas benefits were observed at implants with a modified surface. Although surgical resective and/or augmentative procedures have shown promising results in the treatment of peri-implantitis, the effect on the clinical outcome of surgical treatments needs to be further investigated (Schwarz, Schmucker, & Becker, 2015).