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ACTUALIZACIÓN EN PROTOCOLO DE CARGA INMEDIATA UNITARIA EN SECTOR ANTERIOR

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Resumen

Objetivo: El objetivo principal del presente estudio es proporcionar información actualizada sobre el protocolo de carga inmediata, introduciendo los tipos de restauraciones disponibles cuando se sigue un enfoque de provisionalización inmediata unitaria en el área estética de forma totalmente digital.

Metodología: Tras llevar a cabo una revisión bibliográfica de 130 artículos, entre el 2005 y el 2020, se decide estudiar aquellos 39 que reflejaban los criterios de inclusión y exclusión propuestos. Dichos artículos se encontraron, tras un atento análisis, en distintas bases de datos, cuales PubMed, Medline (gracias a los recursos digitales ofrecidos por la Biblioteca CRAI de la Universidad Europea de Madrid), Scielo y ResearchGate. **Palabras claves:** *carga inmediata, implante dental, zona estetica, trabajo con flujo digital, provisionalización inmediata*.

Resultados: Es necesario que los valores del torque de inserción, del cociente de estabilidad implantar y los micromovimientos tolerados sean respetivamente: ≥ 20 – 45 Ncm, ≥ 60-65 y 50-150 μm. Los resultados mostraron una preferencia por el uso de una técnica cirurgica sin colgajo. En comparación con el uso de un pilar provisorio, con el protocolo One Abutment-One Time se reduce el tiempo de tratamiento, se evitan las múltiples remociones del pilar provisorio y el consiguiente estrés de los tejidos blandos. El uso de pilares de zirconio mejora el resultado estético final respecto a los de titanio.

Conclusiones: Los datos de la literatura mostraron que el protocolo de carga inmediata, tanto tradicional como OA-OT, podría representar un protocolo fiable y eficaz para rehabilitar dientes perdidos individuales y ofrece importantes ventajas para el paciente, en términos de función, estética y comodidad.

Abstract

Aim: The main purpose of the present study is to provide updated information on the immediate loading protocol, introducing the types of restorations available when following a unitary immediate provisionalization approach in the esthetic area in a fully digital way.

Material and methods: After carrying out a literature review of 130 articles, between 2005 and 2020, it was decided to study those 39 that reflected the proposed inclusion and exclusion criteria. These articles were found, after careful analysis, in different databases, such as PubMed, Medline (thanks to the digital resources offered by the CRAI Library of the Universidad Europea de Madrid), Scielo and ResearchGate. **Keywords:** *immediate loading, dental implants, esthetic zone, digital work-flow, immediate provisionalization.*

Results: It is necessary that the values of the insertion torque, the implant stability quotient and the tolerated micromovements are respectively: ≥ 20 – 45 Ncm, ≥ 60-65 y 50-150 µm. The results showed a preference for the use of a flapless surgical technique. Compared to the use of a temporary abutment, the One Abutment-One Time protocol reduces treatment time, avoids multiple removals of the temporary abutment and the resulting soft tissue stress. The use of zirconia abutments improves the final aesthetic result compared to titanium abutments.

Conclusions: The literature data showed that the immediate loading protocol, both traditional and OA-OT, could represent a reliable and effective protocol for rehabilitating individual missing teeth and offers significant advantages for the patient, in terms of function, esthetics and comfort.

Índice

1. Introducción

En las últimas décadas, conocimientos más profundos de la biología ósea y el avance en la tecnología de implantes permitieron una evolución significativa de los protocolos quirúrgicos y protésicos. Se han introducido protocolos de carga temprana e inmediata para reducir el tiempo total de tratamiento y para adaptarse a las nuevas necesidades de los pacientes; de esta manera el protocolo de restauración para implantes dentales ha sido modificado desde una carga convencional hasta una carga inmediata, con resultados comparables al protocolo estándar (1,2).

Los implantes de carga inmediata son los que se someten a funcionalización protésica en la semana siguiente a la colocación del implante y esto implica que estarían expuestos al medio oral y sometidos o no a cargas funcionales (1,2).

En la literatura se han descrito dos tipos de carga inmediata: la carga inmediata funcional u oclusal y la carga inmediata no funcional o no oclusal. La primera se refiere al uso de una prótesis provisional o definitiva colocada el día de la cirugía y en contacto con la arcada opuesta o antagonista; por el contrario, la carga inmediata no oclusal implica la modificación de la restauración provisional inmediata para evitar los contactos oclusales en los movimientos excursivos céntricos y laterales, evitando el riesgo de sobrecarga mecánica por fuerzas funcionales o parafuncionales (2).

También hay que decir que estos términos pueden ser engañosos, sin embargo, ya que la "provisionalización inmediata" no prevee que la restauración sea funcional (3).

De hecho, el término "restauración inmediata" se utiliza cuando una prótesis se fija a los implantes sin lograr un contacto oclusal completo con la dentición opuesta, mientras que "carga inmediata" es cuando la prótesis se fija a los implantes en oclusión (4).

Básicamente, para ser mas concretos aun, la carga inmediata no funcional es sugerida por los autores para restauraciones anteriores individuales, mientras que los provisionales inmediatos funcionales son sugeridos para escenarios clínicos de arcos parciales y completos (2).

Recientemente se ha sugerido la conexión del pilar definitivo en el momento de la cirugía (One Abutment-one Time – OAOT); Un pilar-una vez significa colocar el pilar definitivo en el momento de la inserción del implante y dejarlo inalterado durante las fases protésicas posteriores, ya que las maniobras de atornillado y desatornillado de los componentes protésicos parecen dañar la fijación epitelial. Este protocolo permite una menor reabsorción ósea y una mayor estabilidad de los tejidos óseos periimplantarios (5).

1.1. La evolución de los protocolos: carga convencional, temprana e inmediata

Según los protocolos estándar de implantología propuestos por Branemark en 1977, los implantes deberían estar libres de cargas durante el período de osteointegración (3-4 meses en la mandíbula y 6-8 meses en el maxilar) para evitar la formación de un tejido cicatricial fibroso entre el hueso y el implante y para lograr un alto éxito previsible (2,6,7). La aplicación de este protocolo, junto con la continua investigación científica, ha hecho de la implantología una alternativa terapéutica más que válida a la rehabilitación protésica convencional, que permite reemplazar los elementos dentales extraídos o perdidos con soluciones implanto-protesicas funcionales y estéticas, que proporcionan resultados predecibles. Hoy en día casi no se utiliza el protocolo propuesto por Branemark ya que 3-8 meses se consideran ser un tiempo excesivo para una correcta osteointegración; 4 semanas serían suficientes para un protocolo de carga convencional (2).

Más que la osteointegración de los implantes, los pacientes esperan resultados estéticos óptimos de su rehabilitación, con una reducción concomitante del tiempo de tratamiento, si es posible. Estas son las principales razones por las que los implantólogos han cambiado el enfoque de su práctica hacia la estética, medida por nuevos índices que evalúan aspectos de la tesis protésica y los tejidos blandos (8).

De hecho, Cuando sólo se trata de dientes posteriores, los pacientes no suelen quejarse de este enfoque de larga duración; sin embargo, no están dispuestos a esperar tanto tiempo cuando les faltan todos los dientes de una de las arcadas y sobretodo cuando han perdido dientes en la zona estética (9).

Por otra parte, tradicionalmente un implante se definía como exitoso cuando se perdía menos de 1,5 mm de hueso durante el primer año de funcionamiento y menos de 0,2 mm anualmente a partir de entonces. Sin embargo, este criterio es difícil de aceptar en la zona estética donde una pérdida de hueso incluso inferior a 1,5 mm podría afectar drásticamente al resultado estético y es apenas tolerada por los pacientes (10). Estas razones han facilitado el desarrollo de técnicas quirúrgicas alternativas para acortar el tiempo que va desde la colocación de los implantes hasta la carga protésica y para preservar la placa ósea bucal y los tejidos blandos, especialmente en sector anterior; nacen así protocolos actualizados de implantes cargados de forma temprana e inmediata, antes de que se complete la osteointegración (2,6).

La carga inmediata de la restauración permite a los pacientes llevar sus prótesis soportadas por implantes antes de la primera semana, después de la cirugía de implantes, evitando una cirugía secundaria. Mientras que, el concepto de carga temprana se refiere al aditamento protésico conectado al implante dental entre 1 semana y 2 meses después de la cirugía implantar (2,11).

Podemos resumir que los principales beneficios de la carga inmediata incluyen una reducción de la intervención quirúrgica y del tratamiento general, así como la mejora del cuidado marginal y los tejidos blandos circundantes.

1.2. Carga Inmediata en sector estético

Dependiendo de las diferentes situaciones clínicas que puedan surgir, existen programas clínicos específicos de carga inmediata que pueden cubrir las necesidades de los pacientes desde un punto de vista estético y funcional (1,2).

Los casos descritos en la literatura incluyen protocolos para implantes inmediatos después de la extracción del diente, protocolos para la rehabilitación de la arcada completa del maxilar o la mandíbula, así aquellos de implantes cigomáticos, de restauraciones "*All-on-four*" y de implantes unitarios anteriores y posteriores.

Entre todos los diferentes protocolos de carga inmediata, el presente trabajo se centra en las restauraciones unitarias en el área estética.

Para que se considere exitosa, una restauración apoyada en un implante en la zona anterior debe lograr un equilibrio armonioso de los imperativos funcionales, estéticos y biológicos.

El nivel de soporte óseo y las dimensiones de los tejidos blandos alrededor de la restauración son factores importantes en el resultado final del tratamiento con implantes(8,12). Sin embargo, la estética de los tejidos periimplantarios depende de muchos otros factores, entre ellos el biotipo periimplantario, el nivel de la cresta ósea facial, el ángulo del implante, el nivel del primer hueso que entra en contacto con el implante y la profundidad de la plataforma que lo compone. La conservación del hueso alveolar después de la extracción del diente es importante para mantener

las dimensiones óptimas del hueso y proporcionar un apoyo competente a los tejidos blandos (1,7,13).

Desde el punto de vista protésico las restauraciones provisionales se describen como prótesis temporáneas colocadas para proporcionar beneficios tanto estéticos como funcionales hasta el momento de la entrega de la prótesis final. En el diseño y la fabricación de estas restauraciones se pueden seguir diferentes enfoques clínicos. Cuando sea necesario, las restauraciones temporales inmediatas respaldadas por implantes se consideran la primera opción en las diferentes etapas del proceso de selección, ya que aportarán el mayor beneficio estético y funcional (2).

La restauración provisional también puede utilizarse como instrumento de diagnóstico que ayudará al paciente, al clínico y al técnico de laboratorio a evaluar el futuro resultado de la restauración definitiva (14).

No debe subestimarse la influencia de la porción subgingival en las restauraciones provisionales apoyadas por implantes en el resultado final, ya que podrá definir tanto la anatomía de la corona clínica como el aspecto de los tejidos blandos subyacentes (15).

1.3. Indicaciones y Contraindicaciones del protocolo de carga inmediata en sector anterior

Indicaciones:

- Arcadas parcialmente edentulas.
- Pacientes que no desean o no pueden tolerar (por motivos sociales o psicológicos) el uso de prótesis removible.

- Pacientes que no pueden esperar 3 meses para la prótesis.
- Coordinación de la musculatura oral pobre.
- Reposiciones unitarias.

Contraindicaciones:

- Fumadores crónicos.
- Volumen óseo inadecuado.
- Densidad ósea inadecuada (D4).
- Hábitos parafuncionales de la masticación.
- Posición vestibular del implante (13) (16).

1.4. Ventajas y Desventajas

Ventajas:

- Una única fase quirúrgica.
- Mayor confort del paciente.
- Idealización de los contornos y formas de tejidos blandos.
- Mejor gestión de provisionales.
- Soporte inmediato para los tejidos periimplantarios.

Desventajas:

- Desaconsejado en pacientes parafuncionales y/o con sobremordida profunda.
- Se necesita lograr una estabilidad primaria adecuada.

- Comprobar que haya al menos 2 mm de hueso alveolar.
- Que la distancia entre el hueso vestibular y el implante sea < 2 mm (2,14).

1.5. Estabilidad primaria

La palabra osteointegración fue acuñada por Brånemark en 1965. Este proceso representa el anclaje mecánico del implante en el hueso alveolar, que se encuentra en condiciones normales de función oral. La osteointegración ocurre en dos procesos, primario y secundario (2).

La osteointegración primaria refleja la interconexión del implante con el hueso alrededor después del posicionamiento del implante, por otro lado, la osteointegración secundaria representa los estadios de regeneración ósea y remodelado (16).

La estabilidad del implante dental es uno de los factores mayores para el éxito del tratamiento: representa la ausencia de movilidad clínica. Podría decirse que uno de los aspectos más importantes para lograr una osteointegración clínica es la estabilidad primaria durante la colocación del implante (2).

Se ha demostrado que, si los micromovimientos resultan ser de más de 150 μm, esto podría afectar negativamente al proceso de osteointegración. El exceso de micromovimiento resulta ser directamente implicado en la formación de la encapsulación fibrosa del implante. La literatura sugiere que hay un umbral crítico de micromovimiento por encima del cual la encapsulación fibrosa prevalece sobre la osteointegración.
Se encontró que el umbral de micromovimiento tolerado se encontraba entre 50 y 150 micrones.

En este rango, una carga temprana en la superficie del implante podría incluso estimular el hueso recién formado para que se remodele, acelerando el proceso de osteointegración.

Dicho esto, todos los estudios en la literatura están de acuerdo en que lograr una buena estabilidad primaria del implante es una condición clave para el éxito de la carga inmediata (1,2,11).
Sin embargo, esta estabilidad se ve modificada por muchos factores determinantes como la calidad y la cantidad de hueso local, el macro-diseño del implante y la técnica quirúrgica. El parámetro decisivo y más accesible para evaluar la estabilidad primaria es el valor de torque de inserción del implante (ITV) (6,13,17).
Los valores de par que van de 30 a 40 Ncm han sido normalmente elegidos como umbrales para la carga inmediata. Ese nivel mínimo de torque es importante tanto para asegurar el proceso de osteointegración como para dar suficiente fuerza de acoplamiento a las conexiones implante-pilar, a través del tornillo de fijación (6,9,11,17).
No obstante, algunos estudios evalúan que también los implantes cargados inmediatamente y colocados en un hueso débil con un torque final ≥ 25-45 N tienen un pronóstico tan exitoso como los cargados con protocolo convencional (1,2,13,18).

Además, si se colocan suficientes implantes, la carga temprana puede realizarse, aunque no todos los implantes logren una estabilidad adecuada, gracias al apoyo de los implantes adyacentes, pero los implantes inestables deben dejarse descargados.
Para medir la estabilidad primaria del implante, recientemente se ha desarrollado un Motor de Implante (TMM2®, Idievolución) que permite al clínico medir la densidad ósea durante ambos la preparación del lugar del implante y la inserción de este (2,6).

Otros dos métodos para medir la estabilidad primaria son el análisis de frecuencia de resonancia (RFA) y el Periotest® (PT).

El RFA (Osstell®) es un dispositivo fiable que mide la frecuencia de resonancia de un transductor acoplado al cuerpo del implante (17,19). El resultado de la medición es el cociente de estabilidad del implante (ISQ), que revela la dureza de la conexión implante-hueso. Los valores de ISQ superiores a 65 se han considerado los más favorables para la estabilidad del implante, mientras que los valores de ISQ inferiores a 45 indican una estabilidad primaria deficiente (6,17).

El PT indica la estabilidad del implante midiendo el tiempo de contacto entre la punta del instrumento y el implante, durante las percusiones repetidas generadas por este dispositivo.

La falta de valores de referencia bien definidos, tanto para el RFA como para el PT, y la posibilidad de algunas variaciones dependientes del operador en las mediciones, hacen que su uso clínico rutinario no sea eficiente (6,17).

1.6. Cantidad y Calidad de hueso

Como explicado anteriormente, para lograr el valor de torque necesario para realizar la carga inmediata, es por lo tanto importante evaluar la densidad ósea en el lugar del implante. La tomografía computarizada (CT) ha sido considerado como el mejor método radiográfico para evaluar el hueso residual.

Se han propuesto varias clasificaciones con respecto a la densidad ósea.

En 1985, Lekholm, Zarb GA clasificó la densidad ósea, basándose en la evaluación radiográfica, en Tipo I, II, III y IV. El Tipo I representa el hueso compacto homogéneo. El tipo II muestra una gruesa capa de hueso compacto dentro de un núcleo de hueso trabecular denso. El Tipo III refleja

una capa delgada de hueso cortical que rodea el hueso trabecular denso y el Tipo IV representa una capa delgada de hueso cortical que rodea el núcleo del hueso trabecular de baja densidad (16).

Por otro lado, en 1988, Misch propuso una clasificación basada en las macroscópicas características óseas corticales y trabeculares:

- D1: hueso cortical denso
- D2: hueso cortical poroso
- D3: hueso trabecular grueso
- D4: hueso trabecular fino (20).

Cuando el hueso de clase III o clase IV está presente en sitio del implante, el operador puede superar esta limitación mediante la realización de técnicas quirúrgicas específicas y el uso de implantes con superficies macroscópicas peculiares (6,16).

1.7. Digital Work-Flow

A la hora de tener que reposicionar una pieza con cirugía implantar y sucesiva restauración protesica, fundamental es la planificación previa. Un flujo de trabajo digital integrado en combinación con la cirugía guiada por ordenador permite al clínico visualizar toda la información del paciente al planificar la rehabilitación para obtener una cirugía más predecible y menos invasiva (21).

La cirugía guiada por ordenador (estática) se define como el uso de una plantilla quirúrgica estática que reproduce la posición virtual del implante directamente a partir de datos tomográficos informatizados y no permite la modificación intraoperatoria de la posición del implante (22). El

uso de la tecnología en nuestro campo puede contribuir a una mejor planificación del tratamiento, colocación de implantes, captura de situaciones intraorales y procesamiento de datos para diseñar y fabricar prótesis temporales y permanentes (22). Además, puede ser útil en situaciones en las que la anatomía es compleja y se requiere una cirugía mínimamente invasiva. También se pueden utilizar para optimizar la colocación de implantes en situaciones estéticas graves (2).

De hecho, el creciente interés por la cirugía mínimamente invasiva y la posibilidad de implantar prótesis con funciones inmediatas ha propiciado el desarrollo de programas informáticos y flujos de trabajo digitales; estos pueden utilizarse para planificar y fabricar guías quirúrgicas y prótesis provisionales, que se colocarían inmediatamente después de que se apruebe la operación de implantación (23,24).

En la última década, la tomografía computarizada de haz cónico (CBCT) nos ayuda a lograr este objetivo, sustituyéndose a la tomografía computarizada multicorte (MSCT). Numerosas son las ventajas que ofrecen, entre las que se incluyen, una menor dosis de radiación para el paciente, tiempos de adquisición más cortos, un coste asequible, una mejor resolución y, en ocasiones, mayores detalles.

La CBCT utiliza vóxeles isotrópicos y, como resultado, las mediciones son precisas y se consideran 1:1; por lo tanto, se pueden fabricar modelos de estudio y plantillas quirúrgicas de impresión 3D o fresado con gran precisión (21,25). Es obvio que se debe prestar atención a la cantidad y calidad del hueso local durante la fase de planificación prequirúrgica, pero no hay que olvidarse que, como explicado previamente, la decisión final sobre la seguridad de la carga inmediata debe evaluarse en el momento de la cirugía al medir la estabilidad del implante primario mediante ITV y/o ISQ.

Por otro lado, la técnica del escáner de sonrisas permite crear con éxito un paciente dental virtual (VDP) que muestra una amplia sonrisa en condiciones estáticas para obtener una representación tridimensional del rostro del paciente. El clínico tiene la posibilidad de superponer el archivo de imágenes digitales y comunicaciones en medicina (DICOM) a los archivos estándar de lenguaje de teselación (STL). Los archivos STL se generan mediante la técnica de impresión digital por medio de un escáner óptico intraoral (IOS). Como resultado, se genera un VDP y el clínico tiene la posibilidad de planificar adecuadamente una rehabilitación asistida por ordenador (CAD/CAM) apoyada en implantes siguiendo un proyecto protésico validado. Una vez aprobada la planificación quirúrgica y protésica, se elabora una plantilla quirúrgica a medida con fundas que se utilizan en combinación con un kit de bloqueo de fresado guiadas para dirigir al cirujano a través de la colocación del implante (21,26).

A menudo los cirujanos adoptan colgajos mucoperiósticos cuando operan para visualizar más claramente la zona receptora. Esto no siempre es necesario si se realiza una colocación de implantes guiada por ordenador. La circulación sanguínea se conserva gracias a los procedimientos quirúrgicos sin colgajo o con minicolgajos en los tejidos blandos que mejoran y aceleran el proceso de regeneración.

Sin embargo, la previsualización tridimensional de la zona ósea permite evaluar si es necesario realizar la Regeneración Ósea Guiada (ROG) antes o durante la cirugía. Cuando se realiza una cirugía guiada por computadora, se puede entregar inmediatamente al paciente una prótesis prefabricada hecha por el implante digital y la planificación de la prótesis. Los procedimientos de carga inmediata han ganado gran popularidad entre los clínicos, así como una gran aceptación por parte de los pacientes (21).

2. Objetivos

2.1. Objetivo primario

El propósito de este estudio es proporcionar información actualizada sobre el protocolo de carga inmediata, introduciendo los tipos de restauraciones disponibles cuando se sigue un enfoque de provisionalización inmediata en el área estética de forma totalmente digital.

2.2. Objetivos secundarios

- Fomentar el planteamiento correcto de la futura prótesis de carga inmediata en el área estética a través de la eficacia de nuevas técnicas digitales.
- Valorar el uso de cirugía con o sin colgajo.
- Discutir sobre las diferencias del Protocolo de carga inmediata convencional en comparación con el protocolo One Abutment - One Time.
- Valorar los tipos de materiales de elección para la fabricación de pilares y coronas, tanto provisionales como definitivas.
- Informar de la influencia de la morfología del pilar y las coronas en el manejo de los tejidos blandos.

3. Metodología

3.1. Análisis de búsqueda de estudios: estrategia de búsqueda

Tras llevar a cabo una una revisión bibliográfica de 130 artículos, entre el 2005 y el 2020, se decide descartar 70 de ellos utilizando los criterios de inclusión y exclusión propuestos. De los 60 artículos que se han decidido estudiar, se propone una tabla (**Tabla 1**) con los artículos de mayor relevancia, publicados entre el 2016 y el 2020.

Dichos artículos se encontraron, tras un atento análisis, en distintas bases de datos, cuales PubMed, Medline (gracias a los recursos digitales ofrecidos por la Biblioteca CRAI de la Universidad Europea de Madrid), Scielo y ResearchGate.

Para el presente estudio se utilizaron las siguientes Palabras claves / Keywords: *immediate loading, dental implants, esthetic zone, digital work-flow, immediate provisionalization.*

3.2. Criterios de inclusión y exclusión de los estudios encontrados

Para satisfacer las prioridades propuestas por este trabajo, durante el proceso de búsqueda del material de estudio, se realiza una selección de los datos obtenidos gracias a unos criterios de inclusión y exclusión.

Por esta razón, ya desde el principio, se pretenden eliminar todos los artículos anteriores al año 2005, tomando como criterio de inclusión el objetivo de actualizar el protocolo de carga inmediata, centrándonos en las nuevas técnicas pertenecientes a los últimos años.

3.2.1. Criterios de inclusión

- Reposiciones en la mandíbula
- Reposiciones en la maxila
- Reposiciones unitarias
- Pacientes periodontalmente sanos o tratados periodónticamente
- Artículos en ingles y en español
- Artículos de alta relevancia histórica
- Implantes inmediatos e implantes tardíos

3.2.2. Criterios de exclusión

- Series de casos
- Reposiciones múltiples
- Rehabilitaciones completas o del sector posterior
- Pacientes con estabilidad primaria insuficiente
- Artículos anteriores al 2005

3.3. Recogida de datos

Índice de Abreviaturas

Abreviatura	**Significado**
C	Caninos
CC	Carga Convencional
CI	Carga Inmediata
CTa	Carga Tardía
CTe	Carga Temprana
CTG	Cirugía Totalmente Guiada
I	Implante
IC	Incisivos Centrales
II	Implantes Inmediatos
IL	Incisivos Laterales
ITC	Injerto de Tejido Conectivo
ITV	Valor del Torque de Inserción
OA-OT	One Abutment – One Time
P	Premolar
PCH	Pilar Con Hombro
PRF	Platelet – Rich Fibrine
PSH	Pilar Sin Hombro
RP	Rehabilitación Protésica
TB	Tejidos Blandos
TD	Tejidos Duro

Tabla 1. Artículos de mas relevancia publicados entre en 2016 y el 2020				
Autores y Año	**Nº de sujetos y dientes**	**Tº de estudio**	**Tipo de estudio**	**Conclusiones**
P. Yildiz 2018 (27)	33 pacientes (18 CI, 15 CC). IC = 8; IL = 22; C = 3	1 año	Revisión	La CI puede utilizarse como una alternativa segura a la CT, para proporcionar una buena estética poco después de la cirugía.
Q Cheng 2020 (1)		≥ 12 meses	Revisión sistemática y metaanálisis	En cuanto a la supervivencia del I y la estabilidad de los TB y TD periimplantarios, no se encontraron diferencias significativas entre los protocolos de CI y CC.
S. Doliveux 2020 (26)	1 paciente, diente = 21	≥ 12 meses	Reportaje de caso	
D. Krischik 2021(17)			Estudio experimental en vitro	El diseño de la rosca de los I y la preparación del lecho implantario subdimensionado son importantes para aumentar la estabilidad de los implantes, y alcanzar valores de estabilidad seguros para la CI.
M. Sehgal 2018 (28)	1 paciente Implantes = 3 Dientes = 12, 13, 23	1 año	Reportaje de caso	• El uso de PRF para el mantenimiento del hueso crestal y de los TB proporcionó una mejor estética asociada a la colocación de II. • La CI es una excelente rehabilitación estética.
T. Testori 2018 (8)			Revisión	• La colocación de II es un procedimiento exitoso en términos de estética. • La colocación de II es menos traumática para el paciente. • La CI postextracción es factible en los sitios infectados. • Las morfologías de los pilares juegan un papel en la posición vestibular/palatina del I.

				• El uso de un PSH ofrece más espacio para que el tejido crezca en comparación con el tradicional PCH.
J. Tian 2019 (12)	30 pacientes Deintes = un solo diente de un incisivo anterior maxilar (12-22)	1 año	Estudio de cohorte prospectivo	• El contorno del TB labial mostró un cambio medio de grosor a los 12 meses aceptable desde el punto de vista clínico. • En los primeros 3 meses = la mayor alteración; después de 6 meses = relativamente estable. • Ninguna recesión avanzada.
L.S. John 2020 (16)			Revisión	La CI es un tratamiento fiable y exitoso para la RP. Ofrece ventajas en cuanto a la función y la estética.
W.G. van Nimwegen 2018 (29)	60 pacientes IC, IL, C, y 1P maxilares	1 año	Ensayo Clínico (estudio comparativo)	El uso de ITC no puede compensar totalmente la pérdida ósea facial subyacente, aunque se encontró un nivel de la mucosa significativamente más localizado coronariamente cuando se utilizaron ITC.
M. Nogueira Pigozzo 2018 (11)			Revisión sistemática y metaanálisis	No diferencias significativas entre los protocolos de CTe e CI en las coronas de I individuales con respecto a la tasa de supervivencia o la pérdida ósea marginal a 1 o 3 años.
J.Y. Kwong Kan 2018 (13)			Estudio Clínico	• La CI aumenta el resultado estético. • Los procedimientos sin colgajo reducen las molestias quirúrgicas. • Es importante rellenar el hueco entre el implante y la cavidad alveolar con biomaterial de reabsorción lenta para evitar la reabsorción ósea. • Con un biotipo delgado, aumentamos el TB.

L. Tettamanti 2017 (6)			Revisión	• La CI podría representar un protocolo fiable y eficaz para reposiciones unitarias o múltiples y ofrece ventajas en la función, estética y confort. • La estabilidad primaria es uno de los factores más importantes.
B. Gjelvold 2020 (30)	25 pacientes de carga inmediata Incisivo, Canino o Premolar maxilares	1 año	Estudio clínico prospectivo no aleatorio	• La CI en combinación con la CTG podría afectar negativamente a la supervivencia del I. • La CI, la CTG y un flujo de trabajo digital parecen tener un efecto positivo en la adaptación temprana de los TB. • La CI demuestra un mayor riesgo de fracaso del I en comparación con la CC, aunque las tasas de supervivencia fueron elevadas en ambos. • Los protocolos de carga son muy diferentes. Esta falta de homogeneidad limita la relevancia de las conclusiones que pueden extraerse.
C. Arcuri 2019 (21)	1 paciente Diente = 11	2 meses	Reportaje de caso	El flujo de trabajo digital para rehabilitar una zona estética podría mejorar la previsibilidad y la precisión de una CI.
C.M. Cristache 2017 (25)	1 paciente Diente = 23		Reportaje de caso	El uso de la conversión automatizada de la escala de grises de la CBCT en 5 colores y el proceso de ventana permiten al clínico una mejor evaluación de las características óseas para una planificación precisa del implante y la fabricación de la corona.
L. Canullo 2018 (10)	25 pacientes Incisivos y caninos en el maxilar	5 años	Estudio de cohorte prospectivo	Los resultados mostraron que el enfoque OA-OT permite obtener niveles óseos estables junto con los procedimientos de cambio de plataforma y preservación de la cresta.

L. Canullo 2018 (5)	25 pacientes Incisivos y caninos en el maxilar	5 años	Estudio de cohorte prospectivo	El uso de un pilar cónico junto con el enfoque OA-OT permitió unas dimensiones de tejido blando estables a largo plazo.
M.A. Atieh 2017 (18)			Revisión sistemática y metaanálisis	Los pilares definitivos parecen ser una alternativa viable a los pilares provisorios en el momento de la colocación del I.
G. Bavetta 2019 (19)	18 implantes		Estudio retrospectivo	El ITV por sí solo demostró ser el mejor parámetro para una decisión final sustancial.
T. Lambrechts 2020 (31)			Un estudio de cohortes multicéntrico	La colocación de un pilar permanente en el momento de la cirugía parece pertinente para limitar las alteraciones marginales del nivel óseo.
L. Amorfini 2018 (32)		10 años	Estudio prospectivo aleatorio	• Uso exitoso de pilares de zirconio personalizados para restauraciones de I unitarios. • Ambas, coronas cementadas y atornilladas, mostraron buenos resultados de adaptación de los TB y el mimetismo estético, sin diferencias significativas.
J. Silva Santos 2018 (33)			Revisión sistemática y metaanálisis	• El uso del protocolo OA-OT resulta en una menor pérdida ósea que los procedimientos tradicionales. • La conservación del nivel óseo marginal conseguida con el protocolo OA-OT puede no mejorar la estética.

4. Resultados

El presente trabajo pretende proporcionar un protocolo de carga inmediata que sea eficaz, comparando los resultados obtenidos de diferentes estudios.

Para conseguir que el tratamiento protésico final sea lo deseado hay que tener en cuenta, como explicado anteriormente, numerosos factores; entre ellos la estabilidad primaria y, sucesivamente, secundaria forman parte de aquellos pilares de la implanto-prótesis necesarios para lograr nuestro objetivo. Los autores discuten mucho sobre este tema y nos proporcionan resultados diferentes, pero parecidos, en cuanto al torque de inserción del implante, el cociente de estabilidad primaria (ISQ) y los micromovimientos tolerados. En la **Tabla 2** se comparan estos datos según los autores.

Otra cuestión muy comentada hace referencia al uso de la técnica con o sin colgajo. Este trabajo proporciona información actualizada acerca del uso de estas dos diferentes técnicas en protocolos de carga inmediata (**Tabla 3**).

A la hora de tener que enfrentarnos con el protocolo protésico, numerosos son los aspectos para tener en consideración. Este trabajo quiere, antes de todo, mostrar las diferencias entre el protocolo de carga tradicional y el de "un pilar, una sola vez", reportadas en la **Tabla 4.**

En la **Tabla 5** se quieren mostrar los resultados obtenidos acerca de los dos materiales mas utilizados para la fabricación de pilares en sector estético: titanio y zirconio.

Tabla 2. Resultados según autor respecto a ITV, ISQ y Micromovimientos tolerados durante la inserción de un implante.

Autor	Torque de Inserción del Implante	Cociente de Estabilidad del Implante (ISQ)	Micromovimientos tolerados
Q. Cheng (1)	≥ 20 – 45 Ncm	≥ 60 - 65	50–150 µm
M. Nogueira Pigozzo (11)	32 Ncm	-	-
L. S. John (16)	≥ 20 – 45 Ncm	≥ 60 - 65	50–150 µm
J. Y. Kwong Kan (13)	20 – 45 Ncm	-	-
L. Tettamanti (6)	30 – 40 Ncm o ≥ 20 - 40 Ncm	-	-
D. Krischik (17)	30 – 45 Ncm	60 - 65	50–150 µm
M. Sehgal (28)	35 – 40 Ncm	-	-
W. G. van Nimwegen (29)	≥ 45 Ncm	-	-
C. Arcuri (21)	65 Ncm	-	-
V. Bruno, D. O'Sullivan (7)	≥ 35 Ncm	≥ 65	-
P. A. Schnitman (34)	35 Ncm	-	-
R. Furhauser (9)	≥ 35 Ncm	-	-
W. A. Atieh (18)	25 – 45 Ncm	> 60	-
G. A. Mandelaris (35)	> 35 Ncm	> 70	-
G. Bavetta (19)	> 20 - 45 Ncm	> 60 - 65	50–150 µm
T. Lambrechts (31)	≥ 25 Ncm	-	-

Tabla 3. Resultados según el autor respecto al uso de técnica con colgajo o sin colgajo durante el protocolo quirúrgico.

Autor	Colgajo	Sin colgajo
Q. Cheng (1)		**X**
J. Y. Kan (13)		**X**
W.G. van Nimwegen (29)		**X**
T. Grandi (36)		**X**
L. Amorfini (32)		**X**
L. Canullo (10)		**X**
Guo-Hao Lin (37)	**X**	**X**
Nabil Khzam (38)	**X**	**X**
M.A. Atieh (18)	**X**	**X**
P. Yildiz (27)	**X**	
T. De Rouck (39)	**X**	
C. Arcuri (21)	**X**	

Tabla 4. Diferencias entre uso de pilar provisorio y protocolo One abutment One Time (OA-OT) a través del uso de flujo digital.	
Protocolo de Carga Inmediata Convencional	**Protocolo OA-OT**
Planificación Digital	Planificación Digital
Cirugía con colgajo/sin colgajo	Cirugía con colgajo/sin colgajo
Cirugía implantar con o sin injerto de tejido óseo y/o conectivo	Cirugía implantar con o sin injerto de tejido óseo y/o conectivo
Provisionalización inmediata: pilar provisorio con o sin cambio de plataforma	Provisionalización inmediata: pilar definitivo con o sin cambio de plataforma
Después de 4-6 meses	**Después de 3-4 meses**
Prueba estructura + 1ª remoción pilar provisorio	Restauración definitiva
Remoción final pilar provisorio + pilar definitivo	
Restauración definitiva	
Fuente: elaboración propia a partir de 5 autores (5,10,18,36,40)**.**	

Tabla 5. Materiales de elección para pilares en el sector estético.		
Autor	**Pilar de Titanio**	**Pilar de Zirconio**
T. Grandi (36)	X	
L. Canullo (10)	X	
G.A. Mandelaris (35)	X	
T. Lambrechts (31)	X	
M. Degidi (41)	X	
S. Doliveux (26)	X	
M. Tallarico (40)	X	
B. Gjelvold (30)	X	
A. Carrillo de Albornoz (42)		X
C.Y.S. Lee (43)		X
P. Yildiz (27)		X
J.Y.K. Kan (13)		X
T. Testori (8)		X
W.G. van Nimwegen (29)		X
C.M. Cristache (25)		X
G. Fabbri (14)		X
R. Fürhauser (9)		X
L. Amorfini (32)		X

5. Discusión

5.1. Planificación Digital

Una cirugía guiada ayuda al clínico a pre-plantear y posicionar implantes en la posición mas correcta. Como explicado anteriormente, el uso de un flujo digital no nos sirve solamente para planificar el sitio designado para la colocación implantar, sino que también para visualizar la reconstrucción protésica planificada, mediante un encerado digital (25,30).

Para una correcta planificación preoperatoria, el uso de CBCT y de un escáner intraoral son necesarios. Se realiza una tomografía computarizada de haz cónico (CBCT) del maxilar superior u inferior y las imágenes se almacenan como archivos DICOM (Digital Imaging and Communications in Medicine). Los archivos DICOM del escáner CBCT se importan al software de planificación de implantes y se aislan los huesos y los dientes (21,25,26,30,35).

Se realiza un escaneo de diagnóstico digital directo de la arcada utilizando un escáner intraoral y se guarda como un archivo de lenguaje de teselación estándar (STL); este archivo se importa al software CAD/CAM (21,25,26). Se evalúa la estética de la pieza a reponer en el sector anterior, la posición del borde incisal y el nivel del margen gingival para utilizarlos como parámetros de posicionamiento del implante. En este punto, se crea una conexión entre el software de planificación y el software CAD/CAM, la cual permite transferir el escaneo digital al software de planificación, que puede ser registrado en el escaneo CBCT utilizando la dentición como puntos de referencia comunes. Se planifica virtualmente un implante en la posición correcta y en función de la prótesis deseada (25,26,34).

El implante se coloca de forma que se mantenga el perfil de emergencia del diente existente, proporcionando al mismo tiempo la angulación adecuada para fabricar la restauración. Una vez finalizada la posición del implante, la conexión digital permitirá transferir la posición propuesta del implante desde el software de planificación al software CAD/CAM. En el software CAD/CAM se puede diseñar y fabricar el pilar de cicatrización personalizado en función del tipo y las dimensiones del implante planificado (26,34).

Teniendo en cuenta la forma y el contorno de la pieza a reponer, el pilar de cicatrización personalizado se diseña para que se ajuste a la arquitectura gingival. Una vez completada la planificación, la información digital se transmite a un centro de producción para la impresión digital, con sistema CAD/CAM, de la plantilla quirúrgica para la colocación guiada del implante y de los análogos previamente planteados (26,34).

Imágenes **(Fig. 1-4)** más detalladas sobre la planificación digital se proporcionan en el **Anexo 1.**

5.2. Protocolo Quirúrgico

5.2.1. Cuidados preoperatorios

Antes de la cirugía de inserción de implantes se lleva a cabo un régimen profiláctico de antibióticos, empezando un día antes de la cirugía:

- Amoxicilina 500 mg, 3 veces al día durante 7 días
- Clindamicina 300 mg, 4 veces al día durante 7 días, en caso de alergia a la amoxicilina). (10,21,28,29,36,39).

- Autores como B. Gjelvold prefieren suministrar una dosis mas leve, 2g, de amoxicilina antes de la cirugía (30).
- Otros utilizan como terapia antibiótica profiláctica la cefuroxima 0,25 g, 1 hora antes de la cirugía (12).

Además, se utiliza un colutorio de clorhexidina al 0,2% (dos veces al día durante 7 días) para la desinfección oral (12,29).

5.2.2. Técnicas quirúrgicas con o sin colgajo

Tras la administración de anestesia se realiza una incisión sulcular para separar el ligamento periodontal adherido del diente fallado. Algunos autores utilizan periotomos para extraer atraumáticamente el diente sin levantar un colgajo mucoperióstico (1,12,13,29,32,36).

Básicamente la "flapless technique" semplifica el tratamiento, reduciendo el tiempo operatorio y las molestias para el paciente; desde un punto de vista biológico la principal ventaja que tiene la técnica sin colgajo es la conservación del periostio y del plexo supra-periostio y consecuentemente el suministro de sangre al hueso alveolar se mantiene estable (13).

Por otro lado, otros autores como P. Yildiz no están de acuerdo sobre el uso de la "flapless technique" y deciden levantar un colgajo mucoperióstico con sucesiva osteotomía (21,27,39).

Unos recientes metaanálisis, por otro lado, no encuentran una diferencia significativa entre las dos técnicas (18,37,38).

5.2.3. Injertos de tejido óseo y de tejido blando

El protocolo sigue con el desbridamiento del alveolo a fondo e irrigación con solución salina estéril. Es importante comprobar meticulosamente la integridad de la pared ósea bucal mediante un sondeo dentro del alveolo (12,28,39).

Esta es la fase que comprende la inserción o menos de injertos óseos. La colocación inmediata de implantes es un procedimiento eficaz desde el punto de vista estético. Sin embargo, este enfoque suele estar asociado a la recesión de los tejidos blandos y a la perdida de hueso. La ausencia de una placa ósea vestibular y la presencia de un biotipo periodontal delgado se consideran factores de riesgo para la recesión de los tejidos periimplantarios (38); en estos casos la intervención quirúrgica debería incluir el aumento del volumen óseo y el engrosamiento de los tejidos blandos para lograr la estabilidad en el tiempo (13).

En la literatura hay muchos estudios que investigan diversos enfoques para tratar el espacio residual entre la superficie del implante y las paredes alveolares en casos de colocación inmediata de implantes. Recientes estudios demuestran resultados satisfactorios tras el uso de injertos óseos para rellenar el espacio horizontal entre la superficie del implante y las paredes del sitio de extracción (6,10,13,18,36).

Autores como M. Sehgal utiliza la membrana L-PRF para logras estos resultados (28).

Asimismo, la presencia de tejido sano adherido en la interfaz de tejido blando del diente y el implante se correlaciona con el éxito y la estabilidad a largo plazo en la función y la estética (13,44). Algunos autores consideran que seria útil sea con un biotipo fino, sea con un biotipo

grueso, el manejo de procedimientos de injerto de tejido blando que aumentan el volumen de tejido queratinizado y proporcionan cobertura tanto en los dientes como en los implantes.

Muchas de estas técnicas pueden utilizarse junto con la colocación de implantes, o después de la colocación como medio de salvamento (13,29). De hecho, W.G. van Nimwegen, en 2018, en su estudio confirma un nivel de mucosa facial significativamente más localizado coronalmente cuando se realiza un injerto de tejido conectivo. Sin embargo, destaca también como el uso de estos injertos en implantes colocados inmediatamente y provisionalizados en la zona estética no da lugar a una menor pérdida de volumen de la mucosa después de 12 meses.

5.2.4. Colocación de implante con cirugía guiada

Finalmente se realiza una osteotomía con un sesgo palatino para la colocación del implante. El implante dental se puede colocar utilizando el kit de cirugía guiada, siguiendo el protocolo de fresado (*drilling*) y, una vez colocado, se registra el torque de inserción y se utiliza el RFA para medir el ISQ (6,17,19,30).

La mayoría de los autores confirman que es necesario que los valores del torque de inserción, del cociente de estabilidad implantar y los micromovimientos tolerados sean respetivamente: ≥ 20 – 45 Ncm, ≥ 60-65 y 50-150 μm (1,13,16,18,19,31). Por otro lado, otros autores consideran que los 20 Ncm no sean suficientes y dan como valor mínimo los 32 (11) y los 35 Ncm (9,34,35,45).

D. Krisckick y cols. proponen como ITV el rango que va desde los 30 hasta los 45 Ncm; los únicos a considerar que los valores mínimos comentados hasta ahora sean inferiores a lo necesario son W. G. van Nimwegen y C. Arcuri, que proponen respetivamente los valores ≥ 45 y 65 Ncm (21,29).

Se añaden **Figura 5** y **Figura 6** explicativas relativas al uso de cirugía guiada en el posicionamiento del implante (**Anexo 2**).

5.3. Protocolo protésico

5.3.1. Pilar provisorio en comparación con protocolo One Abutment – One Time

Como comentado anteriormente, el aspecto de los tejidos blandos periimplantarios fue reconocido como un factor crucial para el éxito del tratamiento con implantes y, para facilitar el manejo de estos tejidos, en 2005, Furhauser propuso un índice denominado Pink Esthetic Score (PES), centrado esencialmente en los aspectos del tejido blando de las restauraciones de implantes anteriores (46,47).

Se discutió, por estas razones, la importancia de utilizar el diseño y la fabricación asistidas por ordenador (CAD/CAM) que conllevan la ventaja inherente de un máximo soporte de los tejidos blandos y la subsiguiente optimización de la estética de los tejidos blandos periimplantarios con respecto a la conservación de la papila y la estabilidad del margen gingival (46,48).

Tras la colocación del implante, nuestro trabajo como protésicos consiste en cargar inmediatamente el implante a través del uso de pilares provisorios o definitivos, según la técnica utilizada.

Esta fase comprende la entrega de un pilar fresado por CAD/CAM específico para el paciente y un provisional en la misma cita, con contornos ideales para mantener la arquitectura. Este pilar puede permanecer en su lugar y convertirse en el pilar definitivo, "pilar único, de una sola vez" o bien, alternativamente, puede ser sustituido por un nuevo pilar modificado digitalmente y específico para el paciente, alterando así la interfaz implante-pilar mas de una vez (35). Por esta razón uno de nuestros objetivos es proporcionar información sobre las diferencias entre el protocolo de carga inmediata tradicional con el uso de pilares provisorios y el protocolo One Abutment – One Time (OA-OT).

Entre los autores que prefieren utilizar el enfoque mas tradicional, algunos esperarían hasta que se cumpla la casi completa osteointegración, es decir hasta los 4-6 meses (9), otros dejarían los provisorios unas 4 semanas (21) mientras que, autores como C.Y.S. Lee y cols. los dejarían hasta la duodécima semana (43).

Sin embargo, los cambios múltiples de pilares pueden perjudicar las condiciones de los tejidos blandos en comparación con la no retirada de los pilares definitivos en la restauración inmediata (33,36).

Tallarico y cols. en una reciente revisión sistemática con metaanálisis explica como la desconexión repetida de los pilares podría producir un daño biológico y microbiológico en el complejo tejido/pilar/implante que aumenta considerablemente los cambios del nivel óseo marginal periimplantario. La cantidad de esta pérdida ósea se evaluó en los primeros años en torno a 0,3 mm (40).

Ademas, en un estudio del 2015, se confirma que la inflamación tisular se ve disminuida cuando se usa el protocolo OA-OT en comparación con el protocolo tradicional (49)

Con respecto a la perdida osea marginal, por otro lado, algunos estudios demostraron un valor significativamente menor, que oscilaba entre 0,2 mm y 0,5 mm, al aplicar el pilar único, con una relevancia clínica poco clara (5,36). Otros no mostraron ningún valor adicional (41,49). Estos resultados son contradictorios y deben interpretarse con precaución.

En conclusión, el uso del protocolo AOT con implantes de plataforma cambiada da lugar a una menor pérdida ósea, pero este efecto puede no ser clínicamente relevante. La preservación del nivel óseo marginal conseguida con el protocolo AOT puede no mejorar la estética. Estos resultados deben interpretarse con precaución (10).

Una desventaja asociada al pilar definitivo después de la cirugía podría ser la dificultad para seleccionar el pilar estándar definitivo adecuado inmediatamente después de la colocación del implante, debido a la gran variación de los tejidos blandos y del hueso de la pared. Al enfrentarnos con un trabajo totalmente digital, este limite podría evitarse utilizando pilares personalizados (33).

En ambos casos sería preferible utilizar un pilar sin hombro para evitar el problema de la recesión de los tejidos blandos que se produce después de la cirugía. De este modo, la línea de acabado de la corona final puede definirse fácilmente como el nivel alcanzado por el tejido blando tras la cicatrización (36).

En cuanto a la forma, podemos añadir que, según un estudio comparativo de dos diseños de pilares utilizados para coronas individuales en la zona estética, uno divergente y otro curvo, los resultados indicaron que el diseño de pilar curvado no tuvo mejores resultados que el tipo convencional (divergente) con respecto a la estética gingival, según la evaluación de la PES y la puntuación de la EVA por parte de los dentistas y los pacientes (46).

Acerca del tipo de material a utilizar, en la actualidad, se utilizan varios para la fabricación de pilares protésicos personalizados, como metales, cerámicos y composites.

A pesar de esto, los pilares de resina compuesta se han sugerido como una alternativa para restaurar los implantes dentales y han demostrado ser tan resistentes como los de zirconio en varias pruebas in vitro (50). Sin embargo, la reacción de los tejidos blandos periimplantarios al composite es una preocupación importante. Un ensayo clínico aleatorio demostró que las superficies de resina de composite albergaban una marcada acumulación de placa, que producía inflamación de la mucosa en muchos casos, en comparación con el titanio (51). Por lo tanto, el uso de pilares de resina compuesta sigue siendo limitado.

Abrahamson y cols, en su estudio del 1998, destacaron que, en los lugares en los que se utilizaron pilares de porcelana, no se formó una fijación adecuada a nivel del pilar, sino que el margen de tejido blando retrocedió y se produjo una reabsorción ósea. Por otro lado, los pilares de titanio o de cerámica (zirconio) permitieron la formación de una fijación mucosa que incluía una porción epitelial y otra de tejido conectivo de unos 2 mm y 1,5 mm de altura, respectivamente (52).

Los recientes avances en la tecnología de fresado confirman la posibilidad de seleccionar dos materiales para la fabricación de pilares específicos para cada paciente: el circonio y el titanio

(53). Durante décadas, el titanio ha sido el material preferido debido a la fuerza del material, la resistencia a la distorsión y la posibilidad de fabricar el pilar en una sola pieza. Las revisiones sistématicas han mostrado excelentes resultados que promueven los pilares de titanio como altamente fiables (54,55).

Sin embargo, el mayor inconveniente de estos pilares es que su color oscuro puede brillar a través de los tejidos blandos periimplantarios, creando una apariencia grisácea de la mucosa periimplantaria, que es estéticamente inaceptable. Por esta razón, a pesar de que la investigación no respalda ninguna ventaja evidente de los pilares de Ti o Zr sobre los demás, existe una tendencia significativa en los pilares de Zr que evoca una mejor respuesta de color de la mucosa periimplantaria y un resultado estético superior medido por la puntuación PES (9,32,53).

Por otro lado, otros autores consideran no solamente el aspecto estético de estos pilares, sino que también la resistencia y la sensibilidad a la manipulación de ambos materiales de fabricación (42).

Se concluye que los pilares de zirconio tienen un excelente potencial estético, pero hay que tener en cuenta que son más sensibles a los procedimientos de manipulación que los pilares de titanio. Por los siguientes motivos, el uso de estos pilares cerámicos debería limitarse a la restauración de incisivos y premolares no sometidos a una carga oclusal excesiva (14,42).

5.3.2. Provisionalización unitaria de carga inmediata en sector anterior

Una vez que el pilar esté colocado, tendremos que reposicionar la pieza perdida con una restauración provisoria.

Sobre los tiempos de inserción de la prótesis los autores tienen opiniones diferentes: algunos como P. Yildez y G.W. van Nimwegen afirman que el tiempo correcto de inserción de la protestéis seria a las 24/48 horas desde el posicionamiento del implante, mientras que M. Nogueira extendería este laxo de tiempo desde las primeras 48 horas hasta las 72 horas (11,27,29). Por otro lado, la mayoría de los autores, entre ellos Q. Cheng, M. Peñarrocha-Diago y L. Tettamanti creen que provisionalizar dentro de la primera semana sea la mejor opción de tratamiento (1,2,6).

Como comentado en los capítulos previos, antes de colocar una corona inmediata se verifica que el valor del ISQ sea superior a 60. El pilar protésico BOPT se atornilla al implante con su tornillo de fijación, se protege con una goma y se utiliza resina. La prótesis prefabricada realizada a partir del encerado digital se fresa a partir de un bloque de polimetilmetacrilato (PMMA) y se solda utilizando una resina autopolimerizable. Una vez terminada y pulida la prótesis provisional, se atornilla o se cementa, según la técnica mas idónea (2,21,26,35).

El correcto ajuste oclusal de la prótesis sobre los implantes es esencial para el éxito del tratamiento implantológico. La decisión de restaurar o cargar inmediatamente los implantes dentales suele tomarse durante la fase de planificación del tratamiento (4). Algunos autores aconsejan un contacto oclusal ligero en los casos de carga inmediata de implantes múltiples ferulizados (2,11,17). Sin embargo, en el caso de la carga inmediata de implantes individuales, deben evitarse los contactos oclusales en movimientos céntricos y excursivos (protrusivos y

laterales) (56). Por este motivo, se recomiendan restauraciones provisionales en infraoclusión (57).

Dependiendo de la forma en que se coloque la prótesis sobre los pilares provisionales, las restauraciones fijas implantosoportadas pueden subdividirse en prótesis cementadas o atornilladas (2,4). La decisión de cementar o atornillar una restauración provisional o definitiva dependerá de las situaciones clínicas y de la preferencia de los clínicos hacia el método de fijación (4,58).

Las restauraciones provisionales cementadas se aconsejan por razones estéticas en situaciones clínicas en las que la angulación del implante no permite la colocación de una prótesis provisional atornillada con acceso palatino/lingual (58).

Se requiere un cuidado especial con estas restauraciones provisionales, especialmente en la región estética ya que el acceso al hombro del implante colocado en profundidad puede ser difícil (4). No se deben dejar restos de cemento en la zona subgingival y/o sin contacto con otros tejidos, como el injerto óseo o el tejido conectivo, ya que esto podría favorecer el aumento de la contaminación bacteriana del surco periimplantario y afectar negativamente al resultado final. Por lo tanto, algunos autores afirman que se deberían evitar los márgenes subgingivales (2,4).

A pesar de esto, otros autores consideran que, a la hora de utilizar los procedimientos CAD/CAM, las reconstrucciones cementadas representan las prótesis de elección en muchas situaciones clínicas (59).

Por otra parte, las restauraciones provisionales atornilladas eliminan el riesgo de acumulación de cemento en la parte subgingival (60) y facilitan la colocación y extracción del implante, lo que es muy importante para la conformación de un perfil de emergencia adecuado.

Por el contrario, el uso de una prótesis provisional atornillada implica una mayor contaminación bacteorológica en la parte interna de la conexión en comparación con una restauración provisional cementada (2).

De todos modos, ambas técnicas se consideran eficaces y optimas. De hecho, I. Sailer y cols. afirman que, en el caso de las coronas individuales, se pueden recomendar ambos tipos de métodos de fijación (59).

Además, en un estudio transversal donde se han comparado, mediante el índice PES, los resultados estéticos obtenidos entre los dos tipos de prótesis, se ha demostrado con éxito que ambos tipos de conexión pueden lograr resultados satisfactorios en cuanto a la estética periimplantaria en el maxilar anterior (15).

5.3.3. Restauración definitiva

Tras la osteointegración del implante y la cicatrización de los tejidos blandos, entre 4 y 6 meses después, se procede a sustituir las prótesis provisorias con las coronas definitivas en contacto oclusal (9,21,47).

Algunos autores, entre ellos L. Canullo y cols. , tuvieron resultados satisfactorias posicionando las prótesis definitivas ya a las 4 semanas (5). Otros autores, por otra parte,

tuvieron casos en los cuales se cementaban o atornillaban a los 2 meses, hasta llegar, en casos mas lentos, a los 6 meses (18).

Con respecto a los materiales de elección para la fabricación CAD/CAM de las prótesis definitivas, la literatura sugiere dos principalmente: la cerámica de vidrio de leucita por un lado (9) y el zirconio por el otro (26).

6. Conclusiones

La rehabilitación con implantes en la zona estética es una de las tareas más exigentes debido a la importancia de obtener un resultado estético óptimo. Los datos de la literatura mostraron que la carga inmediata podría representar un protocolo fiable y eficaz para rehabilitar dientes perdidos individuales y ofrece importantes ventajas para el paciente, en términos de función, estética y comodidad.

- Este estudio demuestra que el tratamiento clínico de los implantes, que hasta ahora requería años de desarrollo de habilidades manuales por parte del cirujano, el dentista restaurador y el técnico, puede llevarse a cabo de forma totalmente digital, lo que supone una reducción significativa de la curva de aprendizaje y del nivel de habilidad manual.
- En la colocación y carga inmediata de implantes, el uso de una plantilla referenciada radiográficamente, que aseguraría el posicionamiento específico de las áreas de contacto de las coronas provisionales relacionadas con la cresta ósea interproximal, puede facilitar el mantenimiento y el desarrollo de los contornos estéticos de los tejidos blandos.
- Con respecto al uso de una técnica con colgajo, la decisión de los cirujanos de no levantar un colgajo parece influir más positivamente en la cantidad de cambios en los tejidos blandos cuando se utiliza el protocolo de carga inmediata.
- Dentro de los límites de este estudio, la no retirada de los pilares colocados en el momento de la cirugía resulta proporcionar una mejora en los niveles de inflamación de los tejidos blandos. Además, comparado con la retirada repetida de los pilares, podría ofrecer un mayor mantenimiento de niveles óseos alrededor de los implantes individuales inmediatamente restaurados, aunque esta cantidad de mantenimiento óseo puede no tener un impacto clínico.

7. Responsabilidades

Este trabajo tiene una real importancia social, ya que, hoy en día, la estética juega un papel fundamental en nuestra practica diaria. Nuestro trabajo no solamente consiste en rehabilitar desde un punto de vista funcional, sino que también desde un punto de vista estético y reflejar las exigencias de nuestros pacientes es lo mas importante.

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9. *Anexos*

Anexo 1. Planificación digital para protocolo de carga inmediata.

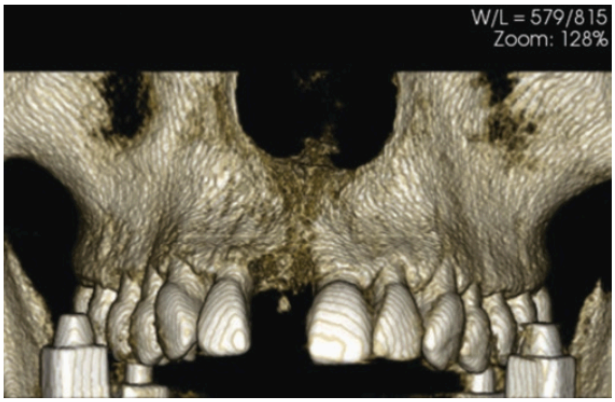

Fig. 1. Se realiza CBCT y se obtienen imágenes en formado DICOM. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading. Pagina 255.

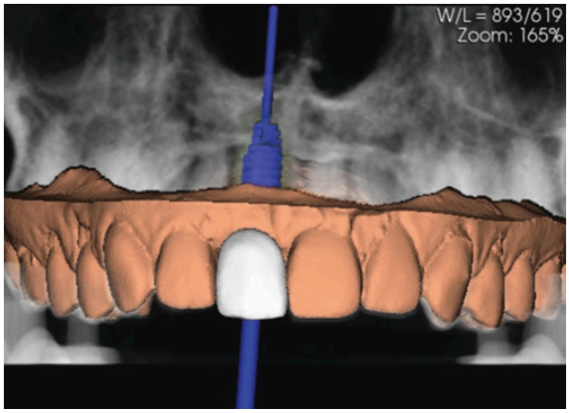

Fig. 3. Tras introducir el encerado diagnostico de la restauración protésica, se planifica el posicionamiento del implante. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading. Pagina 256.

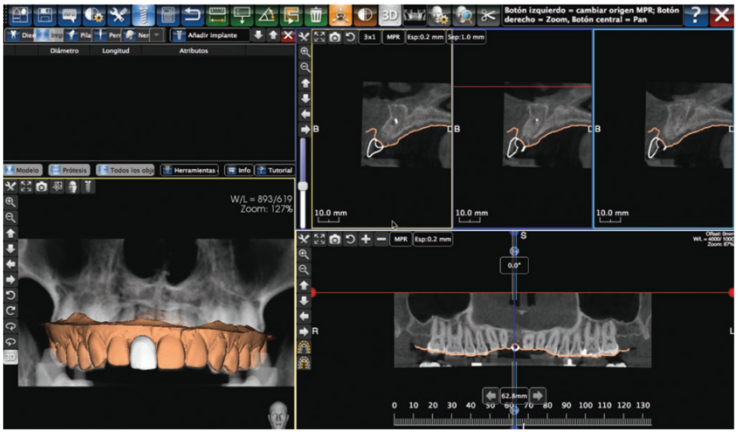

Fig. 2. Ejemplo de sistema utilizado para realizar la planificación digital de protocolo quirúrgico y protésico. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading. Pagina 256.

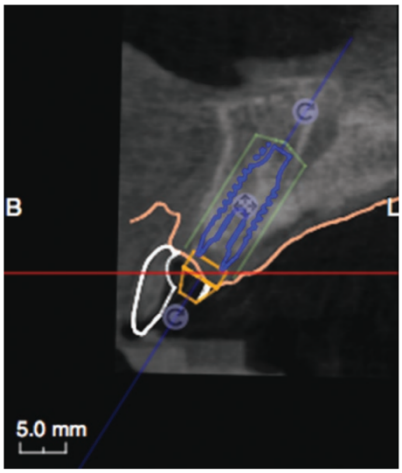

Fig. 4. Imagen lateral después haber realizado la planificación: el software permite posicionar el implante y chequear la correcta emergencia y angulación protésica. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading. Pagina 256.

Anexo 2. Uso de cirugía guiada en el posicionamiento del implante.

Fig. 5. Posicionamiento de implante con guía quirúrgica. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading. Pagina 259.

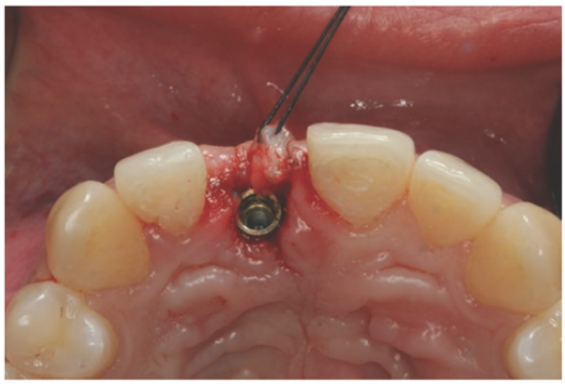

Fig. 6. Imagen oclusal tras posicionamiento del implante. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading. Pagina 259.

Anexo 3. Provisionalización inmediata con PMMA fresado por CAD/CAM.

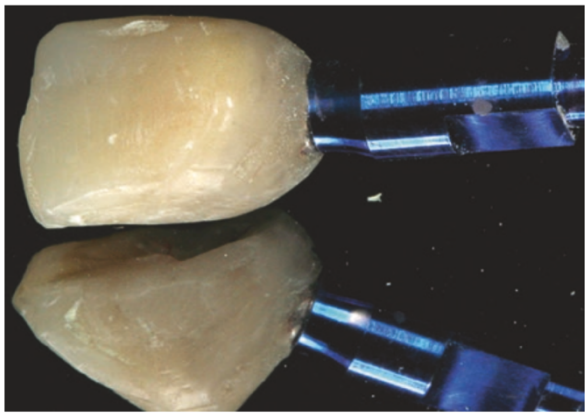

Fig. 7. Restauración provisional BOPT de PMMA. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading.Pagina 259.

Fig. 8. Imagen frontal tras el posicionamiento de la prótesis temporal. Tomada por M. Peñarrocha-diago y cols. Atlas of Immediate Dental Implant Loading. Pagina 259.

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Clinical Outcomes Following Immediate Loading of Single-Tooth Implants in the Esthetic Zone: A Systematic Review and Meta-Analysis

Qian Cheng, MD[1]/Ying-Ying Su, PhD[2]/Xin Wang, PhD[3]/Su Chen, PhD[4]

Purpose: *To identify whether or not immediate loading yields different clinical outcomes from conventional loading of single-tooth implants in the esthetic zone.* ***Materials and Methods:*** *Various databases (MEDLINE/PubMed, Cochrane [CENTRAL], and Embase) were searched electronically to find articles published in the English language from January 2000 to April 2018. Only randomized controlled clinical trials (RCTs) that compared conventional and immediate implant loading with a minimum follow-up period of 1 year or more were considered. Available data were pooled for meta-analysis using the Review Manager software.* ***Results:*** *Seven RCTs were included. There was no significant difference between immediate and conventional loading protocols on implant survival at the 1-year follow-up (risk ratio [RR] = 0.99; 95% confidence interval [CI]: 0.95 to 1.02). The differences regarding marginal bone loss between the two protocols were statistically insignificant (mean difference [MD] = 0.03 mm; 95% CI: −0.09 to 0.15 mm at the 1-year follow-up, and MD = −0.01 mm; 95% CI: −0.16 to 0.15 mm at the 2-year follow-up). Soft tissue changes following different loading protocols revealed no significant differences in the mesial papillae (MD = 0.30 mm; 95% CI: −0.25 to 0.85 mm), the distal papillae (MD = −0.00 mm; 95% CI: −0.42 to 0.42 mm), and the midfacial mucosa (MD = −0.33 mm; 95% CI: −1.17 to 0.50 mm) at the 1-year follow-up. The esthetic outcomes and patient satisfaction were reported in two and three RCTs, respectively.* ***Conclusion:*** *A short-term follow-up of single-tooth implants in the esthetic zone showed that the loading protocols (conventional or immediate loading) are not likely to influence the clinical outcomes, including implant survival and peri-implant stability of soft and hard tissues.*
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Keywords: *esthetic zone, immediate loading, peri-implant, single implant, stability*

Traditionally, a submerged healing period (12 to 25 weeks) was always a requisite to establish the osseointegration of endosseous implants.[1] Due to the recent developments in oral implantology, dental implants with better osseointegration and different designs in terms of forms, dimensions, materials, and surface coatings are available.[2–4] These developments resulted in enhanced primary implant stability and improved prognosis. Consequently, the restoration protocol for dental implants has been modified from conventional loading to an earlier and even immediate loading, particularly in patients with edentulous mandibles with good bone quality.[5] The key benefits of immediate loading include a reduction of surgical interventions and total treatment time; hence, the time span between tooth extraction and insertion of implant-supported restorations may be remarkably decreased.[6] Therefore, the immediate loading protocol has been extensively adopted and showed promise in selected cases,[7] especially in the anterior maxilla, owing to its esthetic advantages.[8–10]

The immediate loading protocol can be commonly applied in both postextraction sockets and healed alveolar ridges.[11,12] Moreover, the comparison of survival rate and marginal bone stability between healed and fresh extraction sites of immediately loaded implants

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Preservation of Soft Tissue Contours Using Computer-Aided Design/Computer-Assisted Manufacturing Healing Abutment with Guided Surgery in the Esthetic Area: Case Report

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Adam Hamilton, BDSc, DCD, FRACDS[3]/German O. Gallucci, DMD, PhD[4]

This case report describes a digital workflow for a computer-aided design/computer–assisted manufacturing (CAD/CAM) healing abutment used in immediate implant placement in the esthetic zone. The design of the healing abutment was based on the existing tooth anatomy in order to provide anatomical support to the gingival tissues and to preserve the gingival contours of the natural tooth. This approach enhances the esthetic outcome of the definitive implant restoration. The surgical procedure including the guided bone regeneration is simplified, postoperative morbidity is reduced, and excessive occlusal loading during healing is limited. Int J Oral Maxillofac Implants 2020;35:e15–e20. doi: 10.11607/jomi.7668

Keywords: *CAD/CAM healing abutment, computer-guided surgery, immediate implant placement*

Implant-supported restorations have become a well-established treatment for the replacement of missing teeth.[1,2] However, such a treatment continues to be a challenging endeavor, particularly in the esthetic zone.[1,3,4] In order to optimize the esthetic outcome of an implant-supported restoration, the use a provisional crown to contour the emergence profile is recommended.[4] Different techniques for the use of provisional crowns and multiple loading protocols exist and are well documented in the literature.[1,2,5–9] Loading protocols for dental implants include: conventional loading, where implants are allowed to heal for a period greater than 2 months after implant placement; early loading, where implants are restored between 1 week and 2 months after implant placement; and immediate loading, where implants are restored within 1 week of implant placement.[5,7,10]

It is well known that following a tooth extraction, significant dimensional alterations in the ridge and soft tissue contours occur within the first 3 to 6 months. It has been suggested that immediate implant placement in conjunction with immediate loading of dental implants (type 1A[7]) may limit changes in the soft tissue architecture and ridge resorption.[2,6] This is most effective when graft material is placed into the socket around the implant in a flapless approach and the provisional restoration is utilized to provide support to the soft tissue as well as containment of the graft material.[11] In addition, providing an immediate implant restoration eliminates the need for a removable transitional prosthesis, which provides additional psychosocial benefits to the patient, particularly in the esthetic zone.[2,5,8] Despite these advantages, type 1A cases (immediate implant placement and loading) are sensitive, and this approach requires strict adherence to a specific set of criteria.[2,5,7,10] These include the achievement of primary stability, minimizing occlusal loading, and appropriate patient selection.[2,5] The reduced bone-to-implant contact may result in higher levels of strain and unfavorable outcomes.[10] Alternatively, the provisional restoration can be delivered at a later stage for a delayed loading protocol. Although

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Review Article

CURRENT CONCEPTS FOR IMMEDIATE LOADING OF IMPLANTS

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Abstract

The loss of one or more teeth affects patient in a detrimental way. Dental implants have become a common choice of treatment due to the high success rate and predictability of the procedure and its relatively few complications. Recently, immediate loading of implants has become popular due to its fewer surgical interventions, reduction in treatment time and overall satisfaction of the patient. This review article describes the current status of immediate loading, with their advantages and disadvantages, and the clinical indications and contraindications.

Keywords: Dental implants, Immediate loading, current concepts.

Introduction

Health of oral tissues and its proper maintenance are very important to nurture deglutition, phonation, appearance and psychological well- being. Loss of teeth can occur due to many reasons, including systemic conditions and dental related factors like dental caries, periodontal disease and traumatic injuries. Patient may suffer certain psychological effects following the loss of one or more teeth. Prosthodontics is one such speciality which focuses on dental prosthesis. There are three basic proposals of treatment to replace a missing tooth which includes removable partial denture, fixed dental prosthesis and dental implants. Every treatment modality has its own merits and de-merits. The selection of treatment depends on several factors including patient's health, financial and emotional conditions. Dental implants have become a very popular solution due to the high success rate and predictability of the procedure and its relatively few complications.

Recently immediate loading has a positive impact since it has a similar clinical outcome compared to conventional loading. And also, it can be used as a treatment with an advantage of reduced treatment time and providing patient with efficient masticatory support and aesthetics.

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Quick Response Code

Definitions

Terminology for the Timing of Implant Loading.[2]

Immediate loading: The prosthesis is attached to the implants the same day the implants are placed.

Early loading: The prosthesis is attached at a second procedure, earlier than the conventional healing period of 3 to 6 months; time of loading should be stated in days or weeks.

Delayed loading: The prosthesis is attached at a second procedure after a conventional healing period of 3 to 6 months.

Wang et al. stated a definition based on a consensus from the International Congress of

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Implant placement in the esthetic area: criteria for positioning single and multiple implants

TIZIANO TESTORI, TOMMASO WEINSTEIN, FABIO SCUTELLÀ, HOM-LAY WANG & GIOVANNI ZUCCHELLI

Implant-based rehabilitation is a clinical challenge, especially in the esthetic area, which is defined as between the first or second contralateral premolars. Numerous factors influence the outcome of the rehabilitation; however, the two main factors are the bone and soft-tissue deficiencies at the intended implant site (66). Planning for these deficiencies is helped by the use of computerized guided surgery (which allows insertion of the implant to be planned in detail) and stereolithographic and three-dimensional printed surgical guides (to aid implant insertion in the most appropriate prosthetic position).

These techniques make implant rehabilitation a more predictable treatment modality and implant survival rates have improved over recent years, as reported in several publications and systematic reviews (55). Nevertheless, expectations from the treatment have changed and esthetics plays an important role in defining the success of rehabilitation. Various surgical approaches are described in terms of timing of implant placement (32) and management of regenerative procedures (73). More than the osseointegration of the fixture, patients expect optimal esthetic results (30) from their rehabilitation, with a concomitant shortening of the treatment time, if possible. These are the main reasons why implantologists have shifted the focus of their study to esthetics, measured using new indices (5, 31, 70) that evaluate the aspects of the prosthesis and soft tissues. Another way of assessing implant 'success' is by using patient-reported outcome measures, introduced at the Eighth European Workshop on Periodontology. Patient-reported outcome measures define the perception of the oral health of the patients and their quality of life, their satisfaction and nonclinical parameters (25, 45). The esthetic area is highly involved in these perspectives and is very challenging for the clinicians. The aim of this article is to discuss the different implant placement alternatives in the esthetic area, in particular:

- the timing of implant placement/regenerative procedures/skeletal growth/altered passive eruption.
- the correct three-dimensional position of the fixture between the cuspids and in the premolar area.
- cases of multiple missing teeth in the esthetic area with single tooth/pontic or cantilevered options/prosthetic compensation.
- implant placement into infected sites.
- the influence of the morphology of the abutments and the crowns on implant position.

Timing of implant placement/regenerative procedures/skeletal growth/altered passive eruption

The frequently cited consensus statements (32) regarding timing of implant placement defines four categories: immediate implant placement (type 1); early placement with soft-tissue healing (type 2); early placement with partial bone healing (type 3); and late placement (type 4). A recent systematic review (14) investigated the outcome of immediate and early placement of implants in the esthetic area: despite the great heterogeneity of the studies included, immediate implant placement provides good soft-tissue esthetic outcomes. The main concern following

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Immediate implant placement and provisionalization of maxillary anterior single implants

JOSEPH YUN KWONG KAN, KITCHAI RUNGCHARASSAENG, MATTEO DEFLORIAN, TOMMASO WEINSTEIN, HOM-LAY WANG & TIZIANO TESTORI

Achieving and maintaining optimal gingival esthetics around anterior single implants is a demanding task (49, 73). In spite of the high success rates achieved with osseointegrated implants, gingival recession of up to 16% has been reported in anterior single implants (38). On the other hand, spontaneous rebound of the receded gingiva has also been observed after a few years of function (20, 45, 50). These changes in the peri-implant mucosa were postulated as being an attempt to establish a stable biologic dimension (9). An understanding of the dentogingival complex and its implant counterpart (the peri-implant mucosa) allows clinicians to balance the biologic/physiologic requirements and esthetic demands of single-implant restorations in the esthetic zone.

The impending loss of a single tooth in the esthetic zone in a patient with an otherwise healthy periodontium can be a distressing experience (48–50, 56), and the inevitable loss of soft and hard tissue following tooth extraction often results in a compromised site for implant placement in terms of esthetics. Various surgical augmentation techniques have been advocated as corrective procedures, but they are challenging and the results are not predictable (7, 44, 67, 70). Since 1998, when Wöhrle (87) first demonstrated success with immediate implant placement and provisionalization of single anterior maxillary implants, numerous studies have substantiated the viability of such treatments (6, 14, 18, 27, 29, 32, 39, 43, 51, 52, 55, 69, 71, 81, 84). One of the most desirable features of immediate implant placement and provisionalization is its efficacy in optimizing esthetic success by preserving the existing osseous and gingival architecture (37, 48, 52, 87).

The esthetic success of immediate implant placement and provisionalisation procedures is influenced by a number of factors that can be categorized as intrinsic and extrinsic (53). Intrinsic factors are patient-dependent and include the relationship between hard and soft tissues, gingival biotype and sagittal root position in the alveolar bone (47, 57). Extrinsic factors, on the other hand, are clinician-dependent and include three-dimensional implant position and angulation, as well as the contour of the abutment and the provisional restoration (48, 57).

The aim of this paper was:

- To review the literature in order to address topics related to immediate implant placement and provisionalization of maxillary anterior single implants, specifically:
  - advantages of the flapless procedure;
  - the opportunity to fill the gap between the implant and the buccal bone;
  - augmentation of soft tissue at immediate implants;
  - the true advantage in terms of esthetics;
  - the esthetic evaluation and patient-centered outcome; and
  - advantages and disadvantages with respect to other delayed approaches.
- To provide a full clinical protocol for immediate implant placement and its provisonalization in the esthetic area.

IMMEDIATE LOADING IMPLANTS: REVIEW OF THE CRITICAL ASPECTS

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SUMMARY

Purpose. Modern dentistry have witnessed, a rapid and continuing evolution. Concerning the implant-rehabilitation protocols, they have been redefined in order to satisfy patient's increasing expectations in terms of comfort, aesthetic and shorter treatment period. The purpose of this review is to explore the concept of implant immediate loading and the indications for clinical practice. All the critical aspects that could influence the outcomes of this treatment will also be considered.

Materials and methods. Three protocols for implant load timing have been classified: immediate loading implants (ILI); early loading implants (ELI); and conventional loading implants (CLI). Two subclassifications point out the different loading modality: 1) Occlusal loading or Non-Occlusal loading, 2) Direct loading or Progressive loading. Micromovements have been considered, since the start of implant dentistry, one of the main risk for the success of osseointegration. The determinant and most accessible parameter to assess the primary stability is the implant insertion torque value. To achieve the necessary torque value to perform immediate loading, it is therefore important to evaluate the bone density at the implant site. Computerized tomography (CT) has been regarded as the best radiographic method to evaluate the residual bone.

Results. The clinical success of this technique is highly dependent on many factors: patient selection, bone quality and quantity, implant number and design, implant primary stability, occlusal loading and clinician's surgical ability. Among these, implant primary stability is undoubtedly the most important.

Conclusion. Studies on ILI show that successful outcome can be expected, if the previous criteria are fulfilled. It seems that ILI demonstrate a greater risk for implant failure when compared to CLI, although the survival rates were high for both the procedures. The use of different surgical procedures, type of prostheses, loading times and have very different study designs. This lack of homogeneity limits the relevance of the conclusions that can be drawn.

Key words: immediate loading implants, implant stability, implant design.

Modern dentistry has witnessed, over the last decades, a rapid and continuing evolution of techniques in different fields (1-44, 122-125). Concerning the implant-rehabilitation protocols, they have been redefined over the years, as a result of new knowledges in implant surgery and in order to satisfy patient's increasing expectations in terms of comfort, aesthetic and shorter treatment period.

Since Branemark introduced the osseointegration system in 1977 (45), new protocols have been proposed regarding the prosthetic-load timing, up to the immediate implant loading.

Classic protocols propose that implants should receive no loading during the osseointegration period, usually 3 to 4 months in the mandible

Evaluation of Pink and White Esthetic Scores for Immediately Placed and Provisionally Restored Implants in the Anterior Maxilla

Guaracilei Maciel Vidigal, Jr, DDS, MSc, PhD[1]/Mario Groisman, DDS, MSc[2]/
Victor Grover Rene Clavijo, DDS, MS, PhD[3]/Igor Guimarães Barros Paulinelli Santos, DDS, MSc[4]/
Ricardo Guimarães Fischer, DDS, MSc, PhD[5]

Purpose: *To evaluate the esthetic result of immediately placed implants with immediate provisional restorations in the anterior maxilla using the pink esthetic score (PES) and white esthetic score (WES).* ***Materials and Methods:*** *The records of patients were evaluated retrospectively. The evaluation was carried out by two examiners using 12 evaluation criteria.* ***Results:*** *The average PES value from the evaluation of 53 images obtained from the 53 selected patients (22 men and 31 women) was 8.63 ± 2.4 (range, 1–14), whereas the average WES value was 6.92 ± 1.67 (range, 2–10). The mesial papilla had the highest average PES (1.39 ± 0.4) and the distal papilla had the lowest PES (0.87 ± 0.54). Texture had the highest average WES (1.54 ± 0.34) and tooth shape had the lowest average WES (1.25 ± 0.43).* ***Conclusion:*** *Treatment with immediate implants providing immediate provisional restoration in the anterior maxilla yields good clinical esthetic outcomes, as assessed by PES/WES values. The PES and WES values showed strong intraexaminer agreement, but weak interexaminer agreement.* Int J Oral Maxillofac Implants 2017;32:625–632. doi: 10.11607/jomi.5149

Keywords: *esthetic zone, immediate implants, immediate restoration, pink esthetic score, white esthetic score*

Comparing the results of different studies of immediately placed implants is challenging. A previous systematic review of the outcomes of implants placed immediately after tooth extraction and those placed in healed areas concluded that it was not possible to compare the results because of the heterogeneity of the studies.[1] Immediately placed implants have high survival rates.[2–4] However, with the progress in surgical and prosthetic techniques for osseointegrated implants and the development of novel materials, the treatment results for immediately placed implants can no longer be assessed solely on the basis of the success/survival rate, as this progress has been accompanied by an increased demand for optimal esthetics. This has raised scientific interest in the evaluation of the esthetic outcomes of these treatments.[5,6]

Several factors can affect peri-implant tissues and the esthetic outcomes of immediate implant therapy,[7] including the morphology of the area,[8,9] the shape of the alveolar bone defect,[10] the surgical technique used,[11] the material composition and design of the implants and abutments used,[12,13] and the use of bone substitutes[14] and connective-tissue grafts.[15] These critical factors should be evaluated by the clinician/surgeon when determining the appropriateness of delayed or immediate implant placement. When considering immediate implant placement and provisional restoration, the risk factors for this loading protocol should also be analyzed. Potentially deleterious effects may result from parafunctional habits,[16] initial insertion torque,[17] and the patient compliance level.[18]

In 2005, Fürhauser et al[19] proposed an index—the pink esthetic score (PES)—to evaluate the esthetic results of treatments involving single implants. The PES provides a rating of seven soft tissue parameters: the mesial and distal papilla, contour and margin level, alveolar process deficiency, and mucosal color and texture. Belser et al[20] proposed combining the PES with a score that assesses the quality of prosthetic restoration of the mucosa over the implant: the white esthetic

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Factors Affecting the Decision to Use Cemented or Screw-Retained Fixed Implant-Supported Prostheses: A Critical Review

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Purpose: This review aimed to compile and enumerate all the factors described in the literature that may affect the decision to use either cemented or screw-retained restorations and to determine the relative weights of each factor by type of retention and prosthesis. ***Materials and Methods:*** The literature was reviewed, and the factors were classified as either determining (present in a clinical situation in which one of the retention mechanisms was clearly more suitable than the other) or conditioning (present in clinical situations in which one type of restoration was not clearly more advantageous than the other). ***Results:*** Three determining factors (esthetic outcome, retention, and biologic risk) and five conditioning factors (passive fit, fracture strength, occlusal area, complications, and retrievability) were identified. ***Conclusion:*** Although there is not a clearly better alternative for all clinical situations, determining factors in certain scenarios can render one of the two approaches more recommendable. For esthetic reasons, when the implant angle cannot be corrected to conceal the access hole, cementation is more suitable; however, screw retention is the better option when the occlusal space is under 6 mm or margins cannot be located supra- or equigingivally. In the absence of determining factors, the decision should be based on conditioning factors, which carry different weights depending on the type of prosthesis. *Int J Prosthodont 2018;31:43–54. doi: 10.11607/ijp.5279*

The two main systems for installing an implant-supported fixed dental prosthesis (FDP) are cementation and screw retention. Although all FDPs were initially retained with screws, they began to be secured to abutments with the cements used in tooth-supported restorations around 20 years after the discovery of osseointegration.[1–4] These two approaches to retention have been compared in a number of in vitro and in vivo studies, although no clear consensus has been reached on when one or the other should be used. Most of the articles and reviews addressing the issue conclude that neither mechanism is obviously better than the other.[5–13]

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Nonetheless, given the specific characteristics of each type of prosthesis, as well as the presence of an access hole in screw-retained restorations and the need for cement in cement-retained restorations, each has its own advantages and drawbacks. The absence of an access hole in cemented systems affords a more uniform surface, which is structurally stronger and obviates the need for restoration material to cover the hole. Moreover, the space provided for the dental cement may contribute to a more satisfactory passive fit. For advocates of screw-retained prostheses, the most prominent advantages include the absence of excess cement (and hence the need for its removal) and easy retrievability, with ready access to the retention screw and its simple removal when necessary for hygiene reasons or to treat complications.

As the advantages and disadvantages of each approach make it more or less suitable depending on the circumstances, attempting to determine which is the most universally appropriate option would appear to be a futile exercise.[14,15] As pointed out in several reviews,[5,7] although many factors may influence the choice of one retention procedure over another, they do not all carry the same weight in the ultimate decision. Their relative influences depend largely on the prevailing circumstances, which in turn revolve around the type of prosthesis. In other words, not all factors affect the final decision equally, for some are

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An In Vitro Evaluation of Primary Stability Values for Two Differently Designed Implants to Suit Immediate Loading in Very Soft Bone

Dirk Krischik [1], Selen Ergin Tokgöz [2,*], Andreas van Orten [1], Anton Friedmann [3] and Hakan Bilhan [3]

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Abstract: The achievement of sufficient implant stability in poor quality bone seems to be a challenge. Most manufacturers develop special dental implants, which are claimed to show higher stability even in very soft bone. The aim of this experimental study was to compare two recently introduced dental implants with differing thread designs. A total of 11 implants of each group were inserted in the part of the fresh bovine ribs, corresponding to very soft bone. The primary stability was measured with resonance frequency analysis (RFA) and Periotest; the average of two measurements for each method and for each implant was taken and statistical analysis was applied. The highest stability values were obtained with the ICX Active Master implants, followed by the Conelog® Progressive-Line implants placed with the very soft bone protocol. The primary stability values of the Conelog® Progressive-Line implants inserted by the very soft bone protocol and the ICX Active Master implants placed with the standard protocol showed sufficient stability for immediate loading in low-density bone. Within the limitations of this study, the thread design of the implants and underdimensioned implant bed preparation seem to be effective for better primary stability in cancellous bone.

Keywords: primary stability; type 4 bone; thread design; immediate loading; resonance frequency analysis

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1. Introduction

Dental implants have been used as a reliable and successful treatment modality for decades. The indication variety is broad, but the immediate loading has become very popular in the latest years. The maxilla especially presents a real challenge with its very often encountered low density bone. Both the implant's length and diameter, together with the bone quality, have been reported as factors important for primary stability [1]. To comply with this purpose, manufacturers are seeking an implant design capable of achieving high stability values during placement even in a very poor-quality bone. Accounting for the latter, the manufacturers are investing efforts into optimization of the implant design in the sense of enhanced primary stability. Primary stability is obtained by mechanical retention and friction in the bone, which relates to the geometry of the implant besides the surgical skills of the clinician [2,3]. Additionally, the adherence with the drilling protocol seems to play an important role in achieving a congruent implant bed, thus increasing the friction and retention. If an immediate loading is planned, an insertion torque over 30 Ncm and an implant stability quotient (ISQ) exceeding 60 resonance frequency analysis (RFA) units is strongly recommended for obtaining sufficient mechanical stability. The rationale behind is the reported tolerance of the bone to micromovements ranging between 50–150 µm [4]. The micromovements are known to be detrimental to implant

Clinical Evaluation of the Influence of Connection Type and Restoration Height on the Reliability of Zirconia Abutments: A Retrospective Study on 965 Abutments with a Mean 6-Year Follow-Up

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This multicenter retrospective clinical study aimed to evaluate the clinical performance of zirconia abutments in anterior and posterior regions, focusing on implant-abutment connections and restoration vertical height (RVH). Six experienced prosthodontists used 965 computer-aided design/computer-assisted manufacture zirconia abutments in 601 patients. Different surgical approaches were taken according to the needs of each patient. The final restorations were all-ceramic single crowns and short-span fixed dental prostheses. Screw-retained restorations were mainly used in anterior areas, whereas cemented prostheses were chosen in cases where the implant position was not ideal. Different types of implant-abutment connections were compared: external, internal with metal components, and internal full-zirconia conical connection. All the restorations were followed up for 4 to 10 years. Technical and biologic complications were assessed in relation to several biomechanical variables, such as RVH. Differences between groups were statistically analyzed, and longevity of abutments was evaluated according to Kaplan-Meier survival analysis. Zirconia abutments resulted in overall survival and success rates of 98.9% and 94.8%, respectively. External connections reported survival and success rates of 99.7% and 94.5%, internal metal connections 99.8% and 95.5%, and internal zirconia connections 93.1% and 93.1%, respectively. Overall complication rates of 1.14%, 3.42%, and 0.62% were reported for fractures, chipping, and unscrewing, respectively. The external connection showed the longest survival while the internal zirconia connection showed the highest fracture incidence over the observation period. The clinical risk limit of RVH was identified as 14 mm. Zirconia abutments showed satisfactory clinical performance in anterior and posterior regions after 4 to 10 years. RVH and connection type influenced the clinical longevity of restorations; in particular, internal connections with secondary metallic components reduced the incidence of complications. Int J Periodontics Restorative Dent 2016;36:19–31. doi: 10.11607/prd.2974

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Due to increasing patient demand for esthetics and the development of computer-aided design/computer-assisted manufacture (CAD/CAM) technologies, the use of zirconia as a dental material has increased significantly in recent decades.[1–6] Yttrium partially stabilized tetragonal zirconia polycrystal (3Y-TZP) exhibits superior mechanical properties compared with other ceramics and is considered the strongest and most commonly used zirconia-based ceramic.[1–5,7–10] Such properties, together with the esthetic advantages due to its white color and reduced soft tissue discoloration, led to the introduction of zirconia as an alternative to metal-based prostheses. It was proposed for different types of all-ceramic dental reconstructions, including implant abutments and frameworks in both tooth- and implant-supported fixed prosthodontics.[2,4,5]

High-strength zirconia implant abutments were introduced in clinical practice to overcome the esthetic limitations correlated with titanium abutments, mainly the possible grayish or bluish appearance of peri-implant soft tissues due to the presence of metal components in relation to periodontal biotype and soft tissue thickness (Fig 1).[4,11–13] The use of titanium abutments is widely documented in the literature.[1,4,14–16] In case of soft tissue recession,

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Interim Prosthesis Options for Dental Implants

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Keywords
Dental implant; provisionalization; provisional restoration; interim prosthesis.

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Abstract

Dental implants have become a popular treatment modality for replacing missing teeth. In this regard, the importance of restoring patients with function during the implant healing period has grown in recent decades. Esthetic concerns, especially in the anterior region of the maxilla, should also be considered until the definitive restoration is delivered. Another indication for such restorations is maintenance of the space required for esthetic and functional definitive restorations in cases where the implant site is surrounded by natural teeth. Numerous articles have described different types of interim prostheses and their fabrication techniques. This article aims to briefly discuss all types of implant-related interim prostheses by different classification including provisional timing (before implant placement, after implant placement in unloading and loading periods), materials, and techniques used for making the restorations, the type of interim prosthesis retention, and definitive restoration. Furthermore, the abutment torque for such restorations and methods for transferring the soft tissue from interim to definitive prostheses are addressed.

Dental implants, as a predictable and documented treatment modality, are used for replacing missing teeth. With the increased number of patients and raised level of expectations, both patients and clinicians consider the esthetic outcome, especially in the anterior region of the maxilla. For the sake of social communication, patients need to feel secure both in regard to esthetics and function during the implant treatment period. Interim prostheses are used to restore lost function and esthetics for this purpose.[1,2] Interim prostheses are fabricated to enhance esthetics and function, provide stabilization, and also may act as a reference in designing the definitive prosthesis.[1-3]

Selection between different interim prostheses is dependent on some factors including provisional timing, interocclusal space, longevity, ease of fabrication and modification, ease of removal, esthetic demands, and economic considerations.[4] Interim prostheses have several advantages, including serving as a diagnostic tool, helping evaluation of peri-implant soft tissue, evaluation of neighboring teeth, and evaluation of the patient's oral hygiene. They also are helpful for patient management (esthetic, phonetic, psychological), communication between patient, prosthodontist, and technician, determination for implant site development, healing of the soft tissue around the implants, potentially loading the implants, improving tissue contours related to emergence profile, and developing of an interdental or inter-implant papillae, and therefore potential avoidance of a third surgical procedure.[5-7] This review summarizes the literature on the provisionalization of dental implants and identifies deficiencies suggesting future research. A general classification of implant interim prostheses based on different subjects is presented in Figure 1.

Provisional timing

The type of interim prosthesis should be determined during the presurgical treatment planning phase by the dental team.[5] Interim prostheses can be categorized in three treatment sections: before placing the implant, after placing the implant in unloading time, and after placing the implant in loading time.

Before placing the implant

Usually, an 8- to 16-week healing period following tooth extraction allows predictable results for implant placement.[8,9] However, in case of bone grafting and reconstructive procedures, usually a 4- to 8-month healing period is expected.[10,11] It is undesirable for patients to live without teeth during this phase. Therefore, an interim prosthesis that would not exert undesirable pressure upon the grafting sites is beneficial.[4] An acrylic resin removable partial denture (RPD) may create problems such as inadequate stability and comfort, in addition to unfavorable distribution of stresses to the supporting tissues.[12] Therefore, interim prostheses fixed to the adjacent teeth, such as bonded interim prostheses (Maryland fixed partial denture [FPD], fiber-reinforced composite, polyethylene ribbon), can

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Case Report

Presurgical Cone Beam Computed Tomography Bone Quality Evaluation for Predictable Immediate Implant Placement and Restoration in Esthetic Zone

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Despite numerous advantages over multislice computed tomography (MSCT), including a lower radiation dose to the patient, shorter acquisition times, affordable cost, and sometimes greater detail with isotropic voxels used in reconstruction, allowing precise measurements, cone beam computed tomography (CBCT) is still controversial regarding bone quality evaluation. This paper presents a brief review of the literature on accuracy and reliability of bone quality assessment with CBCT and a case report with step-by-step predictable treatment planning in esthetic zone, based on CBCT scans which enabled the clinician to evaluate, depending on bone volume and quality, whether immediate restoration with CAD-CAM manufactured temporary crown and flapless surgery may be a treatment option.

1. Introduction

Nowadays, cone beam computed tomography (CBCT) systems replaced multislice computed tomography (MSCT) for dental treatment and planning due to many advantages offered, including a lower radiation dose to the patient, shorter acquisition times [1, 2], affordable cost, better resolution, and sometimes greater details [3, 4]. CBCT uses isotropic voxels and, as a result, measurements are precise and considered 1 : 1; therefore study models and 3D printing or milling surgical templates can be fabricated with great accuracy [5]. Despite these preference factors, the reliability, consistency, and accuracy of CT numbers derived from CBCT imaging systems in bone quality evaluation remain controversial [6]. Therefore gray values resulting from the CBCT scan are referred to as voxel values (VVs) and not HU. The imprecision of the intensity values of CBCT systems is commonly attributed to differences in characteristics of the devices (kVp, mA, exposure time), the imaging parameters (voxel size), and the position or field of view (FOV) of the area being evaluated [7, 8].

Several studies [6–9] performed on homogenous phantoms and nonhomogenous materials (similar to human tissues) using different CBCT scanners demonstrated linear correlation between CBCT gray scale and HU.

Other studies [10–13] focused on investigating the relation between bone characteristics obtained from CBCT scan and primary stability of the implants found a direct correlation between VVs, insertion torque value (ITV), and implant stability quotient (ISQ).

Moreover, González-García and Monje [14] were the first authors to report that a strong positive correlation was present between radiological bone density (RBD) assessed by CBCT and bone density assessed by micro-CT (considered "gold-standard" for evaluating bone morphology) at the site of dental implants in the native maxillary bones. They also stated that preoperative estimation of density values by CBCT was a reliable tool to objectively determine bone density.

Based on the previous experience by González-García [14], his group also supported later the use of CBCT as preoperative tool for implant treatment planning because it

Immediate Loading of Single Implants, Guided Surgery, and Intraoral Scanning: A Nonrandomized Study

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Purpose: To compare clinical and esthetic outcomes between immediately loaded single implants placed with and without a fully guided surgical procedure. ***Materials and Methods:*** Patients with a missing maxillary tooth (second premolar to second premolar) were considered for inclusion in this 1-year prospective nonrandomized study. Exclusion criteria were general health contraindications for oral surgery besides the need for bone grafting or ridge augmentation. One group received digital implant planning, fully guided surgery, and immediate loading (DIL). The other group received freehand surgery and immediate loading (IL). Outcome measures were implant survival, marginal bone loss, soft tissue changes, papilla index, pink and white esthetic scores (PES and WES, respectively), and patient-reported outcome measures (PROMs). ***Results:*** Two of 21 implants failed in the DIL group soon after placement, resulting in a 1-year implant survival rate of 90.5%, while no implants failed in the IL group. Significantly higher papilla index scores and lower soft tissue changes were found for the DIL group compared to the IL group. No differences were found after 1 year regarding marginal bone loss, PES, WES, or PROMs. ***Conclusion:*** Within the limitations of this study, immediate loading in combination with fully guided surgery might negatively affect implant survival. Immediate loading, fully guided surgery, and a digital workflow appear to have a positive effect on early soft tissue adaptation. *Int J Prosthodont 2020;33:513–522. doi: 10.11607/ijp.6701*

Clinicians must take many factors into consideration before proposing a restorative treatment for the loss of a single anterior tooth. Demands from the patient can be high concerning treatment procedure and expected outcome. There are many clinical factors that affect the treatment outcome, and several techniques for improving the success of dental implant treatment have been proposed.[1–5] To evaluate dental implant treatment, the traditional criteria for success proposed by Albrektsson et al[6] and Albrektsson and Zarb[7] are still commonly used in addition to several other criteria for assessing the esthetic outcomes of single-implant restorations.[8–12] A good esthetic outcome and stable marginal bone levels alone do not always guarantee a successful treatment outcome, so implant treatment is further evaluated with patient-reported outcome measures (PROMs) and oral health–related quality of life (OHRQoL). A systematic review has revealed a lack of references with respect to patient satisfaction of single-tooth implants in the esthetic zone.[13]

Treatment time, pain, prognosis, function, economy, and esthetic outcomes are some concerns that can be raised by the patient when implant treatment is considered. Immediate placement and immediate loading may have an effect on these factors

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Original Article

Esthetic Outcomes after Immediate and Late Implant Loading for a Single Missing Tooth in the Anterior Maxilla

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ABSTRACT

Objective: This study compared the esthetic outcomes of 1-year follow-up of immediate and late implant loading after implant restoration of a single tooth in the anterior maxilla. **Materials and Methods:** A total of 33 patients with missing teeth in the anterior maxilla (Central = 8/lateral = 22/canine = 3) were enrolled in this study (18 immediate loading and 15 late loading). At after cementation, 1, 3, 6, and 12 months photographs were taken of anterior maxilla. The photographs were assessed using pink esthetic score (PES) which consists of seven variables. All PES data were analyzed with independent sample *t*-tests and repeated measures ANOVAs. **Results:** PES values increased significantly in both groups at the 1-year follow-up ($P > 0.05$). There was no statistically significant difference between the immediate and late loading groups at any time point ($P > 0.05$). **Conclusions:** Within the limitation of this study, immediate loading did not have a negative effect on esthetics.

KEYWORDS: *Esthetic success, loading protocols, pink esthetic score*

INTRODUCTION

Considering only the survival rate is not sufficient to assess the success of the anterior implants. Osseointegration of an implant does not always result in aesthetic success.[1] For esthetic success, the peri-implant soft tissue should be compatible with the adjacent soft tissue and implant-supported crowns must be in equilibrium with the opposite dentition. In the anterior maxilla, unsuccessful treatment outcomes can lead to disastrous clinical situations that can only be corrected by removal of the implant and a subsequent tissue augmentation procedure.[2,3]

Smith and Zarb studied optimal esthetic outcomes for successful implant treatment in the anterior maxilla.[2] In 2005, the "pink esthetic score" (PES) was proposed by Fürhauser *et al*. focusing on the soft-tissue aspects of anterior implants.[3] Successful implant dentistry should include an assessment of the long-term outcome of the entire implant-prosthetic and soft tissue complex.[4,5] Fürhauser *et al*. recommended PES as a suitable technique for evaluating soft tissue around single-tooth implant crowns that might change over time and as a useful tool for monitoring long-term soft tissue alterations.[3]

Regarding the anterior maxilla, patients expect to be rehabilitated as soon as possible, especially patients undergoing esthetic restorations. After implant insertion, fabrication of the temporary restoration and loading of the implant within 48 h is referred to as "immediate loading." This approach shortens the total treatment time, requires fewer surgical interventions and temporary prostheses, reduces peri-implant crestal bone loss, leads to better soft tissue healing, and can improve the esthetics. Moreover, the stability of peri-implant soft tissue is also of paramount importance within the anterior maxilla.[6,7]

In this study, we compared PES outcomes at the 1-year follow-up of immediate and late implant loading after

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ORIGINAL ARTICLE

WILEY

Labial soft tissue contour dynamics following immediate implants and immediate provisionalization of single maxillary incisors: A 1-year prospective study

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Abstract

Background: Soft tissue dynamics in the esthetic zone are gaining increasing attention in recent years. Emerging intraoral scanning technology allows easier capture of soft tissue contours.

Purpose: To quantitatively assess the time-dependent contour alterations of labial soft tissue following single immediate implants and immediate provisionalization (IIPP) in maxillary incisors via intraoral scanning.

Materials and Methods: This was a prospective cohort study. Thirty eligible consecutive patients were included and received immediate replacement of a failure maxillary single incisor. A screw-retained immediate restoration was delivered for each patient. Subsequently, the anterior maxillary region was scanned by an intraoral scanning system at four time points: preoperation (baseline, BL), 3 months (3 m), 6 months (6 m), and 12 months (12 m). The Standard Tessellation Language files were exported to a dedicated software and superimposed for visual analysis. At 3, 6, and 12 months, the mid-facial mucosa level (ML) was assessed, and the precise three-dimensional (3D) configuration of the altered volume was calculated and reconstructed for visual analysis. Furthermore, quantitative analysis of the reconstructed morphology was performed using the following parameters: mean change in thickness ($\triangle d$), mesiodistal width (w), coronal-apical height (h), and horizontal and vertical position of the thickest point represented by coordinates (x, z).

Result: Twenty-seven of thirty enrolled patients were finally available for analysis at the 1-year follow-up. In general, the frontal view of the reconstructed volume exhibited a crescent shape. The mid-facial ML change at 3, 6, and 12 months was −0.05 ± 0.36 mm, −0.03 ± 0.32 mm, and −0.24 ± 0.37 mm, respectively (P = .012). The mean change in thickness at 3 months ($\triangle d_{3m}$), 6 months ($\triangle d_{6m}$), and 12 months ($\triangle d_{12m}$) was 0.50 ± 0.19 mm, 0.59 ± 0.21 mm, and 0.62 ± 0.22 mm, respectively (P <.001). At 12 months, nine patients had a $\triangle d$ less than 0.5 mm. The mean $\triangle d_{3\,m}/\triangle d_{12\,m}$ and $\triangle d_{6\,m}/\triangle d_{12\,m}$ was 0.81 ± 0.17 and 0.96 ± 0.13. The w, h, x, and z results showed no significant differences during the 1-year observation (P = .126, P = .324,

Jiehua Tian and Donghao Wei authors contributed to the work equally and should be regarded as co-first authors.

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REVIEW ARTICLE

WILEY CLINICAL ORAL IMPLANTS RESEARCH

Papilla height in relation to the distance between bone crest and interproximal contact point at single-tooth implants: A systematic review

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Abstract

Objectives: The aim of this systematic review was to investigate the tooth–implant papilla formation in correlation with the distance between the interproximal bone level and the prosthetic contact point.

Material and Methods: A comprehensive search of the current literature (01/01/2000–01/01/2017) was performed to identify human trials that included 10 patients or more, with at least 12 months follow-up, in need of the replacement of one single tooth in the anterior maxillary region with an implant-supported single crown. To meet the inclusion criteria, studies had to provide both radiographic and clinical data regarding the distance between the interproximal bone level and the prosthetic contact point.

Results: The search yielded 136 records. After evaluation of abstracts and full texts, 12 papers were included in the final review, even though various reference points, for the comparison between the vertical distance and the papilla height, were used. The vertical distance between the interproximal bone level and prosthetic contact point ranged between 2 and 11 mm, and the partial or complete papilla fill (Jemt's score 2–3) ranged between 56.5% and 100% of cases.

Conclusion: There is limited evidence that the vertical distance from the base of the interproximal contact point to the crestal bone level seems to affect the interproximal papilla height; that is, the lower is the distance the higher is the percentage of papilla fill. Complete embrasure fill between an implant restoration and the adjacent tooth seems to be correlated with the integrity of the periodontal ligament of the tooth. To reduce the risk of aesthetic failures, interproximal probing on the adjacent teeth should be encouraged before implant placement.

KEYWORDS
dental implants, aesthetics, interdental papilla, interproximal soft tissue, papillae

1 | INTRODUCTION

Aesthetics has become, in the last decade, a key issue in contemporary implant dentistry (Buser, Chappuis, Belser, & Chen, 2017). One of the greatest challenges facing clinicians is to obtain an ideal soft tissue integration that mimics a perfect gingival contour, particularly in the interproximal area. In the early 90's, Tarnow, Magner, and Fletcher (1992) investigated the effect of the distance from the contact point to the crest of bone on the presence of the interproximal dental papilla and found out that when the measurement from the contact point to the

IMMEDIATE RESTORATION OF A SINGLE UPPER CENTRAL INTEGRATING DIGITAL WORKFLOW AND A NOVEL DENTAL IMPLANT: A CASE REPORT.

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The aim of this study is to report the integrated digital workflow with a novel dental implant to rehabilitate a single tooth in a high value aesthetic zone. A 50-year-old man asked to rehabilitate tooth 1.1. The use of an integrated digital workflow in combination with computer guided surgery allow the clinician to visualize all patient's information when planning the rehabilitation in order to obtain a more predictable and a less invasive surgery. After two months of follow-up there were no biological or prosthetic issues. Within the limitation of this study, the digital workflow to rehabilitate a high value aesthetic zone could improve predictability and accuracy in immediate loading restoration.

The current standard of care for oral rehabilitation by means of dental implants is no longer only the replacement of missing teeth in terms of function, but also the achievement of satisfactory aesthetic (1). Nowadays, the possibility to collect and to merge all patients' data in several implant-planning softwires led to a more predictable and more precise implant-supported rehabilitation. The use of cone beam computed tomography (CBCT) allows volumetric bone imaging with lower radiation doses (2) facilitating the preoperative acquisition such as the available bone volume and quality, the presence and location of relevant anatomical structures and pathologies, and their relationship with future rehabilitation.

The Smiling Scan technique allows the successful creation of a virtual dental patient (VDP) showing a broad smile under static conditions to obtain a 3D rendering of patient's face (3). The clinician has the possibility to superimpose the digital imaging and communications in medicine (DICOM) file to the standard tessellation language (STL) files (4). The STL files are generated using the digital impression technique by means of an Intraoral Optical Scanner (IOS) (5). As a result, a VDP is generated and the clinician has the possibility to plan properly a Computer-Aided Design/Computer-Assisted Manufacturing (CAD/CAM) implant-supported rehabilitation following a validated prosthetic project (6). Once surgical and prosthetic planning are validated, a custom-made surgical template with sleeves used in combination with a guided drill stop kit to guide the surgeon through the implant positioning is made (7).

Often mucoperiosteal flaps are adopted by surgeons when operating freehand to visualize the recipient site more clearly. This is not always necessary if computer-guided implant placement is

Key words: digital workflow, immediate loading, Straumann BLX, CAD/CAM, guided surgery

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ORIGINAL RESEARCH

WILEY CLINICAL ORAL IMPLANTS RESEARCH

Immediate placement and provisionalization of implants in the aesthetic zone with or without a connective tissue graft: A 1-year randomized controlled trial and volumetric study

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Abstract

Objective: To volumetrically compare peri-implant mid-facial soft tissue changes in immediately placed and provisionalized implants in the aesthetic zone, with or without a connective tissue graft.

Material and methods: Sixty patients were included. All implants were placed immediately after extraction. After randomization, in one group, a connective tissue graft (test group, n = 30) was inserted at the buccal aspect of the implant. The other group (control group, n = 30) received no connective tissue graft. Clinical parameters, digital photographs and conventional impressions were obtained before extraction (T_{pre}) and at 12 months following definitive crown placement (T_{12}). The casts were digitized by a laboratory scanner, and a volumetric analysis was performed between T_{pre} and T_{12}.

Results: Twenty-five patients in each group were available for analysis at T_{12}. Volumetric change, transformed to a mean (±*SD*) change in thickness, was −0.68 ± 0.59 mm (test) and −0.49 ± 0.54 mm (control) with a non-significant difference between groups (p = .189). The mid-facial mucosa level was significantly different between both groups (p = .014), with a mean (±*SD*) change of +0.20 ± 0.70 mm (test) and −0.48 ± 1.13 mm (control). The Pink Esthetic Score was similar between both groups.

Conclusions: The use of a CTG in immediately placed and provisionalized implants in the aesthetic zone did not result in less mucosal volume loss after 12 months, leading to the assumption that a CTG cannot fully compensate for the underlying facial bone loss, although a significantly more coronally located mid-facial mucosa level was found when a CTG was performed.

KEYWORDS
aesthetic zone, immediate placement, soft tissue graft, volumetric changes

1 | INTRODUCTION

Different clinical protocols exist to replace a failing tooth in the aesthetic zone by implant therapy (Hämmerle, Chen, & Wilson, 2004). In type 1, implants may be placed immediately after extraction of the failing tooth and be provisionalized within 24 hr. Apart from a reduced treatment time, immediate implant placement and provisionalization (IIPP) is considered a predictable treatment option in

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SYSTEMATIC REVIEW

Immediate versus early loading of single dental implants: A systematic review and meta-analysis

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ABSTRACT

Statement of problem. Patients prefer to be rehabilitated as soon as possible if the risk of implant failure is not increased. However, whether immediate loading of single implants is riskier than early loading is not clear.

Purpose. This systematic review and meta-analysis investigated whether the immediate loading protocol has more clinical disadvantages than the early loading protocol for single dental implants in terms of the marginal bone loss and survival rate of single implant crowns.

Material and methods. Two reviewers conducted an advanced electronic database search, with no language or date restriction, in Medline/PubMed, Embase, and the Cochrane Library up to May 2016. Studies were chosen by title and abstract for screening in accordance with the following inclusion criteria: dental implants studies; cohort studies (prospective and retrospective) and randomized controlled trials; samples involving partially edentulous patients; immediate loading implants; early loading implants; and n≥10 participants.

Results. Of the 5710 studies initially identified, 5 fulfilled the inclusion criteria. A meta-analysis yielding risk differences (RD) and mean differences (MD) with a 95% confidence interval (CI) was performed. The trials included showed no significant differences between early and immediate loading protocols in single implant crowns with regard to survival rate at 1 and 3 years (RD, −0.00; 95% CI, −0.04 to 0.04; *P*=.990 for 1 year and *P*=.980 for 3 years) or marginal bone loss at 1 year (MD, 0.09; 95% CI, −0.02 to 0.19; *P*=.110) and 3 years (MD, −0.23; 95% CI, −0.47 to 0.01; *P*=.060).

Conclusions. This systematic review showed no significant differences between early and immediate loading protocols in single implant crowns with regard to survival rate or marginal bone loss at 1 or 3 years. (J Prosthet Dent 2018;■:■-■)

Since 1990, implants placed in completely edentulous mandibles have been loaded immediately[1-9] or early[10-12] in selected patients.[13] For single implant-supported crowns, similar success rates have been reported for both protocols and for conventional loading protocol,[14-19] especially when implants are placed with adequate length and with insertion torques greater than 32 Ncm.[20,21] These protocols have also become widely accepted after the introduction of a chemically modified titanium surface topography.[22,23] Despite this, little is known about the differences between survival rates and marginal bone loss in these 2 loading protocols in single implant crowns.

A prospective cohort trial with early loaded single implants determined a marginal bone loss of 0.42 mm and a survival rate of 94.44% after 3 years for maxillary anterior teeth.[24] Similar results were stated by a prospective clinical trial with a marginal bone loss of 0.97 mm and a survival rate of 94% for early loaded single maxillary implants.[25] Both studies concluded that an early loading protocol was safe and predictable for patients.[25] Another retrospective study[26] of single implants, anterior and premolar maxillary crowns, loaded immediately reported a marginal bone loss of 0.33 mm (mesially) and 0.28 mm (distally) and a survival rate of 86.4% after 2.5 years.

A systematic review that compared loading protocols for single implant crowns[27] found only 1 study comparing early and immediate loading, with 17

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Case Report

Immediate Dental Implants Enriched with L-PRF in the Esthetic Zone

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The aim of this article is to present the clinical application of immediate implant placement with L-PRF and immediate prosthetic loading in anterior esthetic region. A 24-year-old healthy female patient reported with a chief complaint of poor esthetics in the upper front tooth region with retained deciduous teeth. On oral examination, there were retained deciduous teeth (52, 53, and 63) with congenitally missing permanent successors. The retained deciduous teeth were extracted, and immediate implant placement was done in the extraction sockets along with L-PRF membranes in one surgical session under local anesthesia. Immediate temporization was performed with composite crowns on immediately placed dental implants. After 3 months of the healing period, the final implant-level impressions were made and the temporary composite crowns were replaced with the final zirconia porcelain crowns. A 12-month follow-up was made, and satisfactory esthetic and functional results were obtained.

1. Introduction

Retained primary teeth without permanent successors pose a great restorative challenge for the clinicians and cause functional and esthetic problems for patients. Compromised esthetics, shifting of adjacent teeth, altered occlusion, and supraeruptions of teeth are among the problems that can occur when a permanent tooth is congenitally missing. The mandibular second premolars are the most frequent congenitally missing permanent teeth followed in prevalence by the maxillary lateral incisors [1].

While various treatment approaches for congenitally missing teeth have been proposed, outcome data pertaining to these treatment options are lacking [2]. Replacement of a missing tooth with a dental implant offers specific advantages over other options for tooth replacement such as removable or fixed dentures [3]. These advantages include preservation of the alveolar crest, elimination of the need to restore adjacent teeth, and improved esthetics and function. By understanding the principles of treatment planning, implant surgery, and implant restoration, a clinician can successfully replace a retained primary tooth with a dental implant providing acceptable form, function, and esthetics to the patient.

Dental implantology has been extensively researched in basic and clinical grounds. In an effort to improve and accelerate healing of both hard and soft tissues in immediate implant placement, substitutes including growth factors and biomaterials have been traditionally employed. Membranes were also introduced to separate tissues. Recent research clearly indicates that L-PRF (leukocyte-platelet-rich fibrin, a second generation of platelet concentrates) significantly enhances wound healing in both soft and hard tissues [4–6].

To achieve better esthetic and functional results in the immediate implant placement technique, the use of L-PRF is beneficial at the osteotomy site. PRF consists of an autologous leukocyte-platelet-rich fibrin matrix composed of a tetra molecular structure, with cytokines, platelets, and stem cells within, which acts as a biodegradable scaffold, and favors the development of microvascularization and is able to guide epithelial cell migration to its surface [7, 8].

Some studies have demonstrated that PRF is a healing biomaterial with a great potential for bone and soft tissue regeneration, without inflammatory reactions, which may

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Periodontology 2000

Current state of the art of computer-guided implant surgery

Jan D'haese, Johan Ackhurst, Daniel Wismeijer, Hugo De Bruyn & Ali Tahmaseb

Historical developments

The era of radiography began at the end of the 19th century when Wilhelm Roentgen discovered X-rays, which eventually resulted in a clinical technique used to evaluate internal anatomic structures in a noninvasive manner. A limitation was that only two-dimensional evaluation of mineralized structures was possible (32, 38). Sir Godfrey Newbold Hounsfield, an English electrical engineer who shared the 1979 Nobel Prize in Medicine with Allan McLeod Cormack, developed a method to acquire radiographs from different directions and/or angles, which could be digitally processed to a three-dimensional depiction (1, 28). This novel technique, originally called computerized axial tomography and later computerized tomography, was approximately 100 times more sensitive than conventional radiography and also allowed for the detection of soft tissues (27). At the end of the 1970s, several authors reported on the combined use of stereotaxic frames and computerized tomography scanning of the human head (7, 60). In addition, interactive software was developed and utilized to guide a probe precisely to a target that had been identified in a series of computerized tomography scans. This enabled treatment, for instance, of deep cerebral abscesses by aspiration after guiding a needle into a labeled cavity (51). In the late 1980s, different research groups developed and utilized several software packages to visualize the human head using computerized tomography images. This allowed the tip of an instrument to be mapped dynamically, in computerized tomography images, to the location corresponding to the point of interest. In 1992, an Ontario-based team used the first surgical navigation unit for neurosurgery (21, 50). This frameless system, called the 'Viewing Wand', was developed as an adjunct to preoperative computerized tomography, magnetic resonance imaging and positron emission tomography, for surgical planning before, and navigation during, the operation. The Viewing Wand represented a milestone in guided surgery as it combined conventional surgical approaches with virtual reality in order to plan the surgical procedure in advance and to use the planned intervention as a guide during the actual surgery. In comparison with stereotaxic surgery, the main advantage of the Viewing Wand technique was that neither constant intra-operative scanning nor the fixation of a cumbersome frame to a patient's head was necessary. The primary clinical benefits of the Viewing Wand were the significantly improved surgical navigation and clinical safety for the patient during the surgical intervention itself (21). Also, the localization and size of the incision, craniotomy and corticotomy, as well as the extent of the surgical resection, benefited from the use of this surgical approach. However, stereotaxic surgery was still needed to localize the source of small, deep-seated, targets in procedures such as thalamotomy and pallidotomy (50). Shortly after the introduction of the so-called frameless stereotaxic surgery, new opportunities were created for this technique as it was discovered that it could be used for anatomic navigation in upper cervical spine surgery (45). In the following 5 years, several companies introduced similar products of surgical navigation and the technology also became applicable for other surgical procedures, such as head neck surgery (25), sinus surgery (12), spinal surgery (45) and arthroscopy (18). The surgical paradigm of exposing the tissues in order to obtain a

PRESERVING SOFT TISSUE AFTER PLACING IMPLANTS IN FRESH EXTRACTION SOCKETS IN THE MAXILLARY ESTHETIC ZONE AND A PROSTHETIC TEMPLATE FOR INTERIM CROWN FABRICATION: A PROSPECTIVE STUDY

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Statement of Problem. The technique of immediate implant placement is said to have success rates similar to those of implantation into a healed socket. An implant-supported restoration in an esthetic area must achieve a harmonious balance of functional, esthetic, and biologic imperatives to be considered effective.

Purpose. The purpose of this clinical study was to assess the height of the interproximal gingival papillae adjacent to immediate implants with immediate loading. The hypothesis was that specific positioning of the proximal contact areas of the interim crowns would facilitate the maintenance or regeneration of the interproximal papilla.

Material and Methods. Twenty-eight participants were provided implants (n=36) in the anterior maxillary area that were loaded with a specifically contoured interim crown immediately after tooth extraction. The proximal contact areas of the interim crowns were positioned 5 to 6 mm incisal to the interproximal bony crest by using a prosthetic template. Papilla height was classified according to a previously described papilla index. A comparison was made between the papilla height before the extraction, at interim crown placement after the implant placement, and at 6 and 12 months postoperatively. Parametric and nonparametric tests were used when appropriate (Kolmogorov-Smirnov). Significance was expressed at the α=.05 level. Cross tables were used to describe the changes in the papilla index score.

Results. During the 1-year follow-up, the score of the distal and mesial papilla indices increased significantly (repeated-measures Friedman exact test; P=.035 and P=.002).

Conclusions. This prospective study indicated that the use of a prosthetic template for positioning an interim crown on immediately placed implants and for ensuring that the proximal contact areas of the crown with adjacent teeth are 5 to 6 mm incisal to the interproximal bony crest does not seem to hinder the maintenance or regeneration of the height of the interproximal papillae. (J Prosthet Dent 2013;■:■-■)

CLINICAL IMPLICATIONS

In immediate implant placement and loading, the use of a radiographically referenced template to ensure specific positioning of contact areas of the interim crowns relative to the interproximal bony crest may facilitate the maintenance and development of esthetic interproximal tissue contours.

Numerous protocols exist regarding the extraction, placement, and loading of dental implants. However, allowing 2 to 3 months of alveolar ridge remodeling after tooth extraction has been considered necessary to facilitate the development of a substantial quantity of relatively mature well-formed bone. After implant placement, a supplementary period of 3 to 6 months of load-free healing has been advocated for predictable implant osseointegration.[1] Although there are benefits for using implants to replace missing teeth, this protocol is time consuming, which may influence the final decision on the type of prosthetic rehabilitation provided to patients.[2] The reduction in the duration of the total procedure by placing an implant immediately into fresh extraction sockets has been described in

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Review

The Effect of Flapless Surgery on Implant Survival and Marginal Bone Level: A Systematic Review and Meta-Analysis

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Background: The clinical outcomes of implants placed using the flapless approach have not yet been systematically investigated. Hence, the present systematic review and meta-analysis aims to study the effect of the flapless technique on implant survival rates (SRs) and marginal bone levels (MBLs) compared with the conventional flap approach.

Methods: An electronic search of five databases (from 1990 to March 2013), including PubMed, Ovid (MEDLINE), EMBASE, Web of Science, and Cochrane Central, and a hand search of peer-reviewed journals for relevant articles were performed. Human clinical trials with data on comparison of SR and changes in MBL between the flapless and conventional flap procedures, with at least five implants in each study group and a follow-up period of at least 6 months, were included.

Results: Twelve studies, including seven randomized controlled trials (RCTs), one cohort study, one pilot study, and three retrospective case-controlled trials (CCTs), were included. The SR of each study was recorded, weighted mean difference (WMD) and confidence interval (CI) were calculated, and meta-analyses were performed for changes in MBL. The average SR is 97.0% (range, 90% to 100%) for the flapless procedure and 98.6% (range, 91.67% to 100%) for the flap procedure. Meta-analysis for the comparison of SR among selected studies presented a similar outcome (risk ratio = 0.99, 95% CI = 0.97 to 1.01, $P = 0.30$) for both interventions. Mean differences of MBL were retrieved from five RCTs and two retrospective CCTs and subsequently pooled into meta-analyses; however, none of the comparisons showed statistical significance. For RCTs, the WMD was 0.07, with a 95% CI of –0.05 to 0.20 ($P = 0.26$). For retrospective CCTs, the WMD was 0.23, with a 95% CI of –0.58 to 1.05 ($P = 0.58$). For the combined analysis, the WMD was 0.03, with a 95% CI of –0.11 to 0.18 ($P = 0.67$). The comparison of SR presented a low to moderate heterogeneity, but MBL presented a considerable heterogeneity among studies.

Conclusion: This systematic review revealed that the SRs and radiographic marginal bone loss of flapless intervention were comparable with the flap surgery approach. *J Periodontol 2014;85:e91-e103.*

KEY WORDS

Dental implants; gingiva; gingival recession; meta-analysis; review; surgical flaps.

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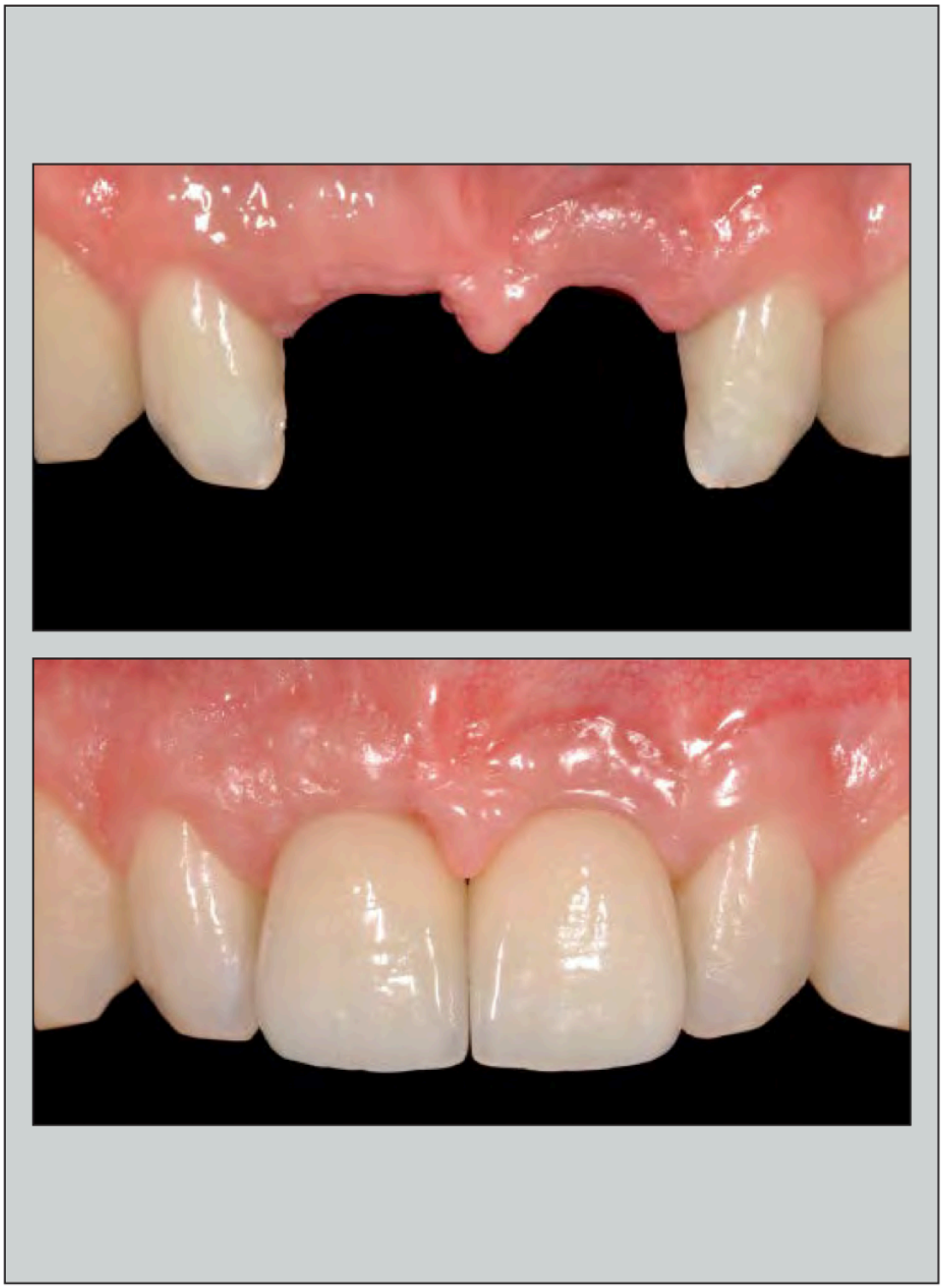

Immediate Restoration of Immediate Implants in the Esthetic Zone of the Maxilla Via the Copy-Abutment Technique: 5-Year Follow-Up of Pink Esthetic Scores

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ABSTRACT

Background: Implant esthetics may benefit from individualized zirconia abutments copying the emergence profile of the natural tooth and delivered within days after immediate implant insertion.

Purpose: To investigate the esthetic outcome of the Copy-Abutment technique using the Pink Esthetic Score (PES).

Materials and Methods: A total of 77 patients with single-tooth implants in the anterior maxilla restored at the day of immediate implant placement using Copy-Abutments and provisional crowns were followed-up after 1 week, 1 month, 4 months, 6 months, 1, 2, 3, 4, and 5 years to assess implant esthetics.

Results: PES ranged between 7 and 14 (median: 13) and improved significantly between the 6 month and 1 year follow-up ($p < .001$), then remained stable up to the fifth year. Significant improvement was seen for the variables PES-6 soft tissue color ($p = .002$) and PES-7 soft tissue texture ($p < .001$) up to the 1 year follow-up, while PES-5 alveolar process deficiency deteriorated ($p = .016$). Mean mucosal recession was 0.26 ± 0.86 mm (range: 0–1.6) after 5 years and not related to gingival biotype.

Conclusion: Copy-Abutments for immediate restoration of implants in the esthetic zone show satisfactory long-term esthetic outcomes.

KEY WORDS: abutments, CAD/CAM technology, fixed implant prosthesis, immediate function, immediate implants, implant-supported crown, long term study, single-tooth implants

INTRODUCTION

From both the surgical as well as the prosthodontic perspective, single-tooth replacement in the esthetic zone of the upper jaw still represents a challenging task.[1] Immediate implant insertion at the time of tooth extraction has been associated with significantly higher patient satisfaction (95%) compared to early (84%) or delayed (80%) implant placement.[2] Besides the reduced number of surgical visits, advantages of a bimodal approach involve less patient morbidity[3] and enhanced maintenance of periimplant soft tissue margin and esthetics.[4] Due to the high esthetic demands in anterior maxilla[5] as well as the patients' disaffection toward removable provisionals[6] immediate fixed restoration of single-tooth implants has gained popularity[7] provided that satisfactory primary implant stability is reached.[8]

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Computer-assisted implant surgery and immediate loading in edentulous ridges with dental fresh extraction sockets. Two years results of a prospective case series study

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Abstract. – INTRODUCTION: The two-stage surgical approach for implant placement first documented in 1977 by Brånemark, represents today the most used protocol for placing implants.

AIM: Aim of this prospective case series study was to compare the clinical and radiological performance of 12 edentulous jaws treated with of a modified prosthetic and surgical protocol for 3D software planning, guided surgery, immediate loading of implants inserted in edentulous jaws and extraction sockets and restored with Cad-Cam Zirconia and titanium full arch frameworks.

PATIENTS AND METHODS: This work was designed as a prospective case series study. Twelve patients have been consecutively rehabilitated with an immediately loaded implant supported fixed full prosthesis. A total of 72 implants, Nobel Replace Tapered Groovy; Nobel Biocare AB, Goteborg, Sweden) 26 of which were inserted in fresh extraction sockets, were inserted. Outcome measures were implants survival, radiographic marginal bone-levels and bone remodeling, soft tissue parameters and complications.

RESULTS: All patients reached 24 months follow-up, and no patients dropped out from the study. The cumulative survival rate was 100%; after 24 months mean marginal bone remodelling value was: 1.35 ± 0.25, mean PPD value was 2.75 ± 0.40 mm and mean BOP value was 3.8% ± 1.8%. Only minor prosthetic complications were recorded.

CONCLUSIONS: These data seem to validate this surgical and prosthetic protocol with valid results when applied in selected cases.

Key Words:
Computer-assisted implantology, Dental implants, Immediate loading, Prosthodontic driven implantology.

Introduction

The two-stage surgical approach for implant placement was first documented by Brånemark[1] in 1977 and today represents the most used protocol for placing implants. Comparable results to the classical two stages approach, have been reported with the one-stage surgical procedure and transmucosal healing of implants[2-4].

Other studies have reported successful dental implants following computer-guided surgery also using the All-on-Four and All-on-Six concepts (NobelGuide, Nobel Biocare)[5-7].

In 2002, the concept of software planning and surgically guided techniques combined with immediate loading was clinically introduced in Leuven, Belgium[8]. These early treatments were limited to the edentulous maxilla and required a full-thickness mucoperiosteal flap. Later, the procedure was refined to include flapless implant placement through virtual planning by producing a stereolithographic surgical template incorporating precision titanium drilling sleeves[9].

The growing interest in minimally invasive surgery, together with the possibility of fitting prostheses with immediate function, have led to the development of software and digital workflows allowing the planning and manufacturing of a surgical guide and provisional prosthesis (fabricated prior to surgery), that can be inserted immediately after the implant surgery step.

Moreover computer-aided implant surgery minimizes positioning error compared to manual or conventional-guided placement[8,10].

The growing need for patients to be rehabilitated with a fixed, implant-supported prosthesis immedi-

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CLINICAL ORAL IMPLANTS RESEARCH

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The influence of customized abutments and custom metal abutments on the presence of the interproximal papilla at implants inserted in single-unit gaps: a 1-year prospective clinical study

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Key words: computer-assisted design, computer-assisted manufacturing, implant abutments, interproximal papilla, outcomes assessment

Abstract

Objectives: To assess and compare the papilla presence mesially and distally to dental implants restored with customized abutments and custom metal abutments in the anterior maxilla.

Material and methods: Thirty-eight patients receiving 38 single-tooth implants, restored with 26 customized abutments and 12 custom metal abutments in the anterior maxillary region were enrolled in this study. The cases where did not existed contact point were excluded. Presence/absence of the interproximal papilla, inter-tooth–implant distance (ITD) and distance from the base of the contact point to dental crest bone of adjacent tooth (CPB) were accessed. Global *P*-values were determined for changes in CPB and papilla score over time ($P < 0.05$).

Results: Thirty-six patients with 36 implants were available for the 12-month follow-up. The abutments and reconstruction survival rate was 100% with no fracture or crown loss. A mean mesial CPB of 5.71 ± 1.54 mm and distal CPB of 4.01 ± 1.73 mm were assessed in the customized abutment group for an overall mean papilla presence of 1.69 ± 0.46. A mean mesial CPB of 5.41 ± 1.31 mm and distal CPB of 4.77 ± 1.21 mm were assessed in the control group for an overall mean papilla presence of 1.08 ± 0.65.

Conclusions: The restoration of single-implants using computer-assisted design/computer-assisted manufacturing abutments appears to help maintaining a regular papillary filling although the variations of the implant positioning or the restoration/teeth relation.

Over recent years, the rehabilitation of partially edentulous patients with dental implants has become a well-established treatment with several restorative treatments alternatives for replacing a missing tooth (Gibbard & Zarb 2002; Lau et al. 2011). These procedures in the aesthetic zone present a complex challenge for the clinicians, due to the difficulty in restore the natural appearing sulcular and papillae anatomy surrounding rehabilitated zones (Priest 2007). There are several studies that report similar success rates for implants rehabilitation in the anterior region compared with those placed in other parts of the jaws (Lindh et al. 1998; Wyatt & Zarb 1998; Noak et al. 1999). The long-term unpredictable stability of the soft tissues is one of the problems of single-tooth implant rehabilitation (Choquet et al. 2001; Kan et al. 2003). In past decades, the presence or absence of papillae between two teeth, a teeth and an implant and between adjacent implants has been a topic widely discussed and important in oral implants rehabilitations. Tarnow et al. (1992, 2000, 2003) related the presence or absence of the interdental papilla to the distance of bone to the contact point between the teeth and between teeth and implants.

Dental implant abutment selection plays also an important role in achieving optimal aesthetic results (Blatz et al. 2009). The

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The use of a prosthetic template to maintain the papilla in the esthetic zone for immediate implant placement by means of a radiographic procedure

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Implant placement in the esthetic zone requires precise preoperative diagnosis and treatment planning combined with excellent clinical skills. One of the most important factors needed to achieve an optimal esthetic outcome, in addition to the 3-dimensional (3-D) positioning of the dental implant, is to maintain or regenerate the interproximal papilla. This article describes a technique to fabricate a template that includes important aspects of rehabilitation in this area. (J Prosthet Dent 2012;108:394-397)

Implant-supported fixed posterior prostheses in partially edentulous patients have become a well-recognized restorative treatment option over the past 20 years.[1] A high success rate has allowed the application of osseointegration principles to be extended to single-tooth edentulism, with similar survival rates and marginal bone stability to those observed in complete and partial edentulism.[2,3] Although this procedure may appear to be more easily performed, the restoration of an anterior tooth, especially a maxillary central incisor, is challenging. A major problem encountered after tooth extraction is the loss of hard and soft tissue.[4]

Immediate dental implant placement has shown several advantages, including reductions in surgical procedures, cost, and length of the edentulism period, when compared with conventional techniques.[5,6] To satisfy esthetic and functional demands, soft tissue contour with an intact papilla and a gingival outline that is harmonious with the gingival silhouette of the adjacent healthy dentition should be established in the final restoration.[7] To be considered successful, an implant-supported restoration in an esthetic area must achieve a harmonious balance between functional, esthetic, and biological imperatives.[8]

Tarnow et al[9] determined the distance from the base of the contact area to the crest of the bone, and the reported results showed that when the distance was 5 mm or less, the papilla was present 100% of the time. This result obtained in natural teeth was confirmed for a single-tooth implant and the adjacent teeth[10] as well as for the interproximal papilla between adjacent implants.[11,12]

The esthetics of the periimplant tissue is dependent upon factors involving the periimplant biotype, the facial bone crest level, including the implant fixture angle and the depth of the implant platform.[13] To prevent incomplete proximal embrasure fill by the papilla, the shape of the proximal contour of the crown is adapted during the provisional phase in relation to the osseous peak, guiding the formation of the papilla. The definitive restoration is only fabricated after complete maturation of the papilla.[14]

A surgical template used in the anterior maxilla to place an implant in a healing or a healed site must be designed with the final position of the implant shoulder according to the diagnostic waxing. It should indicate the facial surface, the final gingival margin position, and the embrasure of the desired restoration.[15]

This article illustrates a simple clinical procedure to apply these findings. The treatment approach described offers a number of advantages, including a less invasive surgical procedure, a shorter course of therapy, correct implant position, and the fabrication of an ideal provisional restoration. This technique also allows for the placement of a provisional restoration that respects the biological width and, consequently, preserves or regenerates the papilla. Figure 1 shows a patient with the maxillary central incisors to be extracted as an example of how this technique may be applied. The technique is summarized in 3 phases.

TECHNIQUE

Radiographic template fabrication and radiographs

1. Fabricate diagnostic casts (Vel-Mix Die Stone; Kerr Corporation, Orange, Calif).

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PRESERVING SOFT TISSUE AFTER PLACING IMPLANTS IN FRESH EXTRACTION SOCKETS IN THE MAXILLARY ESTHETIC ZONE AND A PROSTHETIC TEMPLATE FOR INTERIM CROWN FABRICATION: A PROSPECTIVE STUDY

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Statement of Problem. The technique of immediate implant placement is said to have success rates similar to those of implantation into a healed socket. An implant-supported restoration in an esthetic area must achieve a harmonious balance of functional, esthetic, and biologic imperatives to be considered effective.

Purpose. The purpose of this clinical study was to assess the height of the interproximal gingival papillae adjacent to immediate implants with immediate loading. The hypothesis was that specific positioning of the proximal contact areas of the interim crowns would facilitate the maintenance or regeneration of the interproximal papilla.

Material and Methods. Twenty-eight participants were provided implants (n=36) in the anterior maxillary area that were loaded with a specifically contoured interim crown immediately after tooth extraction. The proximal contact areas of the interim crowns were positioned 5 to 6 mm incisal to the interproximal bony crest by using a prosthetic template. Papilla height was classified according to a previously described papilla index. A comparison was made between the papilla height before the extraction, at interim crown placement after the implant placement, and at 6 and 12 months postoperatively. Parametric and nonparametric tests were used when appropriate (Kolmogorov-Smirnov). Significance was expressed at the α=.05 level. Cross tables were used to describe the changes in the papilla index score.

Results. During the 1-year follow-up, the score of the distal and mesial papilla indices increased significantly (repeated-measures Friedman exact test; P=.035 and P=.002).

Conclusions. This prospective study indicated that the use of a prosthetic template for positioning an interim crown on immediately placed implants and for ensuring that the proximal contact areas of the crown with adjacent teeth are 5 to 6 mm incisal to the interproximal bony crest does not seem to hinder the maintenance or regeneration of the height of the interproximal papillae. (J Prosthet Dent 2013;■:■-■)

CLINICAL IMPLICATIONS

In immediate implant placement and loading, the use of a radiographically referenced template to ensure specific positioning of contact areas of the interim crowns relative to the interproximal bony crest may facilitate the maintenance and development of esthetic interproximal tissue contours.

Numerous protocols exist regarding the extraction, placement, and loading of dental implants. However, allowing 2 to 3 months of alveolar ridge remodeling after tooth extraction has been considered necessary to facilitate the development of a substantial quantity of relatively mature well-formed bone. After implant placement, a supplementary period of 3 to 6 months of load-free healing has been advocated for predictable implant osseointegration.[1] Although there are benefits for using implants to replace missing teeth, this protocol is time consuming, which may influence the final decision on the type of prosthetic rehabilitation provided to patients.[2] The reduction in the duration of the total procedure by placing an implant immediately into fresh extraction sockets has been described in

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A randomized trial on the aesthetic outcomes of implant-supported restorations with zirconia or titanium abutments

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Carrillo de Albornoz A, Vignoletti F, Ferrantino L, Cárdenas E, De Sanctis M, Sanz M. A randomized trial on the aesthetic outcomes of implant-supported restorations with zirconia or titanium abutments. J Clin Periodontol 2014; doi: 10.1111/jcpe.12312.

Abstract

Aim: To evaluate the aesthetic outcomes of zirconia *versus* titanium abutments for single tooth implant-supported crowns in the anterior maxilla.

Material & Methods: A parallel, double blind clinical trial was conducted at the Complutense University (Madrid), where 38 patients were recruited. After random allocation (via computer-generated permuted blocks), either zirconia (test) or titanium (control) abutments were placed. Intra- and inter-group differences in aesthetic (main outcome), clinical, radiographical, and patient-centred outcomes were evaluated at baseline (crown placement) and at 1-year follow-up.

Results: At 1 year, 25 of the 30 randomized patients were analysed (11 test and 14 control). Using the Implant Crown Aesthetic Index (ICAI), the scoring at baseline and 1-year were 7.9 and 7.6 for the test group and 10.6 and 11.3 for the control group, respectively. These differences were not statistically significant (sample size non-contrasted). Patient satisfaction was similarly high in both groups (visual analogue scale 8.5). Furthermore, no differences were observed in the clinical or radiographical outcomes. Two abutment fractures were registered in the test group.

Conclusions: The use of zirconia abutments demonstrated a tendency towards better aesthetic outcomes although the differences were not statistically significant. However, more technical complications were noted with the use of zirconia abutments.

Key words: aesthetic outcomes; implant abutment; mucosal recession; single tooth implants; titanium abutment; zirconia abutment

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Conflict of interest and source of funding statement

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Dental implants have become the first choice of therapy for restoring single missing teeth due to their high predictability (1.12% failure rate after 10 years) (Pjetursson et al. 2012) and lesser invasiveness of biological tooth structure. A successful single tooth restoration in the anterior maxilla is not only dependent on survival but also on the aesthetic outcomes (Tymstra et al. 2011). This is relevant if we mainly consider the judgement of patients (Dierens et al. 2013). Therefore, the success of implant therapy will be dependent on how closely the restoration mimics the natural dentition and merges with the soft tissues (Lang & Zitzmann 2012). The appearance of the soft tissues has thus become an important component of the outcome of the restoration, requiring not only an adequate shape and surface characteristic but also a colour that mimics the adjacent tissues (Furhauser et al. 2005). The ideal

Evaluation of Soft Tissues Around Single Tooth Implants in the Anterior Maxilla Restored With Cemented and Screw-Retained Crowns

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Implant-supported restorations can be attached as screw-retained or cemented prostheses. In both situations, the characteristics of the soft tissues around the implants are crucial for oral rehabilitation and patient satisfaction. Therefore, this study uses the Pink Esthetic Score (PES), which allows evaluation of gingival esthetics around implants, to evaluate the soft tissues around implants in the anterior maxilla rehabilitated with cemented prostheses (CP) and screw-retained prostheses (SP). Forty implants placed in the anterior maxilla were evaluated, and these had been rehabilitated with prosthetic crowns for a minimum of 1 year. Periodontal examination was performed to evaluate probing depth (PD) and bleeding on probing (BOP) of the implant and the corresponding natural tooth. The total mean (±SD) PES for SP was 10.73 (±1.98) and 10.41 (±2.67) for CP, which was not statistically significant ($P \geq .05$). Periodontal examination revealed that CP and SP showed no difference for BOP ($P \geq .05$). Differences were only detected in PD when comparing the reference teeth of both groups to CP and SP ($P \leq .05$). The present study demonstrates that the PES proved to be an efficient index to assess peri-implant tissues, and that the type of crown retention does not influence the health and quality of the soft tissues around implants.

Key Words: implants, prosthesis, screw retention, cement retention, esthetics

INTRODUCTION

Implant-supported restorations can be attached as screw-retained or cemented prostheses, according to the type of retention. Screw retention was developed in response to the need for prosthesis retrievability, which can be obtained with this attachment. This innovation was essential given the high rates of complications in the early development of implant dentistry, when removal of the prosthesis was often required for repair or replacement.[1] Currently, many implant systems use abutments retained by screws, and the prosthesis can be cemented on these abutments using techniques that mimic the procedures used to prepare conventional fixed prostheses on natural teeth.[2] The selection of the type of prosthesis to be used may influence the esthetic result.[1] Ideally, implant-supported prostheses should mimic a natural tooth[3]; therefore, the quality of the peri-implant soft tissues plays a decisive role.[4]

The success of dental implants based on the classic criterion of Albrektsson et al[5] considered implants to be successful if they osseointegrated and were functional after loading. Later, Smith and Zarb[6] added the possibility of placing a prosthesis with good esthetic result to the definition of a successful implant. This fact was taken into consideration in the assessment of esthetically sensitive

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CLINICAL ORAL IMPLANTS RESEARCH

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Cemented and screw-retained implant reconstructions: a systematic review of the survival and complication rates

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Conflicts of interest:
Dr Irena Sailer has a consultancy agreement with VITA and research collaborations with 3M ESPE, Straumann, Astra, Ivoclar, DeguDent, Sirona. The remaining authors have no potential conflicts to declare.

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Key words: biological complications, bridges, cemented, complication rates, failures, fixed, fixed dental prostheses, full-arch, implant reconstruction, screw-retained, single crowns, survival, systematic review, technical complications

Abstract

Objectives: To assess the 5-year survival rates and incidences of complications of cemented and screw-retained implant reconstructions.

Methods: An electronic Medline search complemented by manual searching was conducted to identify randomized controlled clinical trials (RCTs), and prospective and retrospective studies giving information on cemented and screw-retained single-unit and multiple-unit implant reconstructions with a mean follow-up time of at least 1 year. Assessment of the identified studies and data abstraction were performed independently by three reviewers. Failure rates were analyzed using Poisson regression models to obtain summary estimates and 95% confidence intervals of failure rates and 5-year survival proportions.

Results: Fifty-nine clinical studies were selected from an initial yield of 4511 titles and the data were extracted. For cemented single crowns the estimated 5-year reconstruction survival was 96.5% (95% confidence interval (CI): 94.8–97.7%), for screw-retained single crowns it was 89.3% (95% CI: 64.9–97.1%) ($P = 0.091$ for difference). The 5-year survival for cemented partial fixed dental prostheses (FDPs) was 96.9% (95% CI: 90.8–99%), similar to the one for screw-retained partial FDPs with 98% (95% CI: 96.2–99%) ($P = 0.47$). For cemented full-arch FDPs the 5-year survival was 100% (95% CI: 88.9–100%), which was somewhat higher than that for screw-retained FDPs with 95.8% (95% CI: 91.9–97.9%) ($P = 0.54$). The estimated 5-year cumulative incidence of technical complications at cemented single crowns was 11.9% and 24.4% at screw-retained crowns. At the partial and full-arch FDPs, in contrast, a trend to less complication at the screw-retained was found than at the cemented ones (partial FDPs cemented 24.5%, screw-retained 22.1%; full-arch FDPs cemented 62.9%, screw-retained 54.1%). Biological complications like marginal bone loss >2 mm occurred more frequently at cemented crowns (5-year incidence: 2.8%) than at screw-retained ones (5-year incidence: 0%).

Conclusion: Both types of reconstructions influenced the clinical outcomes in different ways, none of the fixation methods was clearly advantageous over the other. Cemented reconstructions exhibited more serious biological complications (implant loss, bone loss >2 mm), screw-retained reconstructions exhibited more technical problems. Screw-retained reconstructions are more easily retrievable than cemented reconstructions and, therefore, technical and eventually biological complications can be treated more easily. For this reason and for their apparently higher biological compatibility, these reconstructions seem to be preferable.

Introduction

Fixed implant reconstructions like single-implant crowns and multiple-unit fixed dental prostheses (partial FDPs) are well documented in the literature and nowadays fully accepted as a treatment option for the replacement of single or multiple missing teeth (Pjetursson et al. 2007; Jung et al. 2008). The establishment of the osseointegration of dental implants has been thoroughly investigated and found to be highly predictable (Esposito et al. 1998; Berglundh et al. 2002). Even more, the implant-borne reconstructions themselves exhibit excellent clinical survival rates. In a recent systematic review, the implant-borne crowns and partial FDPs exhibited high survival rates resembling the ones of tooth-borne reconstructions, amounting to 95% at 5-years (Pjetursson et al. 2007). Albeit, the clinical success of

CLINICAL ORAL IMPLANTS RESEARCH

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Comparison of plaque accumulation and soft-tissue blood flow with the use of full-arch implant-supported fixed prostheses with mucosal surfaces of different materials: a randomized clinical study

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Key words: blood flow, full-arch implant-supported fixed prostheses, laser speckle imaging, mucosal surface, plaque area index

Abstract

Objective: The aims of this clinical study were to determine differences in plaque accumulation and to compare the effects of reinforced composite resin and titanium on peri-implant soft-tissue and residual-ridge inflammation.

Material and methods: A total of 19 subjects were enrolled in this clinical trial; 10 jaws had implant-supported fixed prostheses with composite resin mucosal surfaces, 11 jaws had titanium prostheses fabricated by computer-aided design/computer-aided manufacture (CAD/CAM), and 6 jaws had acrylic resin prostheses. Plaque area indexes (PAIs) were calculated on the mucosal surfaces of prostheses, and blood flow in the mucosa was captured with two-dimensional laser speckle imaging to evaluate residual-ridge inflammation. Subjects were educated about oral hygiene and reevaluated after 3 months.

Results: The PAI was significantly lower on titanium mucosal surfaces than on reinforced composite resin surfaces at the initial and second measurements (initial, $P = 0.0052$; second, $P = 0.0044$). Self-curing acrylic resin surfaces did not show any significant difference when compared with reinforced resin or titanium. Blood flow was significantly lower in mucosa contacting titanium surfaces than in mucosa contacting reinforced composite resin surfaces at the initial measurement ($P = 0.0330$). Although subjects were instructed about plaque control after the initial measurement, PAIs indicated that the difference between the two materials could not be overcome.

Conclusion: In terms of oral hygiene and mucosal inflammation, titanium was superior to reinforced composite resin in implant-supported fixed prostheses for edentulous subjects, and the short-term use of acrylic resin was superior to the use of reinforced composite resin.

Well-harmonized interface conditions between the soft tissue and a dental prosthesis are necessary for successful prosthodontic treatment (Berglundh et al. 1991; Pihlstrom 2001; Schou et al. 2002). The establishment of healthy soft tissue around implant abutments is considered to be important for the long-term service of the implant (Berglundh et al. 1991; Lindquist et al. 1996). Recently, full-arch implant-supported fixed prostheses have been widely used as a clinical intervention for edentulous jaws (Malo et al. 2003, 2005, 2011; Agliardi et al. 2010). However, plaque control is difficult in subjects with this type of prosthesis because the device has an extensive pontic that contacts the mucosa of the residual ridge. Thus, oral hygiene must be considered when choosing a prosthesis material. Titanium has been the standard material used for implant abutments, but the use of high-strength ceramics, such as zirconium, is increasing. No significant difference in soft-tissue healing has been found between abutments made of titanium and those made of zirconium (Welander et al. 2008; Zembic et al. 2009; Brakel et al. 2011a,b). Implant abutment materials have

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A Systematic Review of Soft Tissue Alterations and Aesthetic Outcomes Following Immediate Implant Placement and Restoration of Single Implants in the Anterior Maxilla

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Objectives: To assess the outcome of single tooth immediate implant placement and restoration (IPR) in the maxillary anterior region with a particular emphasis on soft tissue and aesthetic outcomes.

Material and methods: An electronic search in MEDLINE, EBSCOhost, and Ovid (PubMed) was performed to identify studies that reported on soft tissue outcomes following immediate placement and restoration of implants in the maxillary aesthetic region with a mean follow-up of at least 1 year.

Results: A total of 19 studies on single implants inserted immediately into a fresh extraction sockets and provisionally resorted in the maxillary aesthetic region were included. Soft tissue changes were found to be acceptable, with most studies reporting a mean gingival recession of 0.27 ± 0.38 mm and mean papillary height loss of 0.23 ± 0.27 mm after follow up of ≥1 year. The incidence of advanced buccal recession (> 1 mm) occurred in 11% of cases. The long term follow-up studies (> 2 years) reported that the interdental papillae, in particular, showed a tendency to rebound over time. The few studies that reported on patient centered outcome analysis showed a high level of patient satisfaction with the outcomes of IPR treatment.

Conclusions: The IPR protocol resulted in generally acceptable soft tissue and aesthetic outcomes, with sub-optimal results reported in approximately 11% of low risk cases. Factors like pre-operative tissue biotype, use of a flap or connective tissue graft did not significantly influence soft tissue and aesthetic outcomes. Long term prospective controlled clinical trials are necessary to identify factors which may influence the aesthetic outcomes associated with the IPR protocol.

KEY WORDS:

Dental Implants, Single Tooth; Esthetics; Maxilla, Prospective study, Patient Satisfaction

Dental implant supported restorations have become an acceptable, and often preferable, treatment option for tooth replacement in many clinical scenarios.[1-3] The original implant treatment guidelines advocated a three month waiting period following tooth extraction to allow for soft and hard tissue healing prior to placing an implant, which was followed by an additional three to six month load-free period following implant placement to achieve osseointegration.[4, 5]

Immediate implant placement into a fresh extraction socket has been advocated as a protocol that can reduce the treatment time as the socket healing and implant osseointegration occur concurrently.[6, 7] Immediate placement can further be combined with immediate restoration (IPR protocol),[8] which provides the patient with a fixed restoration immediately following tooth extraction. The definitions of immediate placement and immediate restoration are based on widely accepted consensus reports.[9, 10] Immediate implant placement, also known as Type I placement, is defined as the placement of an implant immediately following tooth extraction,[9] while immediate restoration has been defined as any restoration placed within 48 hours of implant insertion but with no contact with the opposite dentition in both centric and eccentric occlusion.[10]

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The Effect of Subepithelial Connective Tissue Graft Placement on Esthetic Outcomes Following Immediate Implant Placement: Systematic Review

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Background: Immediate implantation, in spite of many advantages, carries a risk of gingival recession, papilla loss, collapse of ridge contour and other esthetic complications. Soft tissue graft placement combined with immediate implantation may be utilized to reduce the concerns. This review aims to systematically analyze clinical esthetic outcomes of the immediate implant combined with soft tissue graft (IMITG).

Methods: The PRISMA guideline for systematic reviews was used. The electronic search was conducted using MEDLINE (PubMed), EMBASE, and Cochrane Central Register of Controlled Trials (CENTRAL) from January 1980 to October 2014. Quality assessments of selected articles were performed. Mid-buccal gingival level, interproximal gingival level, facial gingival thickness, gingival ridge dimension, and width of keratinized gingiva were the esthetic outcomes reviewed. Weighted mean difference of mid-buccal gingival level, papilla index score, and width of keratinized gingiva (WDBGL, WDPIS, WDKG) between initial and the last measurements were calculated. Other esthetic outcomes were assessed by the descriptive analysis.

Results: Ten studies with minimum of six-month follow-up were included and their reported esthetic outcomes were analyzed. Mid-buccal gingival level (WDBGL: 0.07 mm (95% Confidence interval: [-0.45, 0.59], p=0.12) and interproximal gingival level did not significantly change following IMITG (WDPIS in the mesial site: 0.31 (95% Confidence interval: [-0.01, 0.64], p=0.06) and WDPIS in the distal site: 0.29 (95% confidence interval: [-0.06, 0.65], p=0.11). Width of keratinized gingiva significantly increased following IMITG (WDKG: 1.27 mm (95% Confidence interval: [-0.08, 2.46], p=0.04). Facial gingival thickness and gingival ridge dimension could be increased following IMITG.

Conclusions: Due to the heterogeneity and limited number of selected studies, no conclusive statement could be made regarding the benefit of IMITG on esthetic outcomes. More randomized controlled trials are needed to provide definite clinical evidence.

KEY WORDS:

Dental implants; Esthetics, Dental; Evidence-based dentistry; Periodontics; Treatment outcome.

Immediate implantation, in spite of numerous benefits, does not preclude loss of the buccal bone[1, 2], gingival recession[3] or ridge dimensional change.[4, 5] Bone grafts, barriers and soft tissue grafting have been utilized separately or together to minimize gingival and ridge contour changes following immediate implantation.

Autogenous soft tissue graft has been utilized in many clinical procedures. [6, 7,8, 9,10,11] A number of studies have demonstrated clinical superiority of autogenous soft tissue grafts

CLINICAL ORAL IMPLANTS RESEARCH

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The effect of zirconia or titanium as abutment material on soft peri-implant tissues: a systematic review and meta-analysis

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Key words: prosthodontics, soft tissue-implant interactions, statistics

Abstract

Aim: The objective of this review was to analyze research with regard to the effect of zirconia or titanium as abutment material on soft peri-implant tissues.

Methods: Clinical studies were selected via electronic and hand searches in English language journals until December 1, 2014. Only randomized clinical trials (RCTs) and prospective controlled clinical trials (CCTs) showing direct comparison between zirconia (Zr) and titanium (Ti) abutments in the same patient were considered. The outcome measures were (1) soft tissue color, (2) soft tissue recession, (3) peri-implant probing, (4) bleeding on probing, (5) esthetic indexes, (6) patient-reported outcome, (7) marginal bone level, and (8) biological complications.

Results: Nine relevant studies (11 papers) were identified: 4 RCTs and 5 CCTs. Due to heterogeneity in the study design, statistical methods, and reported results, a meta-analysis of the data was feasible only for soft tissue color. The outcome was found to be significantly superior for Zr abutments. For the other outcome measures, a qualitative analysis of the selected articles was performed. The studies did not show any statistically significant differences between Zr and Ti abutments on soft tissue recession, probing depths, bleeding on probing, marginal bone level, and patient-reported outcome. One study reported significantly higher pink esthetic score (PES) scores at Zr implants with Zr abutments, compared to metal implants and Ti abutments.

Conclusion: Overall, the research does not support any obvious advantage of Ti or Zr abutments over each other. However, there is a significant tendency in Zr abutments evoking better color response of peri-implant mucosa and superior esthetic outcome measured by PES score.

Prescription of prosthetic abutments has always been a critical part of implant treatment. For many years, standard stock abutments provided by implant manufacturers were the only option available for the clinician. Eventually, doctors had to accept all shortcomings of these products, including predetermined cement line position and lack of emergency profile. Currently, there has been growing evidence in the literature that the use of standard stock abutments for cementation is no longer justifiable, due to compelling proof of improper cement remnants removal (Linkevicius et al. 2011, 2013a,b; Wadhwani et al. 2012; Vindasiute et al. 2013; Korsch et al. 2014; Korsch & Walther 2014). Therefore, modern prosthetic implant dentistry cannot be imagined without the use of customized implant abutments. Such abutments have an individual shape, which follows the peri-implant soft tissue line of the implant site, giving two major advantages, namely (1) support of soft tissues and (2) a favorable location of the cementation margin for cleaning cement excess (Dumbrigue et al. 2002). Currently, various materials are used for fabrication of individually customized prosthetic abutments, such as metals, ceramics, and composites. For a long time, cast gold individual abutments were considered as the state of the art in customized prosthetic solutions; however, recently, their use has been rapidly decreasing due to lack of biocompatibility and higher pricing. It has been shown in animal studies that peri-implant soft tissues do not form a sufficient seal with gold abutments; therefore, soft tissue recession and crestal bone loss can be expected (Abrahamsson et al. 1998). Similarly, dental porcelain appeared not to be a proper material for the establishment of reliable soft tissue adherence. In fact, the outcome with feld-

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CLINICAL ORAL IMPLANTS RESEARCH

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Fatigue resistance and failure mode of CAD/CAM composite resin implant abutments restored with type III composite resin and porcelain veneers

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Key words: adhesion, CAD/CAM, composite resin, dental implant, fatigue resistance, implant abutment, porcelain

Abstract

Objectives: This study assessed the fatigue resistance and failure mode of type III porcelain and composite resin veneers bonded to custom composite resin implant abutments.

Material and methods: Using the CEREC 3 machine, 28 composite resin implant abutments (Paradigm MZ100) were fabricated along with non-retentive type III veneers, milled either in ceramic Paradigm C ($n = 14$) or in composite resin Paradigm MZ100 ($n = 14$). The intaglio surfaces of the veneers were hydrofluoric acid etched and silanated (Paradigm C) or airborne-particle abraded and silanated (MZ100). The fitting surface of the abutments was airborne-particle abraded, cleaned, silanated and inserted into a bone level implant (10 mm, BLI RC). All veneers were luted with adhesive resin (Optibond FL) and a preheated light curing composite resin (Filtek Z100). Cyclic isometric chewing (5 Hz, 30° angle) was simulated, starting with a load of 40 N, followed by stages of 80, 120, 160, 200, 240 and 280 N (20,000 cycles each). Samples were loaded until fracture or to a maximum of 140,000 cycles. Groups were compared using the life table survival analysis (Log rank test at $P = 0.05$). Previously published data using same-design zirconia abutments were included for comparison.

Results: Paradigm C and MZ100 specimens fractured at an average load of 243 and 206 N (survival rate of 21% and 0%), respectively, with a significant difference in survival probability ($P = 0.02$). Fractured specimens presented mixed failure modes and solely adhesive failures were not observed. The survival of composite resin abutments was similar to that of identical zirconia abutments from a previous study ($P = 0.76$).

Conclusions: Non-retentive porcelain veneers bonded to custom composite resin implant abutments presented a higher survival rate when compared with composite resin veneers. Survival of composite resin abutment did not differ from zirconia ones.

Single tooth replacement in the esthetic zone using implant-supported restorations can be challenging (Searson & Meredith 1997; Moberg et al. 1999; Glauser et al. 2004), especially when facing limited interdental/interocclusal space or suboptimal implant–crown angles (Belser et al. 1996; Magne et al. 2008, 2010b). A screw-retained custom abutment and a cemented crown usually help facing those challenges. Traditionally, implant abutments were fabricated from commercially pure titanium due to its well-documented biocompatibility and mechanical properties (Andersson et al. 1992; Haas et al. 1995, 2002; Behr et al. 2001). Despite the numerous improvements in the fabrication and design of metal abutments, there is a risk of metal components shining through the peri-implant mucosa (Nakamura et al. 2003; Ishikawa-Nagai et al. 2007; Park et al. 2007). A new esthetic solution for replacing single-unit implant-supported prosthesis was presented by Magne et al. (2008, 2010b). In this innovative approach the traditional principles of retention and resistance form of the abutment, are replaced by the strong and reliable porcelain-to-porcelain approach (hydrofluoric acid etching and silanization) (Magne & Cascione 2006). This technique consists of a non-retentive screw-retained custom metal ceramic abutment and a separate non-retentive porcelain veneer (Fig. 1). This highly esthetic solution corresponds to the translational application of novel-design (type III) porcelain veneers and adhesive restorative principles (Andreasen et al. 1992; Walls 1995; Magne et al. 2000) in the implant realm. It is also indicated to correct mismatching implant–crown axes and appears

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Esthetic Evaluation of Anterior Single-Tooth Implants with Different Abutment Designs—Patients' Satisfaction Compared to Dentists' Observations

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Keywords
Implant esthetics; patient satisfaction; PES; VAS; curved abutment; single-tooth dental implants.

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Abstract

Purpose: To correlate patients' satisfaction and dentists' observations regarding two abutment designs used for single crowns in the esthetic zone: a divergent one (control) and a curved one (experimental), with special emphasis on muco-gingival esthetics.
Materials and Methods: Twenty-six patients with nonadjacent missing teeth in the esthetic zone were enrolled in a randomized clinical trial (within-subject comparison). Two implants placed in each were restored using abutments of different geometry. Patients' appreciation was assessed on a visual analog scale (VAS) by recording answers to three questions, and dentists' appreciation was determined by means of the Pink Esthetic Score (PES) at T0 (crown cementation, baseline) and at T12 (1 year post-cementation). ANOVA with post hoc analysis was used to identify differences between groups and at different moments in time. Pearson correlations were calculated between all variables, both at T0 and at T12.
Results: No statistically significant differences were found at any time between the control and experimental abutment design, either for the PES or for the VAS score. PES slightly improved after 1 year, as did the VAS rating related to functioning with the implant-crown compared to the natural teeth. All PES and VAS scores demonstrated highly significant correlation. Both patient satisfaction and professional appreciation of muco-gingival conditions after single implant treatment in the esthetic zone were high; however, the curved, experimental abutment design performed no better than the conventional, divergent type.
Conclusion: Curved abutment design does not significantly impact crown or gingival esthetics as assessed by PES and VAS scored by dentists and patients, respectively.

Implant dentistry has been constantly evolving in terms of materials and surgical protocols over the last few decades with the objective of improving patient-oriented results. Initially, success and survival rates for dental implants were measured only in terms of osseointegration. Albrektsson's criteria for success[1] were considered to be well established and were widely used in clinical studies as a "rule" for analyzing success rates; however, these osseointegration-oriented criteria were not adequate to holistically assess the success and survival of the outcomes and, hence, other factors such as gingival and crown esthetics were incorporated. The appearance of the peri-implant soft tissue was recognized as a crucial factor in the success of implant therapy.[2] With osseointegration and restoration in function, patient satisfaction was also considered as a key factor in the success of implant therapy in the anterior maxilla.[3] Therefore, Smith and Zarb[4] extended the criteria by emphasizing that a successful implant must factor in optimal esthetic outcome. In 2005, Furhauser et al[5] proposed an index termed the Pink Esthetic Score (PES), focusing essentially on the soft tissue aspects of anterior implant restorations. Success in implant dentistry should ideally evaluate the long-term primary outcome of an implant-prosthetic complex as a whole.[6]

Despite the importance of esthetic outcomes, only a few studies included in a recent systematic review evaluated the esthetics of implant-supported single crowns.[6] Some studies asked patients to rate overall satisfaction with the implant-supported crowns, and others were asked to rate only crown shape and color. Some studies had the practitioner, not the patient,

Completely Digital Two-Visit Immediately Loaded Implants: Proof of Concept

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Implant dentistry has become a common treatment alternative, yet only a small percentage of patients missing teeth are receiving its benefits. Significant limitations are the small percent of practitioners placing implants due to the long learning curve, as well as the time commitment on the part of the patient. This proof of concept demonstrates clinical implant treatment requiring years of manual skill development on the part of the surgeon, restorative dentist, and technician can be accomplished in 2 visits, completely digitally, without the need for conventional impressions, laboratory procedures, and advanced manual skills. This technique results in reduced learning curve and treatment time. The first visit consists of consultation, diagnosis, CT and optical surface scans of the implant site to include: soft tissue, adjacent teeth, and opposing arch. This digital information is imported and interactively reconstructed in a 3-D open format implant planning software. The implant and restoration are now precisely planned into the optimal bone position with the ideal emergence profile for biologically and esthetically designed restoration. This information is then electronically forwarded to a production facility, where all necessary models are digitally printed and the immediate crown is digitally milled. On the second visit, the patient returns for guided implant insertion and immediate restoration. As digital procedures are refined, many more dental professionals will become involved in providing implant therapy earlier in their careers. This promises to result in reduced costs, making implants available to millions more patients who could benefit from them.

Key Words: completely digital implant and restoration, immediate loading, digital implant dentistry, computer planning, CAD/CAM restoration milling

INTRODUCTION

Implant dentistry has become a common treatment alternative, yet only a small percentage of patients missing teeth are receiving its benefits.

A 2012 National Health and Nutrition Examination Survey (NHANES)[1] reported more than one-half of the adult population were missing 1 or several teeth, and 23% of those above age 65 are missing all teeth. Yet in 2014, only approximately 2.3 million implants were placed in the United States.[2]

The usual reason cited for the limited use of implants is expense. However, more significant limitations are the small percent of practitioners placing implants and the time commitment on the part of the patient. A 2008 ADA survey[3] showed only 15.9% of dentists practicing in the United States are placing implants. Some reasons cited for this are the long learning curve and the complex, expensive delivery systems. Thus, practitioners prescribe the less time consuming and less complex conventional treatment alternatives that they are comfortable providing. This report introduces a proof of concept that promises to overcome these limitations. It demonstrates that a restoratively driven implant and restoration—directly from digital input technology—can be performed in 2 patient visits without requiring years of manual skill development on the part of the surgeon, restorative dentist, and technician.

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METHODS

A 32-year-old male patient presented with a high smile line and missing maxillary left lateral and canine as a result of a bicycle accident that occurred approximately 2 years prior to presentation (Figure 1). At the first visit a CBCT scan (i-CAT, Imaging Sciences International LLC, Hatfield, Pa) of the maxillary arch with an intraorally placed prefabricated appliance containing fiduciary markers (Keybite, ProPrecision Guides, Keystone Heights, Fla) confirmed, at the edentulous site, adequate bone volume and density and acquired a digital image of the bone, remaining teeth, and fiduciary markers. At this same visit, an optical scan of the teeth, soft tissue, and opposing arch, as well as the teeth in occlusion was completed with a digital impression device (Itero, Align Technology Inc, San Jose, Calif) (Figure 2). Following digital data capture, the patient was provided preoperative instruction, medication, and informed consent and was appointed for implant and restoration.

DIGITAL PLANNING

Digitization of the information was undertaken and shown in Figure 3. From the digital data captured by the CBCT, a 3-D

Systematic Review of the Survival Rate and Incidence of Biologic, Technical, and Esthetic Complications of Single Implant Abutments Supporting Fixed Prostheses

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Purpose: *To assess the 5-year survival rate and number of technical, biologic, and esthetic complications involving implant abutments.* ***Materials and Methods:*** *Electronic (Medline) and hand searches were performed to assess studies on metal and ceramic implant abutments. Relevant data from a previous review were included. Two reviewers independently extracted the data. Failure and complication rates were analyzed, and estimates of 5-year survival proportions were calculated from the relationship between event rate and survival function. Multivariable robust Poisson regression was used to compare abutment characteristics.* ***Results:*** *The search yielded 1,558 titles and 274 abstracts. Twenty-four studies were selected for data analysis. The survival rate for ceramic abutments was 97.5% (95% confidence interval [CI]): 89.6% to 99.4%) and 97.6% (95% CI: 96.2% to 98.5%) for metal abutments. The overall 5-year rate for technical complications was 11.8% (95% CI: 8.5% to 16.3%), 8.9% (95% CI: 4.3% to 17.7%) for ceramic and 12.0% (95% CI: 8.5% to 16.8%) for metal abutments. Biologic complications occurred with an overall rate of 6.4% (95% CI: 3.3% to 12.0%), 10.4% (95% CI: 1.9% to 46.7%) for ceramic, and 6.1% (95% CI: 3.1% to 12.0%) for metal abutments.* ***Conclusions:*** *The present meta-analysis on single-implant prostheses presents high survival rates of single implants, abutments, and prostheses after 5 years of function. No differences were found for the survival and failure rates of ceramic and metal abutments. No significant differences were found for technical, biologic, and esthetic complications of internally and externally connected abutments.* Int J Oral Maxillofac Implants 2014;29(Suppl):99–116. doi: 10.11607/jomi.2014suppl.g2.2

Key words: *biologic complications, ceramics, complication rates, esthetic complications, failures, implant abutments, implant prostheses, metal, survival, systematic review, technical complications, titanium, zirconia*

Today, partially edentulous individuals represent the main group of patients requiring treatment in daily dental practice. Therefore, oral implants are the predominant treatment modality for the rehabilitation of these patients.[1] Using implants, fixed partial dentures can be applied in situations where removable dentures would previously have been necessary.[2–4] In addition, more treatment options that preserve the tooth structure are possible by replacing missing single teeth with dental implants.[5] Since most of the patients provided with oral implants are between 40 and 50 years of age, promising long-term survival rates for implants and prostheses are expected both by the clinician and the patient to ensure the longevity of the prosthesis.[6–8] The definition "long-term" has been specified as a follow-up of at least 5 years.[9] Thus, survival rates and the incidence of biologic, technical, and esthetic events should be based on mean observation periods of at least 5 years.[10]

Several years ago, hierarchies of evidence were developed as aid for the interpretation and evaluation of research findings.[11] As evidence, systematic reviews were ranked to be excellent in terms of effectiveness, appropriateness, and feasibility. An evidence level of "excellent" equates with the strongest scientific basis

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The mucosal attachment at different abutments

An experimental study in dogs

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Abrahamsson I, Berglundh T, Glantz P.-O, Lindhe J. The mucosal attachment at different abutments. An experimental study in dogs. J Clin Periodontol 1998; 25: 721–727. © Munksgaard, 1998.

Abstract. The present experiment was performed to examine if the material used in the abutment part of an implant system influenced the quality of the mucosal barrier that formed following implant installation. 5 beagle dogs were included in the study. The mandibular premolars and the 1st, 2nd and 3rd maxillary premolars were extracted. Three fixtures of the Brånemark System® were installed in each mandibular quadrant (a total of 6 fixtures per animal). Abutment connection was performed after 3 months of healing. In each dog the following types of abutments were used: 2 "control abutments" (c.p. titanium), 2 "ceramic abutments" (highly sintered Al_2O_3), 1 "gold abutment", and 1 "short titanium abutment". This "short titanium abutment" was provided with an outer structure made of dental porcelain fused to gold. Following abutment connection a plaque control program was initiated and maintained for 6 months. The animals were sacrificed and perfused with a fixative. The mandibles were removed and each implant region was dissected, demineralized in EDTA and embedded in EPON®. Semithin sections representing the mesial, distal, buccal and lingual aspects of the peri-implant tissues were produced and subjected to histological examination. The findings from the analysis demonstrated that the material used in the abutment portion of the implant influenced the location and the quality of the attachment that occurred between the periimplant mucosa and the implant. Abutments made of c.p. titanium or ceramic allowed the formation of a mucosal attachment which included one epithelial and one connective tissue portion that were about 2 mm and 1– 1.5 mm high, respectively. At sites where abutments made of gold alloy or dental porcelain were used, no proper attachment formed at the abutment level, but the soft tissue margin receded and bone resorption occurred. The abutment fixture junction was hereby occasionally exposed and the mucosal barrier became established to the fixture portion of the implant. It was suggested that the observed differences were the result of varying adhesive properties of the materials studied or by variations in their resistance to corrosion.

Key words: abutment; biomaterials; dogs; histometry; implant; peri-implant mucosa

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The mucosa that surrounds dental implants made of commercially pure (c.p.) titanium has been studied in man as well as in different animal models (Adell et al. 1986, Berglundh et al. 1991, 1992, 1994, Buser et al. 1992, Ericsson et al. 1992, 1995, Abrahamsson et al. 1996, Berglundh & Lindhe 1996, Cochran et al. 1997). It was demonstrated that the portion of the mucosa that faces the surface of the titanium abutment can be divided into 2 different zones; one marginal zone that harbors a junctional epithelium and one more apical zone that is comprised of a fiber rich connective tissue (Berglundh et al. 1991, Buser et al. 1992, Abrahamsson et al. 1996). From experiments in vitro, Gould et al. (1981), and in vivo Gould et al. (1984) concluded that the junctional epithelium of the peri-implant mucosa via hemidesmosomes is attached to the titanium surface, while Berglundh et al. (1991, 1994) and Buser et al. (1992) from experiments in the dog suggested that the connective tissue in the interface zone has the character of a scar (sparse in cells and vascular structures but rich in collagen fibers) which is firmly attached to the abutment. The importance of this epithelial/connective tissue attachment for the maintenance of osseointegration was emphasized by, e.g., Berglundh et al. (1992), Abrahamsson et al. (1996) and Berglundh & Lindhe (1996).

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Journal of Clinical Periodontology

Immediate single-tooth implants in the anterior maxilla: a 1-year case cohort study on hard and soft tissue response

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De Rouck T, Collys K, Cosyn J. Immediate single-tooth implants in the anterior maxilla: a 1-year case cohort study on hard and soft tissue response. J Clin Periodontol 2008; 35: 649–657. doi: 10.1111/j.1600-051X.2008.01235.x.

Abstract

Aim: The objective of the present study was to assess implant survival rate, hard and soft tissue response and aesthetic outcome 1 year after immediate placement and provisionalization of single-tooth implants in the pre-maxilla. All patients underwent the same strategy, that is mucoperiosteal flap elevation, immediate implant placement, insertion of a grafting material between the implant and the socket wall and the connection of a screw-retained provisional restoration.

Material and Methods: Thirty consecutive patients were treated for single-tooth replacement in the aesthetic zone by means of immediate implant placement and provisionalization. Reasons for tooth loss included caries, periodontitis or trauma. At 6 months, provisional crowns were replaced by the permanent ones. Clinical and radiographic evaluation was completed at 1, 3, 6 and 12 months to assess implant survival and complications, hard and soft tissue parameters and patient's aesthetic satisfaction.

Results: One implant had failed at 1 month of follow-up, resulting in an implant survival rate of 97%. Radiographic examination yielded 0.98 mm mesial, respectively, 0.78 mm distal bone loss. Midfacial soft tissue recession and mesial/distal papilla shrinkage were 0.53, 0.41and 0.31 mm, respectively. Patient's aesthetic satisfaction was 93%.

Conclusions: The preliminary results suggest that the proposed strategy can be considered to be a valuable treatment option in well-selected patients.

Key words: dental implants; hard tissue; immediate implantation; immediate loading; maxilla; single-tooth; soft tissue

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The prosthetic rehabilitation of a single maxillary anterior tooth with an implant-supported fixed prosthesis is an accepted concept. The original Brånemark protocol suggested 3 months of soft and hard tissue healing following tooth removal and an additional 3–6-month load-free osseointegration period (Albrektsson et al. 1981, Branemark 1983). This leads to many months of waiting with an uncomfortable removable partial denture and several surgical interventions. Based on the aforementioned concerns, patients occasionally prefer a traditional, sometimes destructive, bridge construction.

In the last decade, Implant Dentistry has evolved considerably: the original protocol has been modified by several investigators to include one-stage surgery (Becker et al. 1997), immediate post-extraction implant placement (Lazzara 1989, Werbitt & Goldberg 1992, Polizzi et al. 2000) and immediate provisionalization (Gomes et al. 1998, Ericsson et al. 2000). Studies have been published in which these three approaches are combined (De Rouck et al. 2007). Most of these reports focused, however, on implant survival and preservation of hard tissues, with much less attention to the soft tissue architecture. Needless to say, the aesthetic success of a restoration

Conflict of interest and source of fundings statements

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Ten-Year Results for Brånemark Implants Immediately Loaded With Fixed Prostheses at Implant Placement

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This investigation was initiated to develop a method to provide patients with a fixed provisional prosthesis placed at the time of implant placement. Sixty-three standard 3.75-mm Nobel Biocare implants of varying lengths were placed into mandibular sites in 10 patients and followed for up to 10 years. Twenty-eight implants were immediately loaded at implant placement, providing support for fixed provisional prostheses, while 35 adjacent implants were allowed to heal submerged and stress-free. Following a 3-month healing period, the submerged implants were exposed and definitive reconstruction was accomplished. All 10 prostheses supported by 28 implants placed into immediate function at the time of implant placement were successful during the 3-month healing period. Of these 28 implants placed into immediate function, 4 ultimately failed. Of the 35 submerged implants, all are osseointegrated and in function to date. Life-table analysis demonstrates an overall 10-year survival rate of 93.4% for all implants. The 10-year life-table analysis of survival is 84.7% for immediately loaded implants and 100% for submerged implants. Statistical analysis of the submerged versus immediately loaded implants demonstrates failure rates for immediately loaded implants to be significantly higher ($P = .022$ by the log rank test). These data demonstrate that although mandibular implants can be successfully placed into immediate function in the short term to support fixed provisional prostheses, long-term prognosis is guarded for those implants placed into immediate function distal to the incisor region.

(INT J ORAL MAXILLOFAC IMPLANTS 1997;12:495–503)

Key words: Brånemark implants, immediately loaded implants, provisional fixed prosthesis, 10-year life-table analysis

The transitional removable prosthesis is a frequent barrier to patient acceptance of implant treatment. Whether it is a partial or a complete denture, patients often resist the idea of wearing a removable prosthesis. The concept of such a prosthesis may be psychologically traumatic to many patients.

Patients undergoing osseointegration therapy generally either wear a removable prosthesis or else wear no prosthesis when abutment support is lacking during an extended healing period. While most edentulous patients are more tolerant of additional months of denture therapy, management of these patients can be difficult. Postoperative changes during the healing period can lead to discomfort and often necessitate frequent prosthesis adjustments.

The present study was initiated in 1986 to address these problems. A method was developed to provide patients with fixed provisional prostheses placed at the time of implant placement. Treatments were planned so as to avoid compromising the long-range predictability of implant therapy for these patients, while eliminating the need for removable prostheses.

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IMMEDIATE LOAD AND ESTHETIC ZONE CONSIDERATIONS TO REPLACE MAXILLARY INCISOR TEETH USING A NEW ZIRCONIA IMPLANT ABUTMENT IN THE BONE GRAFTED ANTERIOR MAXILLA

Cameron Y. S. Lee, DMD, MD, PhD; Henry Hasegawa, CDT

The goal of this prospective clinical study is to evaluate a new all-ceramic implant abutment made from zirconium oxide during the immediate load of dental implants placed in the block grafted anterior maxilla. This new zirconia abutment gives the clinician the opportunity to provide the patient with an all-ceramic restorative system (abutment and crown) for an optimum esthetic result and a high level of patient satisfaction. A total of 9 hydroxyapatite-coated dental implants were surgically placed in 9 patients and were immediately loaded 5 to 7 days later with a custom composite provisional restoration that was placed out of functional occlusion. Each prefabricated, natural colored zirconia abutment was shaped and connected to the implant with a titanium screw. Provisional restorations were cemented to the zirconia abutment with the use of temporary cement. Twelve weeks later, the provisional restoration was replaced with an all-ceramic restoration. Over a 52-week observation period, no abutment fractures occurred, and no abutment screw loosening was observed. No implants failed. All 9 patients reported total satisfaction regarding esthetic quality of the all-ceramic restorative system (abutment and implant). Preliminary results of this clinical study indicate that this new zirconia abutment offers the clinician and the patient exceptional strength, optimal esthetics, and simplicity. It is of important clinical significance that use of this all-ceramic abutment eliminates the well-known disadvantages of metal abutments.

Key Words: Zimmer Contour ceramic abutment, zirconia abutment, zirconium oxide, all-ceramic restorative system,

INTRODUCTION

Osseointegration, which is the successful formation of a direct bone-to-implant interface, is the goal of implant therapy. The 2-stage surgical protocol established by Branemark et al consisted of a healing phase of 3 months for the mandible and 6 months for the maxilla, to allow the

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A systematic review of the performance of ceramic and metal implant abutments supporting fixed implant reconstructions

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Key words: biological complications, ceramics, complication rates, failures, implant abutments, implant reconstructions, metal, stability, strength, survival, systematic review, technical complications, titanium, zirconia

Abstract

Objectives: The objective of this systematic review was to assess the 5-year survival rates and incidences of complications associated with ceramic abutments and to compare them with those of metal abutments.

Methods: An electronic Medline search complemented by manual searching was conducted to identify randomized-controlled clinical trials, and prospective and retrospective studies providing information on ceramic and metal abutments with a mean follow-up time of at least 3 years. Patients had to have been examined clinically at the follow-up visit. Assessment of the identified studies and data abstraction was performed independently by three reviewers. Failure rates were analyzed using standard and random-effects Poisson regression models to obtain summary estimates of 5-year survival proportions.

Results: Twenty-nine clinical and 22 laboratory studies were selected from an initial yield of 7136 titles and data were extracted. The estimated 5-year survival rate of ceramic abutments was 99.1% [95% confidence interval (CI): 93.8–99.9%] and 97.4% (95% CI: 96–98.3%) for metal abutments. The estimated cumulative incidence of technical complications after 5 years was 6.9% (95% CI: 3.5–13.4%) for ceramic abutments and 15.9% (95% CI: 11.6–21.5%) for metal abutments. Abutment screw loosening was the most frequent technical problem, occurring at an estimated cumulative incidence after 5 years of 5.1% (95% CI: 3.3–7.7%). All-ceramic crowns supported by ceramic abutments exhibited similar annual fracture rates as metal–ceramic crowns supported by metal abutments. The cumulative incidence of biological complications after 5 years was estimated at 5.2% (95% CI: 0.4–52%) for ceramic and 7.7% (95% CI: 4.7–12.5%) for metal abutments. Esthetic complications tended to be more frequent at metal abutments. A meta-analysis of the laboratory data was impossible due to the non-standardized test methods of the studies included.

Conclusion: The 5-year survival rates estimated from annual failure rates appeared to be similar for ceramic and metal abutments. The information included in this review did not provide evidence for differences of the technical and biological outcomes of ceramic and metal abutments. However, the information for ceramic abutments was limited in the number of studies and abutments analyzed as well as the accrued follow-up time. Standardized methods for the analysis of abutment strength are needed.

CLINICAL REPORT

Australian Dental Journal 2007;52:(3):234-242

Provisional restoration options in implant dentistry

RE Santosa*

Abstract

Unlike their use in conventional crown and bridge, provisional restorations during implant therapy have been underutilized. Provisional restorations should be used to evaluate aesthetic, phonetic and occlusal function prior to delivery of the final implant restorations, while preserving and/or enhancing the condition of the peri-implant and gingival tissues. Provisional restorations are useful as a communication tool between members of the treatment team which, in most cases, consists of the restorative clinician, implant surgeons, laboratory technicians, and the patient. This article describes and discusses the various options for provisionalization in implant dentistry. Clinicians should be aware of the different types of provisional restorations and the indications for their use when planning implant retained restorations.

Key words: Provisional restorations, dental implant, custom impression.

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INTRODUCTION

Implant supported restorations for partially and fully edentulous patients are a well-accepted and predictable treatment modality. Success rate of implant retained prostheses for complete and partial edentulism has been shown to be over 90 per cent.[1-3] With the increase in treatment acceptance for dental implants, both patients and clinicians have greater expectations towards implant therapy. Patients facing loss of their teeth may experience apprehension towards losing their social image or daily function. Hence, patients often expect to have their implants loaded with some type of fixed prosthesis similar to their natural dentition much earlier. Clinicians also expect their restorations to be functional, aesthetic, and in harmony with the surrounding hard and soft tissues. Today, implant integration is given with the greater knowledge of the biological basis for treatment and improvements primarily associated with implant morphology. Traditionally, for conventional loading protocols, the implants are left unloaded for 3 to 6 months to allow the osseointegration process to take place.[1] During this healing period, patients may have to wear a removable provisional prosthesis prior to delivery of the final prosthesis, especially in the aesthetic zone. In the non-aesthetic zone, clinicians may decide not to construct provisional restorations.

In some cases, patients are able to have a provisional restoration constructed after the treatment planning phase and delivered as early as the day of implant placement.[4] However, in restorative driven implant placement,[5,6] hard and soft tissue augmentation is routinely performed to optimize the implant site prior to surgery, effectively extending the treatment time. Any provisional prostheses would then need to be strong, durable and aesthetic to last throughout the duration of the treatment. A traditional provisional prosthesis may consist of an existing or newly constructed removable provisional denture which can be utilized until delivery of the final prosthesis. However, removable provisional prostheses may place undesirable pressure upon these graft sites, hampering the healing process.[4,7,8] Therefore, provisional restorations that are fixed to the adjacent teeth or that completely eliminate the possibility for soft tissue contact may be more beneficial for implant integration and soft tissue maintenance. Tooth borne or fixed provisional restorations may also satisfy patients' aesthetic, functional and psychological demands. One of our roles as clinicians is to provide functional and aesthetic provisional restorations that allow for the smooth transition of patients from natural dentition to implant based restorations.[8,9]

Function of provisional restorations

According to *The Glossary of Prosthodontic Terms*,[10] a provisional prosthesis is a prosthesis designed to enhance aesthetics, provide stabilization and/or function for a limited period of time, and should be replaced by a definitive prosthesis after a period of time.

In restoration-driven implant placement,[5,6] implants are positioned in relation to anticipated requisites of the restorative phase rather than the availability of bone. Provisional restorations can be used as a diagnostic restoration to evaluate the position and contours of the planned definitive restoration prior to surgical implant placement and during the healing

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One Abutment at One Time Concept for Platform-Switched Morse Implants: Systematic Review and Meta-Analysis

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The aim of this systematic review and meta-analysis was to compare the peri-implant vertical bone loss of immediate loading of implant crowns using the one abutment at one time (AOT) protocol and implants with abutment removal (AR). This systematic review with meta-analysis was reported according to the PRISMA statement, with guidance from the Cochrane Collaboration Handbook. A total of 103 publications were identified in the PubMed database and reference lists of examined articles. After the screening of titles and abstracts, the eligibility of eight full-text articles was assessed. Five studies published between 2010 and 2015 were included in the meta-analysis. There was less peri-implant vertical bone loss at implants using an AOT protocol than at implants using AR protocol (WMD -0.19, 95% CI -0.26 to -0.13; p<0.0001; random-effects model). In conclusion, the use of the AOT protocol with platform-switched Morse implants results in less bone loss than do AR procedures, but this effect may not be clinically relevant. The preservation of marginal bone level achieved with the AOT protocol may not enhance the aesthetics. These results should be interpreted with caution.

Key Words: dental abutment, platform-switched, marginal bone loss.

Introduction

Canullo et al. were the first authors to use the term "one abutment - one time" concept to refer to the connection of an immediate non-removal abutment in post-extractive implant (1). This clinical trial showed at 36 months after loading a statistically significant mean difference of 0.2 mm upper peri-implant marginal bone level in favor of the maintenance of the abutment. Other trials (2-4) also showed a less vertical bone loss after 12 months using definitive abutments, although this may be not clinically perceptible.

Nowadays treatment with implant may incorporate divergent option of treatment that does not follow a general rule. Long-term implants switching platform immediately loaded into smokers had the same results to non-smokers if the abutments were screwed after implant placing and no longer removed (5). Two times dis/reconnections of abutment did not show significant differences in peri-implant soft and hard tissues when compared with definitive abutment (6). Researchers have been trying to evaluate whether a definitive abutment has advantage over standard guideline (1,2,5-7).

Albrektsson et al. proposed criteria for the success of a dental implant, including radiographic evidence of crestal bone around the implant, 1.5 mm bone loss in the first year and <0.2 mm bone resorption annually after 1 year of loading (8). Abrahamsson et al. studied the effects of abutment disconnection and reconnection on the peri-implant soft-/hard-tissue complex in dogs (9). They observed that abutment handling resulted in marginal bone resorption due to tissue reactions initiated to establish proper biological width, which moved the mucosal barrier apically relative to the soft tissue. Other factors, such as microgaps between the implant and abutment (10), micromovement at the implant-abutment interface (11), microleakage between the implant and abutment (8), and abutment disconnection and/or reconnection (1-3) also affect bone remodeling.

There is a biologic base for the use of non-removal abutment placed after implant insertion. However, this option treatment needs assessment of the potential clinical benefit and risk associated with the technique. The liability of excess cement remainder in the periodontal area and its consequences has been discussed as an adverse outcome, in case with abutment margin depths and immediate cemented restoration (12), which may be prevented with abutment that allow screw-retained crowns (6). Another disadvantage associated with definitive abutment after surgery is the difficulty of selecting the appropriate definitive standard abutment immediately after implant insertion, concerned to high soft tissue and wall bone variance (12) that can be prevented by using customized abutments (13).

Material and Methods

Aim

The aim of this systematic review and meta-analysis was to compare the peri-implant vertical bone loss of

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ORIGINAL RESEARCH

CLINICAL ORAL IMPLANTS RESEARCH WILEY

A multicenter cohort study on the association of the one-abutment one-time concept with marginal bone loss around bone level implants

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Abstract

Objectives: To investigate the association of the one-abutment one-time concept with marginal bone loss (MBL) around bone-level implants in relation to other factors.

Materials and methods: Records from patients treated by four experienced implant surgeons between January 2016 and July 2019 were scrutinized. Subjects treated with two bone-level implant types with varying machined collar (subgroups: 0.5 and 0.8 mm) were considered, receiving a healing abutment (HA cohort) or a permanent abutment at the time of surgery (OT cohort). The primary outcome was MBL registered at 3 months and the longest follow-up. A clustered two-part regression model for semicontinuous data was used.

Results: Data pertaining to 160 patients (92 females, mean age 54) and 344 implants (125 in HA cohort, 219 in OT cohort) were available for evaluation. Mean MBL amounted to 0.52 mm (*SD* 0.68) after a mean follow-up of 20 (*SD* 9.2) months, with 33.8% of the implants showing complete bone preservation and 5.0% demonstrating >2mm MBL. OT was not related to the presence of MBL using MBL as dependent binary variable (0: no MBL; 1: MBL irrespective of its magnitude). However, OT significantly reduced the magnitude of MBL with 0.300mm when compared to HA (p = .023) in the cases where MBL was detected. Subgroup (p = *.212*), smoking (p = *.789*), history of periodontitis (p = *.839*), type of edentulism (p = *.054*), implant surgeon (p = *.079*), patient compliance (p = *.617*), and follow-up (p = *.443*) failed to show a significant association with MBL in the regression model. Ninety-eight % of the implants survived.

Conclusion: Within the limitations of a cohort study, the one-abutment one-time concept was associated with a decrease in MBL at implant sites with bone loss. Therefore, the placement of a permanent abutment at the time of surgery seems relevant to limit marginal bone-level alterations.

KEYWORDS

bone remodeling, dental abutments, dental implants, radiography dental, smoking

Tommaso Grandi, Paolo Guazzi, Rawad Samarani, Hassan Maghaireh, Giovanni Grandi

One abutment–one time versus a provisional abutment in immediately loaded post-extractive single implants: A 1-year follow-up of a multicentre randomised controlled trial

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Key words *abutment dis/reconnection, bone loss, implant-abutment interface, platform switching, post-extractive implants*

Purpose: To compare immediately loaded post-extractive single implants using a definitive abutment versus provisional abutment later replaced by custom-made abutment.
Materials and methods: In two private clinics, 28 patients in need of one single post-extractive implant in the maxilla or mandible from the left second premolar to the right second premolar area were randomised shortly before tooth extraction to provisional abutment (PA) and definitive abutment (DA) groups. Three patients had to be excluded for buccal wall fracture after tooth extraction. In the PA group, implants were immediately restored using a platform-switched provisional titanium abutment and definitive platform-switched titanium abutments were used in the DA group. In both groups, a non-occluding provisional single crown was provided. Implants were definitively restored after 4 months. In the PA group, the abutment was removed and the impression was made directly on the implant platform. In the DA group an impression of the abutment was made using a retraction cord. Outcome measures were: implant failures; complications; and marginal peri-implant bone level changes. Patients were followed up to 1 year after loading.
Results: Twelve patients were randomised to the DA group and 13 patients to the PA group. At the 12-month follow-up, no implant failed. One biological complication occurred in the DA group and one mechanical complication occurred in the PA group. All complications were successfully treated. One year after loading, implants in the DA group lost an average of 0.11 mm (SD: 0.06) of peri-implant bone and implants in PA group about 0.58 mm (SD: 0.11). At the 12-month follow-up, there was a statistically significant difference in bone level change between groups (mean difference: 0.48 mm, CI 95% 0.40; 0.55, $P < 0.0001$).
Conclusions: Within the limits of this study, the non-removal of abutments placed at the time of surgery resulted in the maintenance of 0.5 mm more bone levels around immediately restored post-extractive single implants than repeated abutment removal, although this amount of bone maintenance may not have a clinical impact.

Conflicts of interest notification: *Dr Tommaso Grandi and Dr Paolo Guazzi serve as consultants for JDentalCare. This study was completely self-financed and no funding was sought or obtained, not even in the form of free materials.*

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Clinical Study

A Retrospective Study on Insertion Torque and Implant Stability Quotient (ISQ) as Stability Parameters for Immediate Loading of Implants in Fresh Extraction Sockets

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Background. To date, insertion torque value (ITV) and implant stability quotient (ISQ) obtained by the Osstell instrument are common clinical methods to assess the initial stability of an implant for a predictable loading procedure. The aim of this current study is to evaluate the ITV and ISQ as stability parameters as part of the decision-making protocol in the adoption of immediate loading in fresh extraction sockets. *Materials and Methods.* A total of 41 tapered implants were allocated into two groups: the test group ($n = 11$; 3 males and 8 females; mean age: 62.8 ± 10.7) which received 18 implants as type 1 fresh extraction sockets after teeth removal and the control group ($n = 7$; 4 males and 3 females; mean age: 65.4 ± 9.7) which received 23 implants placed in healed sockets for a period of at least 3 months. Both the ITV and ISQ data were recorded at the time of insertion (t_0). Since ITV (test group) and ITV/ISQ (control group) values were useful for the immediate loading protocol, a screw-retained temporary crown was immediately loaded. ISQ values were recorded after a healing period of 4 months (t_1). *Results.* ITV mean values at t_0 in test and control groups were, respectively, 48.61 ± 15.39 and 70.47 ± 14.71, whereas ISQ mean values were 57.55 ± 1.93 and 72.86 ± 5.25, respectively, showing a statistically significant difference (p value < 0.001). ISQ mean values at t_1 in either the test or the control group were 68.68 ± 4.20 and 74.54 ± 4.17, not showing a statistical difference. The implant survival rate was 100% in both groups, and no surgical and prosthetic complications were reported during the study. *Conclusion.* In conclusion, this study remarked the presence of a residual gap that influenced the ISQ during implant insertion in fresh extraction sockets making this parameter not sufficient for a conclusive decision in the immediate loading, whereas the ITV alone showed to be the best parameter for a final substantial decision.

1. Introduction

Implantology is a field of dentistry that has been practiced since many years, thanks to the biological osteointegration principles of Branemark's protocol [1]. The osteointegration, defined as "a direct structural and functional connection between the living bone and the surface of the load-carrying implant," depends on an atraumatic surgery with the use of

ONE-ABUTMENT, ONE-TIME

Guided Implant Surgery with Placement of a Presurgical CAD/CAM Patient-Specific Abutment and Provisional in the Esthetic Zone

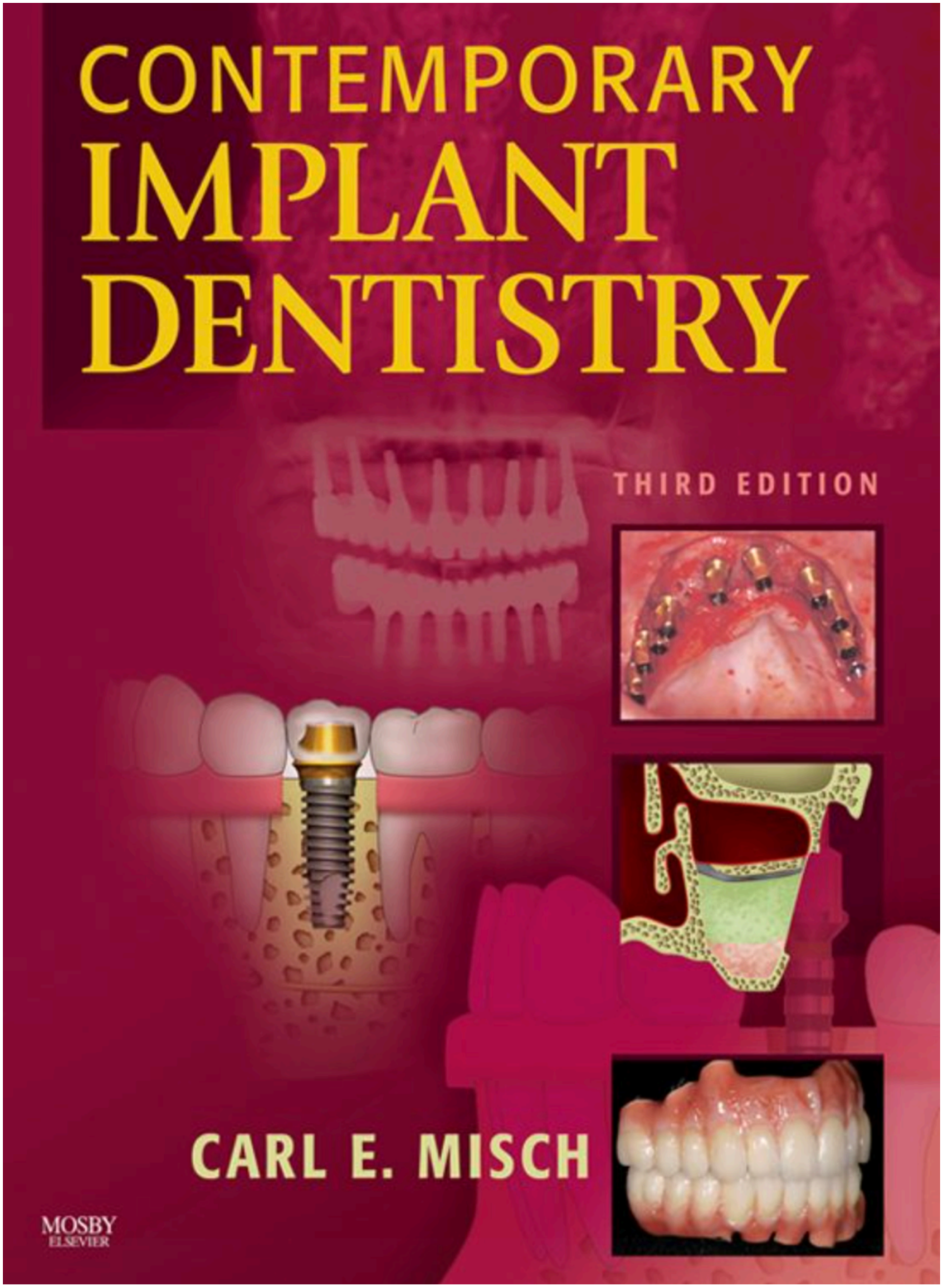
George A. Mandelaris, DDS, MS; and Scott D. Vlk, DDS

Abstract: Parallel use of implant treatment planning software and cone-beam computed tomography (CBCT) can, using certain criteria, consolidate steps and streamline tooth replacement strategies. The authors describe such a case in the esthetic zone whereby flapless extraction and immediate implant placement using CT-guided surgery were performed simultaneously, with placement of a computer-aided design/computer-aided manufactured (CAD/CAM) patient-specific abutment and non-occlusal function provisional in a single visit (supporting the "one-abutment, one-time" concept). An over-retained primary cuspid in a periodontally healthy woman with well-controlled type-2 diabetes was replaced with an implant and CAD/CAM patient-specific abutment in the No. 11 position. A necessary implant-axis angle correction was customized using digital information from a CBCT scan and implant treatment planning software, without the need for site development or a conventional impression. This data integration and streamlined workflow enabled fabrication of a CAD/CAM patient-specific abutment before surgical treatment. The abutment remained in place from implant surgery to the prosthetic phase, with minimal soft-tissue changes, enabling preservation of pink esthetics and expediting treatment. The result was a preserved emergence profile in the presence of high esthetic demands. However, due to slight post-extraction soft-tissue changes, digital reformatting of the abutment was required when the final crown was fabricated, thus limiting the disruption of the biologic width to a one-time occurrence. The importance of case selection for this treatment protocol in the esthetic zone cannot be overemphasized. A thick crestal dentoalveolar bone phenotype (> 1 mm, approaching 2 mm in this case), broad zone of attached and keratinized gingiva (3 mm to 4 mm in this case), adequate peri-implant soft-tissue thickness (> 1 mm in this case), and high primary implant stability (ISQ = 80 in this case) were all critical factors influencing outcome.

Implant treatment planning software has been used successfully for more than two decades.[1-4] Such virtual planning modalities offer implant clinicians the ability to map the proposed implant sites relative to the existing bony regional anatomy, and to produce a stereolithographic surgical guide that provides a relatively precise path for optimal osteotomy site preparation in three planes of space.

Assessments of bone quality and quantity are especially critical and often require site development modalities that involve both hard- and soft-tissue regenerative therapy in order to meet acceptable pink and white outcome esthetic scores. This involves a protracted treatment course and increased expense in general. Interestingly, data from prospective clinical studies suggest that more favorable hard- and soft-tissue esthetics can be achieved in maxillary single-tooth replacement cases that do not require pre-implant surgery.[5,6]

Even if regenerative therapy is not indicated, the typical tooth replacement process requires multiple appointments, including not only diagnostic modeling, but also possible fabrication of a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Comparison of Cemented vs Screw-Retained, Customized Computer-Aided Design/Computer-Assisted Manufacture Zirconia Abutments for Esthetically Located Single-Tooth Implants: A 10-Year Randomized Prospective Study

Leonardo Amorfini, DDS[1]/Stefano Storelli, DDS, PhD[2]/Daniela Mosca, DDS[3]/
Massimo Scanferla, DMD[4]/Eugenio Romeo, DMD[5]

Purpose: To compare the clinical outcomes of screw-retained vs cemented single crowns supported by customized zirconia abutments on implants. ***Materials and Methods:*** Thirty-two patients received implant-supported (Regular Neck, Tissue-Level, Straumann AG), single-tooth restorations with customized zirconia abutments in the anterior areas. Participants were randomly assigned to the screw-retained (full-crown abutment [FCA]) group or the cemented (zirconia crown [ZrC]) group and followed up over a 10-year period. Prosthetic and biologic complications, marginal bone level (MBL), mucosal recession, and pink and white esthetic scores (PES and WES, respectively) were evaluated. ***Results and Conclusion:*** There were no implant failures during the study period; after 10 years, 94% of crowns were functional. Prosthetic complications were recorded in both groups (three FCA and two ZrC), and no significant difference was found ($P = .65$). Two cases of mucositis were recorded, one in each group. Esthetic outcomes were assessed using PES and WES scores. MBL was 0.95 mm in the ZrC group and 0.82 mm in the FCA group, with no significant difference between groups. These encouraging preliminary results need to be confirmed with long-term follow-up on larger study samples. *Int J Prosthodont 2018;31:359–366. doi: 10.11607/ijp.5305*

Several clinical studies have confirmed that the advantages of implant-supported, single-tooth restorations are comparable to those of traditional techniques.[1–3] The presence of intact adjacent teeth is an indication for a single-implant tooth replacement; however, complex surgical-prosthetic procedures may be required to optimize esthetic outcomes. Since standard abutments rarely allow customized solutions for managing demanding esthetic cases,[4,5] new materials and procedures have been developed to improve esthetic results. The recent trend in implant therapy indicates less use of standard titanium abutments and instead proposes customized components, which enable the ceramic material to provide optimal mucosal support and improve outcomes.[6] Moreover, advances in digital dentistry and new prosthetic materials enable customized esthetic solutions. Zirconia abutments have been used because of their white or tinted color and their mechanical properties.[1,7]

The present study was designed to evaluate the clinical outcomes of customized zirconia abutments used for single-tooth restorations by comparing screw-retained vs cemented restorations over a 10-year period.

Materials and Methods

A prospective randomized clinical study was designed with the aim of comparing screw-retained, full-crown abutments (FCA; ceramic veneer fused directly on the zirconia abutment) to a zirconia crown (ZrC; a porcelain-fused-to-zirconia crown cemented on a customized zirconia abutment). The study was conducted on consecutive patients at the Department of Prosthodontics, University of Milan and in two private

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Nonremoval of Immediate Abutments in Cases Involving Subcrestally Placed Postextractive Tapered Single Implants: A Randomized Controlled Clinical Study

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ABSTRACT

Purpose: The aim of this trial was to assess if the nonremoval of abutments placed at the time of surgery would improve bone and gingival healing around single immediately restored implants placed in postextraction sockets.

Materials and Methods: All patients received a single square-threaded tapered implant placed in postextraction sockets and immediately restored. All the implants were placed 2.0 mm below the bone crest, avoiding any contact with the coronal portion of the buccal wall. Six months after surgery, 35 patients were treated following the control standard prosthetic protocol: the abutments were removed and impressions were made directly on the implant platform. Thirty-three patients underwent the "one abutment at one time" test protocol: impressions were made of the abutments using snap-on abutment copies. The dimensional changes of the soft and hard tissues were assessed using digital photography and cone beam computed tomography radiographs immediately after surgery and at 6-, 12-, and 24-month follow-up examinations.

Results: All implants were osseointegrated and clinically stable at the follow-up examinations. No statistically significant difference was evidenced between the two groups regarding the measurement of vertical bone healing. After the placement of the final restoration, a significant horizontal loss in the hard tissue portion over the implant platform was assessed ($p = .03$ mesial sites; $p = .04$ distal sites). An 87% increase of the mean recession of the buccal soft tissue was observed in the control group (+0.27 mm) in the same time frame.

Conclusions: The nonremoval of abutments placed at the time of the surgery improves the stability of healed soft and hard tissues around the immediately restored, subcrestally placed tapered single maxillary implant.

KEY WORDS: alveolar bone remodeling, CBCT imaging, chamber concept, immediate loading

INTRODUCTION

The concept of placing an implant into a fresh extraction site has been evaluated many times[1] since it was first discussed in the literature.[2] The first guidelines were that, once the compromised tooth had been extracted, the alveolar socket was more or less to be completely obliterated by the immediately placed implant. These implants used to be placed precisely in the middle of the socket, at an equicrestal depth, in order to provide support for the bone walls of the socket itself. Recently, this approach has been revised: implants placed closer to the palatal wall are used and reduced diameter implants have been advocated,[3] with the intention of reducing the predicted bone loss on the buccal side as much as possible. The depth of the placement has also changed. Originally, the increase of the sinking depth of the collar of standard two-piece butt-joint connection implants was supposed to compensate for the loss of vertical bone height,[4] but some authors demonstrated that this implant design results in an increased bone loss if placed beneath the bone crest.[4,5] The introduction of tapered implants with a moderately rough surface and a shifted

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Effects of Abutment Removal and Reconnection on Inflammatory Cytokine Production Around Dental Implants

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Objectives: *The purpose of this study was to examine effects of abutment change on inflammatory cytokine production around implants.*

Materials and Methods: *Ten partially edentulous patients with a mean age of 60 years were recruited and divided into 2 groups. External Brånemark implants with anodic oxidized surface were installed and submerged in all patients. In the control group, the healing abutments were delivered at the second surgery, and they were removed more than 3 times till the final prosthesis delivery. In the test group, the final abutments were delivered at the second surgery. At different time points during the treatment, periimplant crevicular fluid was collected, and proinflammatory cytokines (interleukin-1β [IL-1β] and tumor necrosis factor [TNF]-α) were measured with enzyme-linked immunosorbent assay. The bone level was measured on the radiograms and clinical indices were also taken.*

Results: *All implants were osseointegrated. In the test group, IL-1β level and probing depths were less in test group patients compared with the control group patients, whereas TNF-α level and bone level were not different between the groups.*

Conclusion: *Although TNF-α and bone levels were not significantly different, delivering final abutment at the second surgery would induce less inflammation in the tissues around the implant. (Implant Dent 2015;24:730–734)*

Key Words: cytokines, periimplant crevicular fluid, abutment

In dental implant treatment, establishment and maintenance of healthy soft tissue around implant abutments are considered to be important for the long-term success of the implants.[1,2] Cytokines according to their function are grouped as proinflammatory and anti-inflammatory. Depending on the triggering factors, macrophages can secrete both types of cytokines. The proinflammatory cytokines are usually secreted in acute inflammation and in response to pathogens and also play a part in recruitment of neutrophils, differentiation, and activation of B and T cells.[3–5] Analyzing the periimplant crevicular fluid (PICF) is a noninvasive procedure to know the inflammatory condition around the implant. Studies have analyzed the cytokines around the healthy implants[6,7] and diseased implant sites.[8–10] The key proinflammatory cytokines interleukin-1β (IL-1β) and tumor necrosis factor (TNF-α) are among the many cytokines, which play an important role in the inflammatory process around the periimplant tissues.[8–12] Both of these cytokines play an important role in the inflammatory process[13–16] by stimulating bone resorption, prostaglandin synthesis, and protease production by many cell types that include fibroblasts and osteoblasts.[17–21]

In the standard prosthetic protocol for crestal bone level implants, the healing abutments are removed and reconnected during the various stages of the treatment. It has been reported that repeated removal and reconnection of the abutments created a soft tissue wound with subsequent bone resorption.[23] Degidi et al[25] compared bone levels between the 2 different protocols: one abutment at one time (new protocol) and the abutment disconnections (conventional protocol). The latter conventional protocol resulted in more bone loss around the implants at 3 years. However, the inflammatory cytokines in this new treatment protocol have not been analyzed.

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ORIGINAL ARTICLE

Marginal soft tissue stability around conical abutments inserted with the one abutment-one time protocol after 5 years of prosthetic loading

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Abstract

Background: Soft tissue stability is crucial to obtain and maintain optimal esthetic results.

Purpose: This study aimed to investigate, over 5 years, the soft tissue response using a conical abutment together with the "one-abutment one-time" (OA-OT) protocol in the restoration of implants inserted in the anterior esthetic area.

Material and Methods: From January 2011 to January 2012, all consecutive patients requiring an implant n the maxillary area between canines were enrolled. After submerged healing and osseointegration, a definitive abutment with a provisional crown was inserted. After 1 month, the definitive crown was delivered (Tdef). Analog impressions were taken before tooth extraction (T0), at implant insertion Timpl, and Tdef, and at 12 months (T1) and 60 months (T5). Casts were scanned and superimposed using a dedicated software. Differences in vertical height of soft tissue margins between the digitized model casts were calculated and paired sample *t* test was conducted to compare results. To detect the potential role of biotype, groups (thick vs. thin) were compared by analysis of variance with general linear model.

Results: Twenty-five patients were enrolled. Three patients dropped out. At the 60-month, 22 patients (12 men and 10 women with mean age of 68.3 ± 11 years) concluded the study follow-up. Horizontal changes demonstrated gain of 1.06 mm at Timpl, 0.94 mm at Tdef, 0.92 mm at T1 and 0.97 mm at T5 compared to T0. Vertical changes demonstrated gain of 0.84 mm at Timpl, 0.11 mm at Tdef, 0.29 mm at T1 and 0.59 mm at T5 compared to T0. The analysis of variance showed a significant better performance of thick biotype in soft tissue horizontal width (P = .022). No statistical differences were noticed for vertical width (P = .111).

Conclusions: The use of a conical abutment together with the OA-OT approach allowed longitudinal stable soft tissue dimensions.

KEYWORDS

conical abutments, long-term, one-abutment-one-time, platform switching, soft tissue, soft tissue biotype

1 | INTRODUCTION

Dental implants are now-a-days a routine and highly successful treatment to rehabilitate edentulous areas.[1] Functional success is predictable according to the literature, so current long-term outcome assessments are focusing on the maintenance of soft and hard tissue stability.[2]

Peri-implant soft tissues have an essential role as barrier between the environment and the peri-implant bone.[3] In this sense, thick soft tissues have been associated with reduced peri-implant marginal bone

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ORIGINAL ARTICLE

Five-year cohort prospective study on single implants in the esthetic area restored using one-abutment/one-time prosthetic approach

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Abstract

Purpose: This study was aimed to investigate, over 5 years, bone response to "one-abutment onetime" (OA-OT) protocol in the restoration of implants inserted in the anterior maxilla. Additionally, influence of soft tissue biotype in the bone remodeling was investigated.

Materials and Methods: From January 2011 to January 2012, all consecutive patients presented with a hopeless tooth in the maxillary area between canines were enrolled. Post-extraction ridge preservation was performed. After 6 months, implant was midcrestaly inserted and intraoperative impression was taken. Two months thereafter an immediate definitive abutment with a provisional crown was inserted. At final crown connection, patients underwent a standardized periapical radiograph (T0). At 12 (T1), 24 (T2), 36 (T3), 48 (T4), and 60 (T5) months, radiographic follow-up and clinical control were carried out. Independent sample *t*-test was conducted to compare bone loss at different times. To detect the potential role of biotype, groups (thick TK vs thin TH) were compared by analysis of variance with general linear model.

Results: Twenty-five patients were enrolled, but only 22 patients concluded the study. The radiographic analysis showed a stable longitudinal condition of bone levels after the first-year significant increasing (0.17 ± 0.25 mm, 0.33 ± 0.25 mm, 0.28 ± 0.27 mm, 0.25 ± 0.26 mm, 0.31 ± 0.35 mm, and 0.31 ± 0.29 mm, respectively at T1, T2, T3, T4, and T5). No statistical significant differences in bone loss among the two groups TH vs TK over the time ($P = 0.952$) were demonstrated.

Conclusion: Results showed that the OA-OT approach allow to obtain stable bone levels.

KEYWORDS
dental implant prosthesis, one abutment one time, peri-implant marginal bone levels

1 | INTRODUCTION

Traditionally an implant was defined successful when less than 1.5 mm of bone were lost during the first year of function and less than 0.2 mm annually thereafter.[1]

However, this criterion is difficult to accept in the esthetic area where a bone loss even lower than 1.5 mm could dramatically affect the esthetic outcome and is scarcely tolerated by patients. For this reason, many researches in the last years had focused their attention on the best options to preserve the buccal bone plate and soft tissues especially in the esthetic zone.[2-9] The sub-crestal placement of the implant shoulder was proposed by Buser et al[2] to obtain a more comfortable prosthetic emerging profile and improve soft tissue esthetic results. Unfortunately, after the connection of the abutment and delivery of the final prosthesis, a "physiological" adaptation of the bone was observed around two-piece implants, both horizontally and vertically.[6] This increased loss may be caused by the bacterial colonization of the micro-gap presents in the fixture/abutment junction, as had already been reported by Quirynen.[10] The platform switching

Review

The One Abutment–One Time Protocol: A Systematic Review and Meta-Analysis

Momen A. Atieh,*† Andrew Tawse-Smith,*† Nabeel H.M. Alsabeeha,‡ Sunyoung Ma,* and Warwick J. Duncan*†

Background: The use of definitive abutments (DAs) at time of implant placement has been introduced to overcome limitations of dis/reconnection of healing/provisional abutments (PAs). With little and inconsistent information in the literature regarding the effectiveness of using DAs, the aim of this systematic review is to examine marginal bone and soft tissue level changes, technical and biologic complications, and implant failure rate associated with use of DAs and PAs.

Methods: This systematic review was prepared according to guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement. MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, and online trial registers were searched for studies comparing use of DAs and PAs. The Cochrane Collaboration risk of bias tool was used to assess selected studies, and meta-analyses were performed using statistical software.

Results: A total of 1,124 citations were identified. Of these, seven trials with 363 dental implants in 262 participants were included in the analysis. Pooled estimates for marginal bone level changes showed significant differences between the two prosthetic techniques in favor of using DAs. No significant differences were found in soft tissue level changes, technical and biologic complications, or implant failure rate.

Conclusions: Within the limitations of this review, DAs appear to be a viable alternative to PAs at time of implant placement. However, favorable changes in peri-implant marginal bone level associated with use of DAs should be viewed with caution as its clinical significance is still uncertain. *J Periodontol 2017;88:1173-1185.*

KEY WORDS

Dental abutments; dental implants; dental implant–abutment design; meta-analysis as topic; review literature as topic.

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Outcomes of dental implant treatment are among the most studied and most predictable of therapeutic options in modern dentistry. Although the validity of titanium to bone osseointegration has been established beyond doubt, the long-term stability of peri-implant hard and soft tissues remains one of the main challenges in implant treatment.[1] In this context, different implant micro and macro designs,[2-7] surgical and prosthodontic protocols,[8-11] prosthetic superstructures, implant–abutment connections, and platform-switching concepts have been developed to minimize marginal bone loss (BL) and maintain peri-implant soft tissue levels, although without clear evidence of the superiority of one design over another.[12-14]

One of the limitations of the standard prosthetic protocol for implant treatment is the need to disconnect and reconnect the prosthetic components. Such frequent exchange of abutments may disturb the surrounding peri-implant mucosal barrier and subsequently cause marginal BL.[15,16] In the current era of increased emphasis on minimizing soft and hard tissue trauma, the "one abutment–one time" protocol was introduced as a minimally invasive prosthetic protocol.[17,18] It involves the use of one definitive abutment (DA) instead of a cover screw or healing/provisional abutment (PA) at the time of implant placement to overcome potential limitations of repeated changes of a cover screw or PA.[17,18]

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Definitive Abutments Placed at Implant Insertion and Never Removed: Is It an Effective Approach? A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Purpose: To assess whether repeated abutment disconnections and reconnections have any impact on peri-implant bone resorption and soft tissue healing.

Materials and Methods: Electronic and manual searches were conducted for English-language articles published up to March 2017 that identified a relation between repeated disconnections of implant abutments (PA group) and prosthetic or implant failures, complications, marginal bone loss (MBL), soft tissue healing, and esthetic evaluation (pink esthetic score [PES]) after at least 1 year of function compared with implants receiving a final abutment at the time of implant placement (DA group).

Results: Fourteen articles (535 patients with 994 implants) were selected for qualitative analysis. Six of these were included in the meta-analysis. Five prostheses failed in the PA group and 1 failed in the DA group (P = .1047). Seven biologic complications occurred in the PA group and 6 occurred in the DA group (P = .8121). MBL was significantly less in the DA group (difference, 0.279 mm; P = .000). Greater buccal recession occurred in the PA group (difference, 0.198 mm; P = .0004). The PES evaluation showed no differences between groups (P = .289).

Conclusions: Repeated abutment disconnections and reconnections considerably increased MBL and buccal recession. Further studies are needed to confirm these results.

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Previous reports by consensus conferences and observational studies have suggested that numerous etiologic factors are specifically associated with peri-implant bone loss, including, but not limited to, surgical trauma, occlusal overload, biologic width establishment, design of the implant-to-abutment interface, and flap procedures.[1-4]

After connection of the abutment and delivery of the final prosthesis, physiologic horizontal and vertical bone remodeling is observed around 2-piece implants; thereafter, minimal annual bone loss is observed.[5] According to Papaspyridakos et al[6] and Galindo-Moreno et al,[7] the bone remodeling process is multifactorial and represents one

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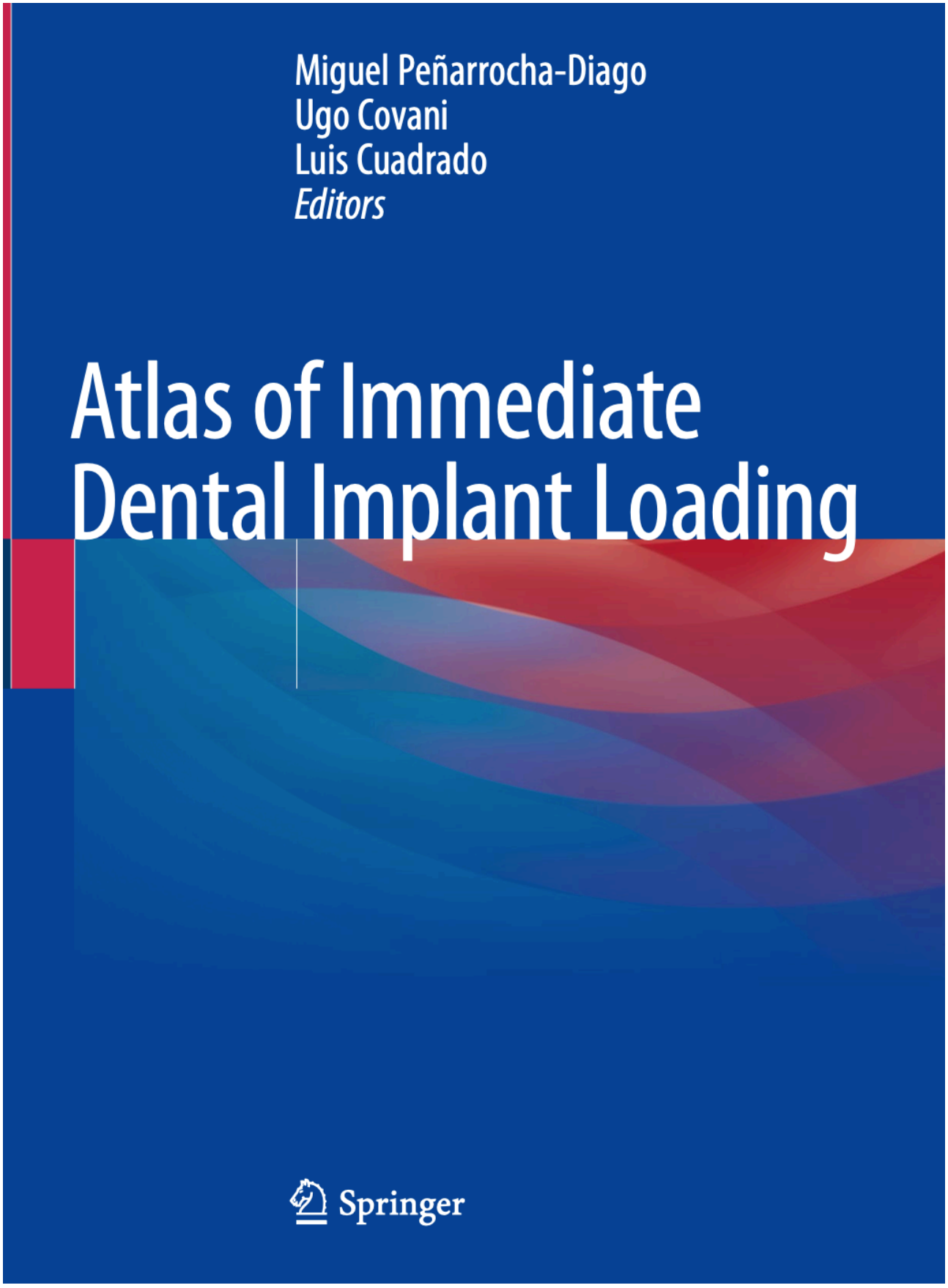
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