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CONFECCIÓN DE PROVISIONALES PARA EL MANEJO DE TEJIDOS BLANDOS EN PRÓTESIS SOBRE IMPLANTES

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RESUMEN:

Introducción: La restauración mediante implante en el sector anterior es un tratamiento ampliamente aceptado y cada vez más demandado, sin embargo, cuando queremos obtener un resultado estético ideal, se convierte en una tarea específica y minuciosa para el clínico.

Objetivos: El objetivo principal se basó en evaluar cómo lograr una estética ideal mediante la fabricación de provisionales sobre implantes unitarios en el sector anterior.

Metodología: Se realizó una búsqueda bibliográfica a través de bases de datos científicas. La selección final fue de 54 artículos.

Discusión de Resultados: Diferentes estudios han documentado la importancia del procedimiento quirúrgico en la colocación del implante, de igual manera ocurre con la fase protésica. Por consiguiente, para obtener el resultado estético más favorable posible, entra en juego la elaboración de un provisional con el que conformar y mantener los tejidos periimplantarios.

Varios obstáculos clínicos pueden complicar la decisión a tomar para la elaboración de un provisional implantosoportado, como la ubicación del implante y la situación inicial de los tejidos que rodean al implante.

Conclusiones: Se presentan múltiples alternativas ante la confección de un provisional sobre implante en el sector anterior, como la elección de hacerlo de forma inmediata o diferida, o si el tipo de provisional ha de ser atornillado o cementado, así como los aditamentos y materiales a usar. Del mismo modo, cuándo y cómo aplicar un diseño cóncavo o convexo en las áreas del contorno crítico y subcrítico del provisional, todas ellas son cuestiones de gran relevancia clínica.

ABSTRACT:

Introduction: Implant restoration in the anterior sector is a widely accepted and increasingly demanded treatment, however when we want to obtain an ideal aesthetic result, it becomes a specific and meticulous task for the clinician.

Objectives: The main objective was based on evaluating how to achieve ideal aesthetics by making temporaries on single implants in the anterior sector.

Methodology: A bibliographic search was carried out through scientific databases. The final selection contains 54 articles.

Discussion of Results: Different studies have shown that the surgical procedure presents a great importance in the placement of the implant. It happens the same with the prosthetic phase. Therefore, making a provisional with which to shape and maintain the periimplnatary tissues is decisive to obtain the best possible aesthetic result.

Several clinical obstacles can complicate the decision to be made for the development of an implant-supported provisional, such as the location of the implant and the initial situation of the tissues surrounding the implant.

Conclusions: Multiple possibilities are presented before the preparation of a provisional over implant in the anterior sector, such as the choice to do it immediately or delayed or if the type of provisional has to be screwed or cemented, as well as the accessories and materials to be used. Similarly, when and how to apply a concave or convex design in the critical and subcritical contour areas of the provisional, all of them are questions of great clinical relevance.

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1 INTRODUCCIÓN:

La rehabilitación mediante implantes para dientes ausentes en la zona estética es una opción de tratamiento óptima y de elección para su restauración[1].

Durante más de treinta años se ha constatado, tanto en la literatura científica, como en la práctica clínica un resultado previsible en el tiempo, basado principalmente en el éxito de la osteo-integración de los implantes, centrando la investigación en su supervivencia y el tratamiento de superficies[2, 3].

Sin embargo, en la odontología actual se destaca cada vez más la exigencia estética que demandan los pacientes. Ante esta situación se considera de vital importancia, no sólo lograr la reposición del diente y su función, sino también conseguir un resultado estético satisfactorio para el paciente. La pérdida de alguna pieza dental en la zona anterior del maxilar es un reto para el profesional[4], de ahí que su rehabilitación mediante implantes requiera un trabajo planificado y minucioso para obtener el mejor resultado estético cumpliendo con las expectativas de los pacientes[2, 5, 6].

Los protocolos respecto a la colocación de un implante han ido cambiando en el tiempo. Donde antes se recomendaba un periodo mínimo de espera de tres meses después de la extracción de un diente para la colocación de un implante, hoy en día, puede realizarse la colocación inmediata del implante en el alveolo en el momento de la extracción, de esta forma se produce al mismo tiempo la cicatrización del alveolo junto con la osteointegración del implante, consiguiendo con ello reducir el tiempo de tratamiento[1].

En términos de estética, el uso de implantes dentales en el sector anterior es un procedimiento

sensible a la técnica, ya que los posibles errores en la colocación del implante o el manejo de los tejidos blandos pueden causar un enorme fracaso estético[7].

En consecuencia, es de interés conocer el proceso de reabsorción y remodelación que sufren las estructuras óseas y tejidos blandos tras la extracción dental[8]. Después de la extracción de un diente existe una pérdida ósea de la cresta alveolar[8, 9], dicha pérdida es más acusada cuanto más delgada es la pared del alveolo, siendo la más afectada la pared bucal de los incisivos maxilares[8][10]. De igual manera se ven afectados los tejidos blandos tras la extracción, permaneciendo más estables y predecibles los que presentan paredes óseas gruesas[8]. Hay que tener en cuenta que esta pérdida de cresta alveolar también ocurre en la colocación de un implante de forma inmediata[8,11], aunque se ha probado que para minimizar esta pérdida de volumen del reborde se puede regenerar el área existente entre el implante y la pared bucal del alveolo, lo que además será beneficioso para la estabilidad del tejido gingival[9].

Se describen diferentes planes de acción respecto a la colocación de un implante y su restauración. La elección del plan de acción es independiente para cada caso y se ve afectado por las distintas condiciones clínicas. Las paredes alveolares y los tejidos blandos pueden presentar fenestraciones o incluso deshidencias, de modo que la decisión del abordaje quirúrgico depende principalmente de su estado[11, 12, 13]. Por consiguiente, el implante se puede colocar de forma inmediata, temprana o tardía[14], así como la carga del implante, que puede ser carga inmediata, restauración inmediata, carga temprana y carga convencional. En cada caso, el tiempo de tratamiento varía de forma significativa[12, 13, 15].

Así pues, en los alveolos que presenten unas paredes en condiciones óptimas de reabsorción ósea se puede optar por la colocación de un implante de forma inmediata[8]. A su vez también se debe valorar el estado de los tejidos blandos, siendo más previsibles los de biotipo grueso[14,

16].

Los implantes diseñados para que la conexión del pilar se posicione a nivel yuxtaoseo, son preferiblemente indicados en el área estética, dado que así el clínico tendrá más libertad en el manejo de los tejidos blandos[7, 17].

En relación a la conexión del implante y de acuerdo con la literatura revisada, la recomendación para implantes individuales en el área estética es la conexión interna, en particular la cónica, por presentar una alta estabilidad mecánica, mejor sellado entre la interfase pilar-implante y una menor pérdida ósea a nivel crestal[18, 19, 20]. Del mismo modo, se ha demostrado que los implantes con cambio de plataforma pueden mejorar la estabilidad de los tejidos óseos así como los tejidos blandos periimplantarios[7, 14, 21].

Para lograr el éxito del tratamiento con implantes en el área anterior y una estética agradable, uno de los objetivos clave y desafiantes del tratamiento es obtener el contorno ideal del tejido blando existente alrededor del implante. Igualmente la altura de las papilas interdentales debe coincidir y armonizar con la de los dientes adyacentes[22].

Aunque para realizar un análisis y diagnóstico estético completo es necesaria la combinación de parámetros faciales, dento-labiales, fonéticos, dentales y gingivales[5, 23], para la restauración individual de un implante en el sector anterior se destaca principalmente la evaluación del análisis dentolabial y dentogingival[5].

De manera que, en los últimos años se han incorporado a los estudios nuevos índices estéticos específicos a través de un sistema de puntuación, siendo estos[24]:

- *Implant Crown Aesthetic Index* (ICAI)

- *Subjective esthetic score (SES)*
- *Peri-implant and Crown Index* (PICI)
- *Pink Esthetic Score* (PES)
- *White Esthetic Score* (WES)

Estos índices se utilizan para evaluar la estética en coronas sobre ún único implante; ICAI es un índice que valora la estética de la corona del implante, SES aporta una puntuación estética subjetiva, PICI es un índice de corona y tejido periimplantario y por último, el índice más completo abarca PES / WES.

PES (puntuación estética rosa) (Fig. 1) como su propio nombre indica se encarga de evaluar toda la zona rosa, es decir, toda la encía que hay alrededor del implante en la cara bucal. Por otro lado, el WES (puntuación estética blanca) (Fig. 1) se centra específicamente en la zona visible de la restauración del implante, en otros términos, la parte de la corona que emerge de la mucosa periimplantaria[7, 24].

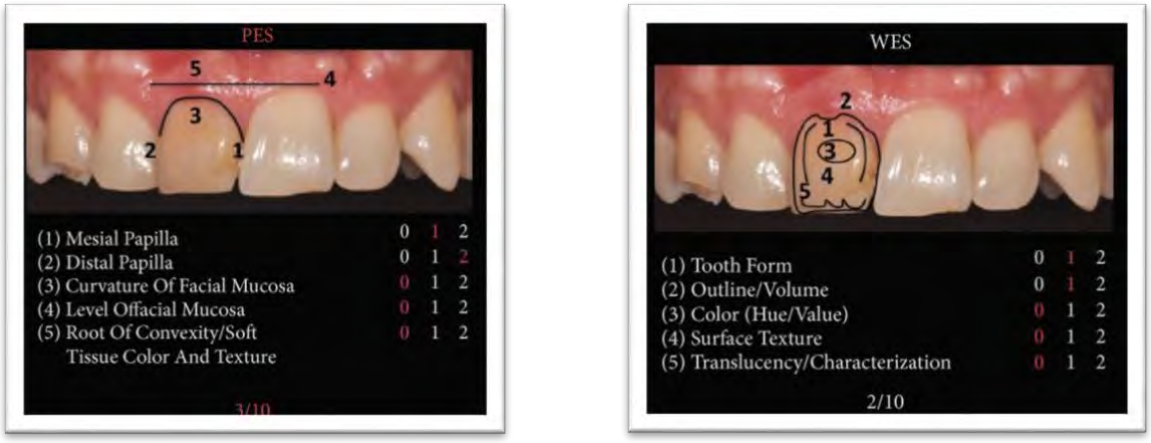

Figura 1: Aplicación clínica del índice PES / WES en dientes naturales[24].

A la hora de confeccionar un provisional sobre implante (CPI), se han de analizar cuidadosamente los siguientes condicionantes:

1.1 PERFIL DE EMERGENCIA:

El perfil de emergencia (PE) es la zona que está representada por la parte intramucosa de la restauración[25]. La colocación de un CPI es recomendable y beneficioso para guiar el PE y conformar la arquitectura de los tejidos blandos periimplantarios, así como su conservación[17, 21, 22, 26, 27], al igual, cabe destacar que el mantenimiento y desarrollo de las papilas está íntimamente ligado con el hueso marginal y el nivel de inserción del diente vecino[21]. De este modo se logra acondicionar la mucosa antes de la restauración definitiva[28].

En ocasiones es necesario un aumento de volumen gingival, lo que requiere un injerto de tejido blando. Este aumento de tejido se puede realizar tanto a nivel vertical como horizontal, por tanto, se han descrito diferentes técnicas quirúrgicas para corregir defectos de tejidos blandos, pudiéndose realizar en el momento de la colocación del implante o pasados unos meses de cicatrización[8, 9, 22, 29].

El tejido blando periimplantario consta de tejido conectivo y epitelio de unión, sin embargo este tejido tiene una disposición diferente al del periodonto que rodea el diente natural (Fig. 2). Puesto que el complejo de tejido periimplantario carece de fibras Sharpey, ofrece menos resistencia al sondaje clínico y a la penetración de biopelículas (Fig. 3) en comparación con un diente natural. Por lo tanto, es de suma importancia el correcto diseño del PE de la restauración[30].

Figura 2: Contorno de un diente natural sano. Distribución de las fibras Sharpey del tejido conectivo que se insertan en el cemento, perpendicular al eje longitudinal del diente[30].

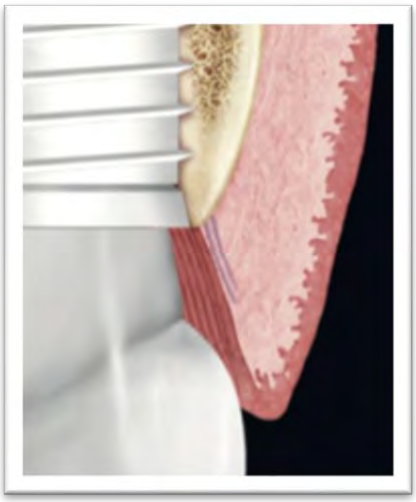

Figura 3: Contornos de un implante. Distribución de las fibras de tejido conectivo paralelas al eje longitudinal de la restauración sobre implante[30].

Es conveniente que la colocación del implante en el sector anterior se realice a cierta profundidad para lograr un margen mucoso suficiente y así poder cubrir las necesidades del diseño de la prótesis[25, 30, 31].

Se definen dos áreas en la zona transgingival del CPI, estos son el contorno crítico y el contorno subcrítico, en estas áreas se producen modificaciones para conformar los tejidos blandos[27, 30].

1.1.1 EL CONTORNO SUBCRÍTICO.

Este contorno se sitúa apical. Es la zona más profunda de la restauración, espacio que comprende entre el cuello del implante y el margen gingival. Puede diseñarse siguiendo un perfil recto, cóncavo o convexo según la posición y angulación del implante. El contorno subcrítico está condicionado por la profundidad a la que se coloque el implante, de ello depende que exista suficiente espacio, a este área se la denomina "espacio para correr"[30, 31].

La angulación del implante hacia palatino o hacia bucal va a determinar la orientación del área subcrítica[30].

1.1.2 EL CONTORNO CRÍTICO

Se ubica subgingival a la corona del diente, lo representa la unión amelocementaria. Se encuentra alrededor de toda la restauración de forma circunferencial. Asiduamente este contorno tendrá un perfil convexo, pero existen excepciones según la posición del implante[27, 30, 31]

De manera similar otros investigadores desarrollan una descripción del perfil de emergencia con más divisiones. Este es el concepto de *esthetic biological contour* (EBC) (Fig.4) es un parámetro específico para un diseño adecuado del perfil de emergencia y de este modo conseguir tratamientos estéticos y biológicamente sólidos con CPI[32].

Figura 4: Vistas frontal y lateral de las zonas de contorno biológico estético del perfil de emergencia[32].

Cada una de estas zonas estará en contacto con un tipo específico de tejido y su diseño tendrá una función diferente (Tabla 1).

Tabla 1: Las zonas del contorno biológico estético, características perio-prostodóncicas[32]

	Función	Diseño	Tejido	Histología	Longitud
ZONA E	Acondicionamiento estético	Convexo para brindar soporte al margen gingival	Epitelio sulcular	Epitelio escamoso estratificado	1 mm
ZONA B	Área de límite biológico	Depende de la posición del implante y del grosor del tejido blando	Epitelio de unión	Epitelio no queratinizado	1-2 mm
ZONA C	Estabilidad del hueso crestal	Recto	Tejido conectivo	Tejido conectivo	1-1,5 mm

1.2 RESTAURACIONES PROVISIONALES INMEDIATAS O DIFERIDAS.

1.2.1 PROVISIONAL INMEDIATO:

La colocación de implantes de forma inmediata en un alveolo postextracción en el sector estético ha ido ganado popularidad puesto que se presentan múltiples ventajas ante esta situación, como que al agrupar procedimientos se reduce el periodo del tratamiento general y con ello se mejora la experiencia total del paciente[33]. Sin embargo, también se plantean diversos factores de riesgo que pueden derivar en grandes complicaciones estéticas[7, 34].

La decisión para seleccionar como parte del tratamiento la colocación de implante con restauración inmediata (CPII) variará según la situación clínica, dicha decisión depende principalmente de los siguientes requisitos[17, 22]:

- La extracción del diente debe ser lo más atraumática posible, sin elevación de colgajo ya que esto interrumpe la vascularización del hueso facial y puede contribuir a la recesión de la mucosa gingival facial[8, 35].

- Es esencial la estabilidad primaria del implante, siendo así cuando el torque de inserción del implante es de 30 Ncm o superior[9, 11] o un valor ISQ superior a 70[15].
- La posición y angulación correcta del implante, tanto tridimensionalmente como en profundidad. La tendencia es una inserción hacia el hueso palatino[11, 12, 14, 27]. El implante debe quedar sumergido lo suficiente para así poder trabajar de una forma correcta el PE. De este modo es de vital importancia el uso de la tecnología 3D para una correcta planificación[9, 12].
- La cantidad y calidad del tejido duro y/o blando. El tratamiento es más favorable ante un biotipo de tejido gingival grueso[31], así como en un alveolo con paredes de hueso intacto y de buena calidad. Conservar al menos 1mm de pared bucal y carecer de infección aguda[8, 15], todos estos son requisitos necesarios para la realización del CPII.

El objetivo principal en la CPII es dar apoyo y estabilidad a la arquitectura de los tejidos blandos para conseguir un contorno natural y estético, para ello es necesario que la arquitectura existente sea óptima y no presente anomalías antiestéticas[27].

Cabe destacar la diferenciación entre "restauración inmediata" y "carga inmediata" debido a que se considera restauración inmediata siempre que esta se realice dentro de las 48 horas posteriores a la inserción del implante y en ausencia de contactos, tanto en oclusión céntrica como excéntrica[1].

La restauración inmediata no debe comprimir ni los tejidos blandos ni los duros, por esta razón debemos tener en cuenta que tras la cirugía se va a producir un proceso inflamatorio que puede dar lugar a una isquemia no deseada, reduciendo así el espacio regenerativo necesario entre la superficie de la restauración y los tejidos circundantes del implante para la formación de un coágulo estable y la contención del material injertado (Fig. 5). Si existiera esa falta de espacio

se podría producir un colapso de los tejidos blandos produciendo complicaciones estéticas[27].

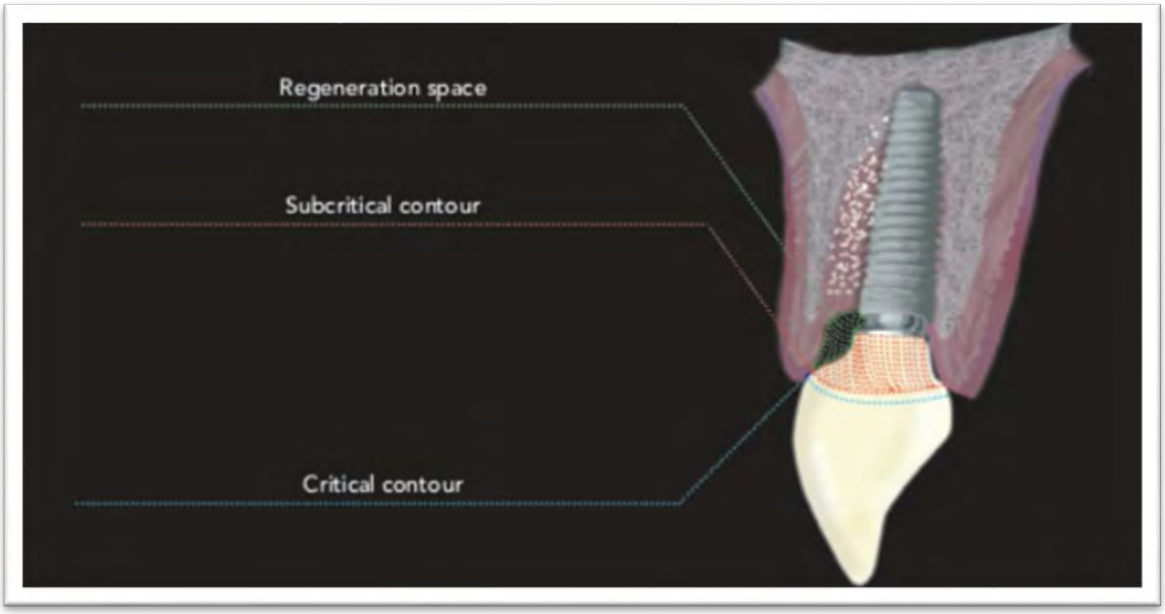

Figura 5: Mantener el espacio regenerativo evitando la compresión de los tejidos duros y blandos es obligatorio al colocar una CPII[27].

El contorno crítico generalmente presenta un diseño convexo (Fig. 5) que va a soportar el margen gingival y la altura de la papila de manera que se mantenga la arquitectura preexistente[27, 30].

La transición entre las zonas crítica y subcrítica debe ser continua y armoniosa. Antes de la instalación de la CPII se ha de pulir para que quede suave y lisa y así evitar la contaminación bacteriana durante la cicatrización[27].

Naturalmente, es conveniente que el CPII no se retire durante todo el proceso de osteointegración, y realizar un control clínico y radiográfico periódico[36].

En otro orden de ideas, se describen otros diseños para la CPII como el diseño CSC (contorno subgingival cóncavo) (Fig. 6) cuyo objetivo es conseguir un mejor sellado biológico gracias a un collarete de tejido fibroso que se formaría tras realizar un surco cóncavo alrededor de todo

el perímetro del provisional a 2 mm del margen gingival. El diseño CSC está especialmente indicado en casos que presenten un periodonto fino[36].

Figura 6: Detalle de la restauración inmediata implanto-soportada atornillada con el contorno subgingival cóncavo (CSC)[36].

La tecnología digital en este momento nos aporta una herramienta de gran utilidad, pero hay que tener en cuenta que está en continua evolución. Hay estudios que tratan del uso de la tecnología digital para la toma de impresiones del alveolo tras la extracción (Fig. 7), obteniendo así un modelo ideal para la confección del provisional y la colocación inmediata de un implante[6]. De otra forma, también se emplea la tecnología digital para la elaboración de guías quirúrgicas que dirigen la posición óptima para la colocación del implante, así como la confección de un dispositivo de posicionamiento para la restauración provisional a través de una prueba virtual de diagnóstico, planificado en un software de diseño asistido por ordenador(CAD)(Fig. 8)[37].

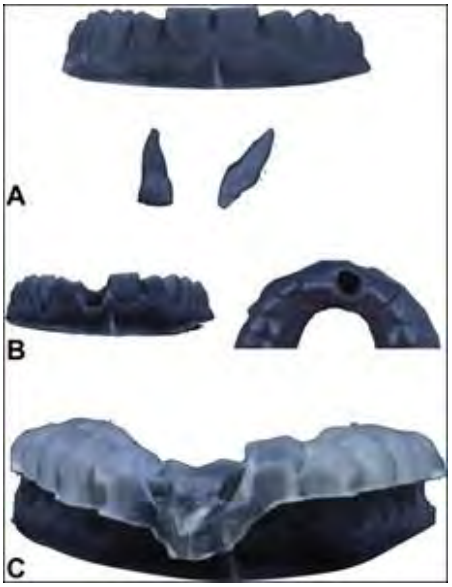

Figura 7: (A) modelos impresos en 3D del maxilar y el diente del paciente, (B) modelo3D del alveolo de extracción creado digitalmente antes del procedimiento quirúrgico, (C) guía para la colocación de implantes ajustada al modelo[6].

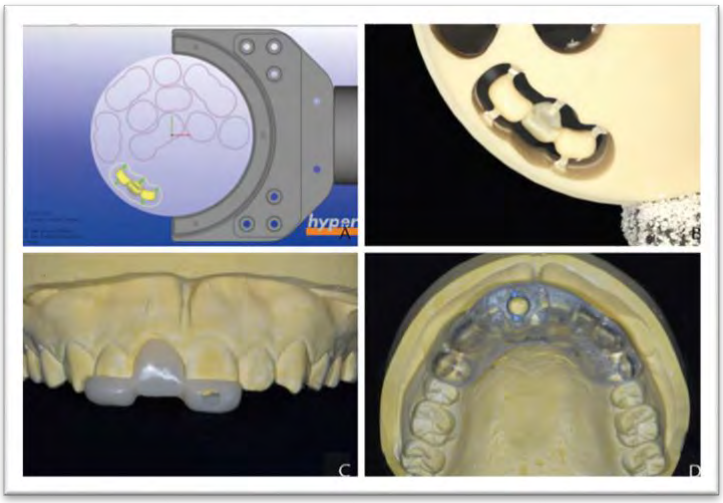

Figura 8: (A) captura de pantalla del software de la fresadora, (B) Salida inmediata después de fresar el dispositivo de posicionamiento de la matriz con bloque de resina (metacrilato de metilo), (C) dispositivo de posicionamiento de matriz, (D) guía quirúrgica CAD[37]

1.2.2 PROVISIONAL DIFERIDO:

Cuando se presentan casos con deficiencias óseas o que no cumplen alguno de los requisitos desarrollados anteriormente, necesarios para la colocación de un implante inmediato, se opta por un tratamiento más previsible como es la restauración provisional diferida (CPI)[3].

Durante el tiempo de espera para la osteointegración del implante y maduración de los tejidos blandos, para cubrir someramente la estética del paciente se pueden colocar diferentes tipos de prótesis sin estar soportadas sobre el implante, desde una prótesis parcial removible de acrílico, un puente tipo Maryland / tipo Rochette o una férula tipo essix, entre otras[3, 17, 22, 29, 38]. En referencia a la prótesis fija adherida con resina como es el puente tipo Maryland o Rochette, además, en ciertas ocasiones, pueden ser empleadas para dar forma a los tejidos mediante la técnica de presión selectiva y así evitar que quede un contorno anatómico plano[3].

Llegado el momento para la fabricación del CPI, previamente se ha de evaluar la arquitectura del tejido del que disponemos alrededor del implante. Generalmente nos encontramos con cuatro posibles escenarios[27]:

a) Perfil de cresta sobreaumentado.
b) Una Cresta ideal.
c) Una cresta subcontorneada, con una discrepancia horizontal de 1,5 a 2mm.
d) Una cresta con un contorno deficiente con una discrepancia más significativa.

a) Perfil de cresta sobreaumentado.

En esta situación de cresta sobreaumentada en la que se encuentra el margen gingival vestibular aumentado hacia coronal, el encargado principal de acondicionar este escenario es el contorno crítico. Para conseguir un desplazamiento apical del margen gingival de una forma armoniosa, se debe aumentar y desplazar la forma convexa del contorno crítico, en una dirección facial – apical, de esta manera observamos que se invade parte del espacio del contorno subcrítico y a su vez se ve disminuido, dicho contorno se mantendrá recto o cóncavo[27].

b) Cresta ideal.

Ante una cresta ideal, no queremos variar el contorno. En esta situación, el contorno crítico debe situarse igual al del diente natural (convexo) y el contorno subcrítico al igual que en la situación anterior, será un diseño recto o cóncavo[27].

c) Una cresta subcontorneada, con una discrepancia horizontal de 1,5 a 2mm.

En esta situación existe un reborde deficiente, donde el nivel gingival se ubica hacia apical del

nivel óptimo. Cuando esa discrepancia oscila entre1,5 a 2mm en sentido horizontal, se puede recomendar reducir el volumen convexo del contorno crítico, de manera que esto pudiera permitir la migración coronal del margen gingival. De otro modo, al contorno subcrítico se le puede modificar dándole un diseño con un contorno convexo sólo en la cara bucal. Si embargo también se puede intentar cubrir esta deficiencia de reborde con un injerto de tejido conectivo y la inserción del provisional, ante esta situación, también se debe reducir el volumen del contorno crítico para evitar presiones inadecuadas sobre el tejido injertado[27].

d) Una cresta con un contorno deficiente con una discrepancia más significativa.

Ante discrepancias mayores de tejido solo cabe la posibilidad del aumento quirúrgico. Es recomendable que este acto quirúrgico se realice con anterioridad a la fase provisional, por ejemplo durante la cirugía del implante[27, 39].

Por otro lado, ante una papila disminuida en altura se puede sopesar un aumento del contorno crítico en este área. Así mismo también se puede aumentar la convexidad del contorno subcrítico para promover un aumento de las papilas hacia coronal de entre 0,5 a 1mm[27, 31]. Para que la corona no presente una apariencia demasiado cuadrada se puede optar únicamente por darle convexidad al contorno subcrítico, sin embargo hay que tener precaución de no impactar contra el hueso alveolar por lo que es necesario disponer al menos de un grosor de 2 a 3mm de espacio interdental[27, 31].

Como ya se ha descrito anteriormente, este tipo de restauraciones están condicionadas por la posición del implante, debido a que esto influye en gran medida en el diseño del PE.

Por este motivo y de una forma general, cuando la posición del implante es hacia palatino o incisal, el contorno crítico debe ser convexo y el contorno subcrítico debe ser plano o

cóncavo[30].

Ante un implante colocado excesivamente hacia el lado facial, puede estar indicado un diseño plano o cóncavo para el contorno crítico y de igual manera será plano o cóncavo el contorno subcrítico [30].

Una forma de guiarnos sobre la cantidad de material que debemos añadir al CPI y cuanta presión se debe aplicar, es mediante la técnica de "compresión dinámica"[17]. En esta técnica la indicación es que la reacción isquémica que se genera con la presión del CPI modificado, ha de ser moderada y no debe superar la mitad de los dientes adyacentes. Es de vital importancia que la apariencia blanquecina de la encía provocada por la reacción isquémica, debe desaparecer en 15 minutos, de lo contrario se puede provocar daño tisular o incluso necrosis[17, 22].

Una vez que se ha conseguido la posición correcta, es importante ser especialmente cuidadosos particularmente en la zona de las papilas. Hay que reducir progresivamente el volumen del provisional y darle forma subcontorneada para provocar que las papilas maduren en ese espacio. Normalmente son necesarias varias citas para lograr el objetivo[17, 22].

1.3 Provisional Atornillado o Cementado.

A la hora de realizar un provisional sobre implantes en el sector anterior hay que tomar una importante decisión sobre la confección de dicho provisional, para que la elaboración sea de forma atornillada o cementada.

Existen diferentes aspectos clínicos que se deben valorar antes de definir el tipo de restauración provisional a realizar[18, 40, 41]. Teóricamente cuando el implante presenta una posición más

palatina la tendencia será utilizar una prótesis atornillada, de otro modo, cuando la inclinación del implante es más hacia el borde incisal, se puede elegir una prótesis cementada[18]. Sin embargo, existen más consideraciones a tener en cuenta, además de la posición tridimensional del implante, se han de valorar también la profundidad del implante, el espacio interoclusal, el espacio interproximal y el tejido perriimpantario[40].

Se recomienda confeccionar el mismo diseño de contorno crítico y subcrítico, tanto en los provisionales atornillados, como en los cementados[30].

Las principales diferencias entre un provisional cementado frente a un provisional atornillado, es que el provisional cementado se encuentra, por un lado, un pilar que va directo al implante, pudiendo ser este prefabricado (Fig. 10) o personalizado (Fig. 13,14), con el contorno subgingival acondicionado para conformar los tejidos blandos y por otro lado, una corona provisional de acrílico o incluso el propio diente del paciente ahuecado que irá cementada sobre el muñón de forma provisional[3, 25, 33, 40, 42].

En cambio, el provisional atornillado se elabora todo en una única pieza. Consta de un pilar normalmente de titanio o de PEEK (poliéter éter cetona) (Fig.17) que se acondiciona para conformar los tejidos blandos, normalmente mediante resina acrílica o composite fluido y se une a la vez con una corona provisional consiguiendo agrupar dos materiales individuales en una única restauración[18, 22, 42].

1.4 MATERIALES

Se describen diferentes componentes y materiales para la confección de los CPII, aportando cada una de ellas diferentes ventajas.

1.4.1 USO DE DIENTES ANTERIORES EXTRAÍDOS:

La provisionalización mediante los dientes del paciente es de gran utilidad, tanto para proporcionar una situación cómoda al paciente, como para guiarnos en la cirugía de los implantes (Fig. 9). Con este protocolo se consigue un PE similar al diente natural. Este procedimiento se puede llevar a cabo siempre y cuando la estructura del diente no esté dañada, como es el caso que exponen en el artículo citado, en el que la paciente pierde tres incisivos por una reabsorción radicular externa grave[2, 3].

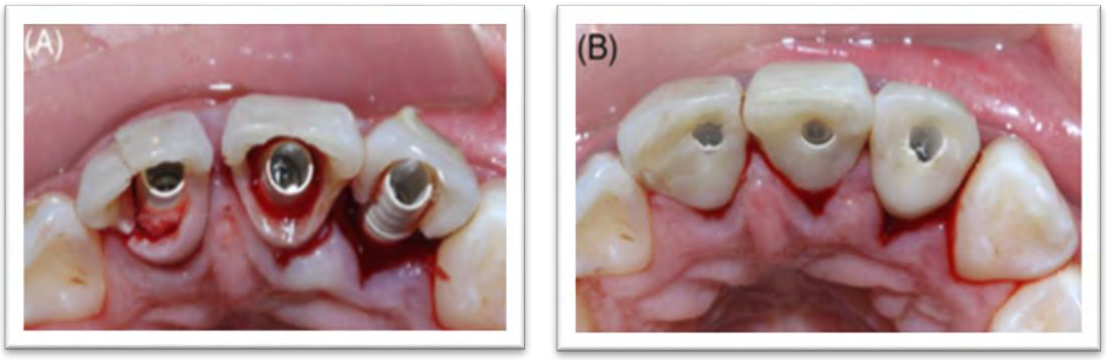

Figura 9: A, pilares temporales de plástico con coronas naturales. B, Vista oclusal maxilar de la restauración provisional atornillada[2].

1.4.2 PILARES PREFABRICADOS:

Los pilares prefabricados suelen ser de Titanio (Fig.10) o de poliéter éter cetona (PEEK) (Fig. 11 y 12). Es un pilar curativo multifuncional y son utilizados como apoyo para la confección de los CPII[3, 37, 43, 44]. Los pilares PEEK presentan propiedades que indican su uso como biomaterial para pilares transitorios, sin embargo, dada su superficie inerte dificulta la unión a los materiales dentales para subsanar este inconveniente se recomienda desbastar el material superficialmente[43]. Dichos pilares se atornillan sobre el implante y sobre ellos se puede colocar una corona de acrílico o bien el diente natural que se ha extraído al paciente. De esta manera se construye una prótesis provisional atornillada[18]. Cuando se trata del diente

natural, previamente se ahueca y se ajusta al pilar con resina fotopolimerizable dual (Protenmp, 3M Espe)[3]. Este mismo proceso también se puede realizar con dientes de acrílico elaborados de forma directa o indirecta, como material de relleno y ajuste para establecer el contorno crítico y subcrítico se puede utilizar composite fluido, resina compuesta o resina acrílica[37, 43, 45].

Figura 10: Pilar de titanio para conformación del perfil de emergencia[44].

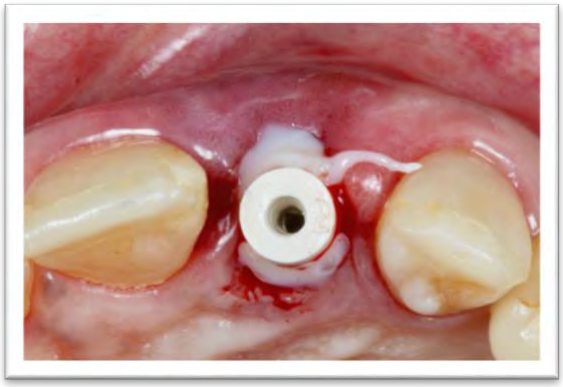

Figura 11: Pilar curativo poliéter-éter-cetona posicionado, con resina fluida polimerizada rellena el contorno del tejido blando[43].

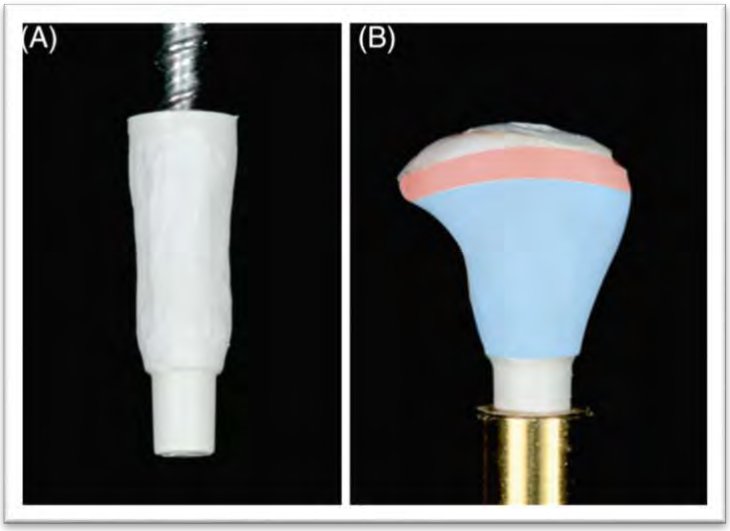

Figura 12: (A) Pilar curativo de poliéter-éter-cetona desbastado. (B) Pilar de sanación personalizado después de pulir, se proyectan contornos críticos (color rojo) y subcríticos (azules)[43].

1.4.3 PILARES PERSONALIZADOS:

Aunque la tendencia en la implantología va hacia las restauraciones atornilladas, parece haber algunas ventajas atribuidas a las restauraciones cementadas soportadas sobre pilares personalizados[44]. Para evitar las conexiones y desconexiones del pilar, especialmente para los implantes de colocación inmediata, se puede optar por un pilar definitivo como puede ser de Zirconia (Fig. 13, 14)[40, 44]. El zirconio es un material con reconocida biocompatibilidad con los tejidos blandos[36] El pilar definitivo se puede crear en el laboratorio después de adquirir un registro de la posición del implante[40], también se puede diseñar haciendo una copia exacta del diente original y así presenta todos los parámetros necesarios para crear un PE ideal y un sellado del alveolo de extracción[44].

Figura 13: Inserción de pilar de Zirconia, al que se le dió una forma cóncava en las áreas subgingivales a la línea de acabado marginal[44].

Figura 14: Vista frontal del pilar de zirconia, sobre el que irá cementado una corona provisional[44].

1.4.4 ADITAMENTO PROTÉSICO PREFABRICADO:

Este aditamento es como una cofia prefabricada (Fig. 15) que replica el contorno del diente extraído en la región cervical cuyo objetivo es preservar la regeneración guiada de los tejidos (Fig. 16). Además ayuda a evitar el colapso de la mucosa y controlar el sangrado durante la confección del CPII. Este sistema puede reducir el tiempo de trabajo, es fácil de realizar y

consigue unos resultados estéticos sostenibles(Fig. 17)[33].

Figura 15: Se utilizó un armazón de tamaño mediano. Se muestran tres vistas: (a) facial, (b) facial-oclusal, (c) oclusal[33].

Figura 16: (a) El ajuste del armazón se comprobó en el alveolo de extracción. (b) El aspecto mesial del caparazón es por diseño un poso más incisal (c) El caparazón sostiene los tejidos de la mucosa y controla el sangrado[33].

Figura 17: (a) Cilindro temporal insertado. (B) Se añadió resina acrílica, mediante la técnica de Nealon. (c) Colocación de la corona provisional prefabricada , se adaptó con acrílico autopolimerizable[33].

A continuación se describen materiales para confeccionar la restauración provisional en el sillón dental.

Alrededor del pilar provisional se puede utilizar material bis-acrílico autopolimerizado. Para finalizar la restauración y darle la forma adecuada al PE en las zonas más próximas al implante se utiliza resina compuesta fluida [22, 25, 28, 43]. De igual manera, para las siguientes modificaciones en el contorno crítico y subcrítico, está indicado el uso de composite fluido[22, 25, 43].

2 OBJETIVOS:

2.1 OBJETIVO GENERAL:

- El objetivo general de esta revisión bibliográfica se va a centrar en cómo obtener mediante restauraciones provisionales la conformación de los tejidos blandos alrededor del implante, formación de papilas y perfil de emergencia ideal.

2.2 OBJETIVOS ESPECÍFICOS:

- Conocer las características del perfil de emergencia.
- Diferenciar diseños de provisionales sobre implantes, tanto inmediatos, como tardíos y que den como resultados un contorno gingival en sintonía con los dientes adyacentes.
- Cuándo elegir una restauración atornillada y cuándo una cementada.
- Distinguir diferentes situaciones en las que emplear el perfil cóncavo o convexo, tanto para el contorno crítico como el subcrítico de la restauración.
- Conocer los materiales y componentes más habituales y beneficiosos para la realización de estos provisionales.

3 METODOLOGÍA:

Para el desarrollo de este trabajo monográfico de investigación bibliográfica se ejecutó una búsqueda entre los años 2005-2021, seleccionando preferentemente los mejor referenciados y citados, así como los más actualizados. En una búsqueda inicial se escogieron 106 artículos, tras aplicar criterios de inclusión y exclusión, la selección final se redujo a 54 artículos.

Palabras clave: *Immediate Provisional restorations, Emergency profile*, *soft tissue conditioning, preservation of peri-implant soft tissues, platform connection, immediate implant*.

Se realizó una búsqueda de artículos a través de buscadores académicos y diferentes bases de datos científicas tales como *EBSCO, CINAHL with full text*, *Pubmed*, *MEDLINE Complete, Scopus, Dentistry & Oral Science Source* y Google académico, a su vez, se ha completado la información con libros publicados como "Rehabilitación estética sector anterior el paso a paso en la rutina clínica" de Raphael Monte Alto y Cols. y "Rehabilitación estética en prostodoncia fija" de Mauro Fradeani.

La información se recogió bajo los siguientes criterios de inclusión y exclusión:

3.1 CRITERIOS DE INCLUSIÓN:

- Rehabilitación con implantes en sector anterior.
- Implantes unitarios.

3.2 CRITERIOS DE EXCLUSIÓN:

- Rehabilitaciones múltiples sobre implantes.
- Restauraciones provisionales sobre diente natural.

- Restauraciones en el sector posterior.

4 DISCUSIÓN DE RESULTADOS:

La elaboración de este trabajo de investigación bibliográfica se ha realizado con el objetivo principal de obtener directrices a la hora de conformar los tejidos blandos existentes alrededor de un implante en el área estética mediante la confección de restauraciones provisionales.

Este es un proyecto que constituye un desafío para el clínico y que comienza con una correcta planificación de la colocación del implante[9, 12].

Hoy en día los pacientes presentan unas expectativas altas respecto a la estética, en particular cuando se trata del sector anterior. Según encontramos en la literatura se propusieron varios índices para evaluar la restauración implantoprotésica.

Meijer et al[46] comenzó un nuevo camino en la búsqueda de un índice para evaluar la estética de coronas unitarias sobre implantes y tejidos blandos adyacentes[46]. Doce de los artículos revisados han utilizado PES / WES como evaluación de parámetros estéticos[1, 7, 14, 21, 24, 26, 28, 35, 38, 39, 47, 48] lo que justifica que PES / WES son los índices más recomendados para el uso clínico. Están indicados para evaluar el resultado estético[24, 26] en los tejidos periimplantarios y la corona implantosoportada[21, 26, 46]. Dichos índices nos proporcionan una medición objetiva y reproducible entre el blanco y el rosa y son fáciles de usar[26, 49].

4.1 PERFIL DE EMERGENCIA

Numerosos autores coinciden en la evidencia de que la colocación de un provisional sobre implante es beneficioso y necesario para mantener y guiar el PE[17, 18, 21, 22, 26, 27, 43].

Polese et al[18], clasifica a los pacientes con biotipo fino, severamente festoneado como un factor alto de riesgo estético. Kolerman et al[35], en pacientes con biotipo fino recomienda injertos de

conectivo para evitar futuras recesiones y mejor estabilidad de los tejidos blandos.

De otra manera, Beretta et al[50] explica que en casos con biotipo grueso a los que no se les ha conformado la encía mediante provisionales pueden darse complicaciones como sería la retracción de tejidos blandos ocasionados por la isquemia producida durante la inserción de la corona definitiva.

Diferentes autores coinciden en recomendar la colocación de los implantes en el sector anterior a una profundidad entre 3 a 4mm para conseguir un margen mucoso suficiente que permita un PE óptimo y así se puedan cubrir las necesidades en el diseño de la prótesis[25, 30, 31].

Chu et al[30] compara el tejido blando perrimplantario con el complejo dentogingival, siendo estos similares ya que coinciden en que poseen una dimensión vertical de 3,0 mm que consta de un surco, epitelio de unión y tejido conectivo.

Su et al[31] definió la zona intramucosa del pilar / corona como los contornos crítico y subcrítico. A su vez, resalta la necesidad de que debe existir suficiente espacio mucoso para poder realizar modificaciones con las restauraciones provisionales, a dicho espacio lo denominó “espacio para correr”.

Un artículo más actual, como el de Gómez-Meda et al[32] sugiere que los tejidos blandos faciales del PE deben tener un grosor superior a 2-3 mm para evitar la transparencia y sombras que puede producir el pilar. Además, describe de una forma más específica el diseño del PE con un concepto nuevo *esthetic biological contour (EBC)*, en el que se desarrolla notablemente más el aspecto de la histología en toda la zona que compete al PE. Además cabe destacar que aporta nuevas directrices sobre como actuar en la zona C que es la zona más próxima al implante, de una forma específica para los diferentes diseños de implantes[32], sin embargo, no se perciben

grandes diferencias ni ventajas con respecto al ya descrito contorno crítico y subcrítico de Su et al[31].

4.2 PROVISIONAL INMEDIATO

Se han descrito varias técnicas para conformar el tejido blando periimplantario mediante la confección de CPII.

González-García y Domínguez-Cardoso[36] proponen una diseño para las CPII llamado CSC (contono subgingival cóncavo) con el objetivo de proporcionar una mayor estabilidad y sellado biológico a los tejidos que rodean al implante. Se le realiza al provisional un surco cóncavo alrededor de todo el perímetro del provisional a 2 mm del margen gingival, provocando un aumento de grosor alrededor de la restauración. Este diseño puede favorecer a biotipos de festoneado fino.

Un estudio elaborado por Jiang et al[9] comprobó que un injerto de tejido conectivo junto con la colocación de un CPII puede compensar el colapso del tejido facial. Sin embargo, se observó reabsorción ósea bucal en fenotipos de pared delgada y se concluyó que el injerto de tejido conectivo no tuvo ningún efecto sobre la remodelación del tejido duro. Aunque este estudio se realizó con un seguimiento de solo 6 meses.

Respecto a la carga inmediata con un provisional lo conveniente según Khzam et al[1] es no dejar contactos funcionales[1]. No obstante, se especula si existe diferencia significativa entre la carga funcional y la no funcional de implantes unitarios respecto al fracaso del implante y la perdida ósea[38, 51].

Varias investigaciones se dirigen cada vez más hacia el campo digital, como el artículo de Siqueira et al[6] que describe un caso realizado mediante la tecnología digital. Comenzando por

el diagnóstico a través de la tomografía computerizada de haz cónico (CBCT), la planificación, diseño de la sonrisa, impresiones STL con un escáner intraoral (3Shape de Trios) con las que se realiza una férula quirúrgica como guía en la colocación del implante en el lugar planificado y la fabricación del provisional de una manera extraoral con el apoyo de un modelo que se imprimió en la impresora 3D. Este artículo explica el paso a paso de una forma destallada.

Este flujo de trabajo puede reducir el tiempo de trabajo en el gabinete dental en la confección de un CPII y mejorar la estética en la rehabilitación de dientes anteriores[37].

Generalmente la recomendación para implante inmediato es que una vez colocado no se retire el CPII de la conexión[36]. En cambio, artículos como el de Esposito et al[51] no encuentran diferencias clínicamente relevantes entre pacientes a los que se les coloca un pilar permanente y pacientes que sufren cambios repetidos de pilar, a pesar de que describen menos pérdida de hueso crestal, en los pacientes que se les coloca un pilar permanente respecto a los pacientes con cambios repetidos de pilar. Por consiguiente, recomiendan que los clínicos pueden optar por la retirada del pilar en las situaciones que lo consideren necesario, aún así consideran que debe prevalecer la regla empírica de manipular lo mínimo posible el implante colocado de forma inmediata[51].

4.3 PROVISIONAL DIFERIDO

El provisional diferido se realiza una vez se ha producido la maduración de los tejidos blandos y duros[27].

Según Nam et al[22], en la mayoría de los casos se puede conformar los tejidos blandos del PE añadiendo o reduciendo material al CPI o bien mediante injertos de tejido conectivo proporcionando un tejido más grueso.

Las técnicas de "compresión dinámica" son muy utilizadas para la conformación de tejidos blandos con provisionales en implantes osteointegrados[17, 22, 28].

Tanto Wittneben et al[17] como González-Martín[27] recomiendan que cuando se precisa realizar futuras modificaciones en el CPI para lograr la arquitectura deseada del margen gingival es recomendable espaciar un intervalo de tiempo de 14 -15 días entre las modificaciones para dar paso a la vascularización y cicatrización de la mucosa periimplantaria,

4.4 PROVISIONAL CEMENTADO VS ATORNILLADO

La elección del sistema de retención implica diversas consideraciones que son independientes para cada paciente[40, 41]. Entre las consideraciones a tener en cuenta se describen la posición tridimensional del implante, la profundidad del implante, el espacio interoclusal, el espacio interproximal y el tejido periimplantario[40].

- Posición tridimensional del implante: El sector anterior del maxilar está condicionado por la inclinación del reborde alveolar en consecuencia la posición del implante está determinado por las características anatómicas de la zona y las necesidades de la restauración. En los casos en los que la inclinación del implante provoca la salida del orificio de acceso de la corona en una situación bucal, está indicada una restauración cementada para así lograr una mejor estética[40, 41].
- Profundidad del implante: Para logar un PE óptimo se recomienda colocar el implante a una profundidad de 2 a 4 mm[25, 30, 31, 40]. En un implante en el que el tejido gingival libre sea de 2-3 mm es recomendable siempre que sea posible el uso de restauraciones atornilladas o bien utilizar pilares personalizados con margen de restauración personalizado. De esta manera se evita la retención de cemento subgingival de la restauración cementada ya que en estos casos aumenta el riesgo de una remoción

incompleta del exceso de cemento[40, 41, 42].

- Espacio interoclusal: En áreas en las que el espacio entre arcadas está limitado a 4mm, la restauración atornillada va a ofrecer mejor retención dado que el pilar para la restauración cementada no tendría suficiente estructura para aportar una retención adecuada[40].
- Espacio interproximal: Cuando el espacio interproximal es estrecho, el canal de acceso a los tornillos puede comprometer la estructura limitada del provisional y por ello sufrir fracturas. Para evitar este problema están indicadas las restauraciones cementadas[40].
- El tejido preiimplantario: Situaciones en el que el tejido periimplantario ha sufrido técnicas de cirugía, como la inserción de un implante o el aumento con injerto del tejido blando, está comprometida la restauración provisional cementada, dado que el fraguado del cemento en un campo quirúrgico en el que hay humedad implica riesgo de descementación y en consecuencia posibles inconvenientes. En cambio la restauración provisional atornillada aporta mayor recuperabilidad[40].

Cuando se diferencia de una forma general entre complicaciones técnicas y complicaciones biológicas, se le atribuye una mayor incidencia de complicaciones técnicas a las reconstrucciones atornilladas y una mayor incidencia de complicaciones biológicas a las reconstrucciones cementadas[25, 41, 52].

Ventajas y desventajas de las restauraciones cementadas frente a restauraciones atornilladas:

4.4.1 PROVISIONAL CEMENTADO:

- Ventajas: Las ventajas de la restauración cementada principalmente son: una estética superior al no presentar ningún orificio y ser una restauración íntegra, fabricación más sencilla y en consecuencia un coste más económico, es útil en la corrección de la

angulación para los implantes con inclinaciones indebidas, presenta un mejor ajuste pasivo gracias a la capa de cemento que hay entre el pilar y la restauración, evita que el tornillo se afloje y la corona está intacta en la cara oclusal, lo que la hace más resistente[40, 41, 52].

- Desventajas: La desventaja más importante de la restauración cementada sobre implantes, y que se presenta con cierta frecuencia, es la imposibilidad de retirar completamente el cemento subgingival, pudiendo provocar inflamación de los tejidos y en consecuencia perdida ósea periimplantaria. Durante la retirada del cemento, se puede rayar el pilar, incluso el implante[40, 41, 52]. Presenta dos interfases implante-pilar y pilar-corona lo que promueve infiltración bacteriana[33, 40]. Dificultad para resolver ciertos inconvenientes como el aflojamiento del pilar, teniendo en ocasiones que destruir la restauración[41].

4.4.2 PROVISIONAL ATORNILLADO:

- Ventajas: Flexibilidad para agregar o restar material al provisional para conformar el PE[30]. Así como mayor facilidad para controlar la presión para conformar el tejido blando[22]. Presenta un mejor pulido y ausencia del gap entre el muñón y la corona[17, 33, 36, 42]. Facilidad en su remoción para añadir o rebajar material en los casos de manipulación de los tejidos blandos periimplantarios, como para su reparación en caso de fractura o similar[41, 42, 52].
- Desventajas: Las restauraciones atornilladas suelen ser más costosas económicamente[41, 42, 52]. En ocasiones no muestran una estética ideal. Problemas de aflojamiento de tornillos. Mayor riesgo de fractura al no ser una estructura íntegra[42, 52].

Grizas et al[3] aboga porque una restauración cementada es el tratamiento más habitual debido a la inclinación natural del reborde alveolar[3].

Aunque últimamente las restauraciones cementadas tienen muchos detractores a causa del alto riesgo de periimplantitis provocada por el cemento residual, se encuentran artículos y técnicas que trabajan para intentar solucionar este problema[30, 42, 52, 53], sin embargo estos estudios no son determinantes por ser in vitro.

Según Polese et al[18] si el implante está ubicado hacia palatino está indicada una prótesis atornillada. En cambio si el implante tiene una angulación bucal, es más recomendable una restauración cementada[18].

Así como Nam et al[22] que también asocia la posición del implante con la decisión del tipo de restauración, de otra manera, destaca que siempre que sea posible, la restauración atornillada es más recomendable porque aporta un mejor control de la presión y es más fácil de manejar en la adicción o sustracción de material que la restauración cementada[22].

Finalmente, varios autores han sugerido utilizar provisionales atornillados siempre que sea posible y de esta forma minimizar el riesgo de cemento residual y periimplantitis iatrogénica, así como de aportar una reversibilidad más favorable y un mejor control del PE[18, 30, 36].

4.5 CONTORNO SUBCRÍTICO:

La angulación del implante hacia palatino o hacia bucal va a determinar la orientación del área subcrítica[30].

Chu et al[30] indica que cuando queremos darle más soporte al tejido gingival, el diseño subcrítico será convexo. Por otro lado, si el objetivo es aumentar el grosor de tejidos blandos

periimplantarios o disminuir la presión en la encía facial, el diseño subcrítico será cóncavo. De manera similar se aplican estos diseños para la zona interproximal[30].

Respecto al CPII, Su et al[31] describe que para evitar sombras oscuras en la encía, producidas por la pérdida de volumen después de la extracción del diente, se puede optar por un contorno subcrítico convexo y así de esta manera reducir los efectos de las sombras. Aún así, especifica que esta situación depende del grosor de la encía facial que presenta el paciente, siendo especialmente cuidadosos cuando los tejidos blandos son delgados.

En cambio, González-Martín et al[27] en un artículo publicado en 2020 destaca que la confección de un CPII es un procedimiento sensible en el que es necesario establecer una correcta planificación. Por ello no es fácil encontrar el equilibrio entre la creación del perfil subcrítico y el espacio para el conectivo periimplantario. En consecuencia, el contorno subcrítico debe tener un diseño tan cóncavo como sea posible alrededor de toda la CPII para conseguir crear un espacio de regeneración idóneo[27].

4.6 CONTORNO CRÍTICO:

Chu et al[30] define el contorno crítico como el área que se encuentra subgingivalmente de 1 a 1,5 mm del margen gingival libre, está presente alrededor de toda la restauración intentando duplicar la anatomía del diente natural.

Con el manejo del contorno crítico se puede determinar el nivel del margen gingival, así como controlar la ubicación del cenit gingival y la altura de las papilas. De esa manera González-Martín et al[27] indica para los casos en los que exista una recesión gingival leve en la encía del paciente, se puede reducir el contorno crítico en la zona vestibular del CPII entre 0,5 a 1 mm en comparación con el diente natural para favorecer que el tejido blando migre hacia coronal.

En el área interproximal y palatal el diseño debe ser igual al del diente natural.

Frecuentemente el contorno crítico se hará con un perfil convexo para así soportar el contorno del margen gingival libre o el cénit en la posición adecuada, salvo en el caso de implantes colocados con una angulación pronunciada a bucal en cuyos casos la forma del contorno crítico será recta o cóncava[27, 30, 31].

En casos de implantes con una angulación excesiva del implante a labial será necesario un perfil de contorno crítico recto o cóncavo[30].

En un estudio in vitro, llevado a cabo por Sancho-Puchades et al[25] con coronas cementadas sobre implantes comparaban pilares de implantes con una emergencia cóncava y convexa, con el diseño del margen gingival de la corona a diferentes profundidades. Obtuvieron unos resultados en los que encontraban mayor cantidad de restos de cemento, principalmente en las zonas interproximales, en los diseños cóncavos cuando el margen gingival del corona estaba situado más submucoso.

Chu et al[30] recomienda confeccionar el mismo diseño de contorno crítico y subcrítico, tanto para los provisionales atornillados, como en los cementados.

Antes de confeccionar la prótesis definitiva González-Martín et al[27] ha sugerido un tiempo de acondicionamiento de los tejidos blandos periimplantarios con restauraciones provisionales que oscila entre 3 y 12 meses.

4.7 COMPONENTES Y MATERIALES.

En la actualidad la tendencia respecto a la conexión de un implante en el área estética es hacia una conexión interna, en particular conexión cónica[18]. Sin embargo, un estudio llevado

a cabo por Carvalho et al[54] en el que se comparan implantes con conexiones de hexágono externo, hexágono interno y cono morse y tres materiales para el pilar; titanio, zirconio e híbrido (combinación de titanio con zirconio). Concluye que los valores de estrés mecánico entre las conexiones fueron similares, aunque se observaron mayores concentraciones de estrés en las conexiones internas. Para los aditamentos, el pilar híbrido y el de titanio presentaron un comportamiento mecánico similar, pero mejor comportamiento que el de zirconio.

Siempre que la posición del implante lo permita, Wittneben et al[41] indica que el provisional debe apoyarse directamente sobre el implante para facilitar el acondicionamiento de los tejidos blandos. Sin embargo Polese et al[18] aboga por las interfaces protésicas de plataforma reducida sobre conexiones internas cónicas ya que esto hace que mecánicamente el CPI y la restauración definitiva sean más estables, además de beneficiar a la estética a largo plazo.

Gamborena et al[44] describe que la colocación de un pilar personalizado de titanio y zirconia con un provisional cementado presenta ventajas frente a las restauraciones provisionales atornilladas ya que existe una unión epitelial entre la parte más interna y los pilares de titanio y zirconia. Este pilar se diseña como una copia exacta del diente, por lo que se aconseja como uso de pilar definitivo y evitar así su retirada. Además, la corona cementada que va sobre el pilar se puede modificar para conformar los tejidos blandos.

El concepto del uso de una cofia prefabricada descrito por Chu et al[33] y nombrada por otros autores como Ruales-Carrera[43] es muy beneficioso con el fin de mantener la arquitectura de los tejidos blandos, evitando el colapso mientras se personaliza el pilar curativo. Además, puede ayudar a preservar y a contener la regeneración ósea del alveolo.

Distintos artículos describen de una forma común materiales como resina compuesta fluida o

material bis acrílico autopolimerizado para la manipulación de sus provisionales[22, 25, 28, 43]. Todos estos materiales y componentes aportan como ventaja al tratamiento la flexibilidad de añadir o quitar material y dar forma al PE de forma ideal[30, 33, 36, 37, 43].

5 CONCLUSIONES:

1. Basándose en la evidencia revisada es prioritario, siempre que sea posible, la posición del implante hacia palatino y la profundidad necesaria para poder desarrollar un perfil de emergencia adecuado.
2. El biotipo del paciente en el área estética es un factor importante a tener en cuenta para conseguir un resultado predecible estéticamente hablando. Siendo el biotipo grueso más favorable para la estabilidad y manejo de los tejidos blandos. Diseños como el CSC pueden aportar beneficios, en casos con biotipo fino.
3. El perfil de emergencia de la restauración provisional ha de tener un diseño conveniente para la cicatrización y estabilidad de los tejidos, así como la contención de los posibles injertos óseos.
4. Es vital una correcta planificación para la elección adecuada del procedimiento, bien sea el caso de una restauración provisional inmediata o diferida.
5. El contorno crítico debe modelarse de manera que imite al diente contralateral independientemente de la colocación del implante, por eso suele ser convexo porque sigue la anatomía cervical de un diente natural.
6. El contorno subcrítico dará soporte a los tejidos más profundos.
7. El uso de la tecnología digital en la confección de provisionales inmediatos nos abre un nuevo camino a desarrollar, lleno de capacidades y virtudes por descubrir.
8. Aunque la tendencia aumenta hacia el uso de restauraciones atornilladas sobre implantes, no debemos desmerecer las restauraciones cementadas que aportan grandes ventajas en multitud de situaciones.

9. Está sobradamente demostrada la biocompatibilidad del titanio y el zirconio como materiales para aditamentos odontológicos. En consecuencia, la unión de estos dos componentes aporta mayores beneficios biomecánicos a las prótesis sobre implantes.
10. Ante la perspectiva futura del tema de estudio, animo al desarrollo de nuevas publicaciones ya que en la literatura actual escasean técnicas sobre el manejo de tejidos blandos sobre implantes y frecuentemente se describe cómo modificar el provisional sobre implante sin detallar con precisión la actuación.

6 RESPONSABILIDAD:

> Sostenibilidad medioambiental: Este trabajo cumple los criterios de sostenibilidad medioambiental ya que es un trabajo de revisión bibliográfica que se basa en buscar la mejor manera de solucionar un problema dental a los pacientes. En él se incluyen artículos que presentan un flujo de trabajo digital, por consiguiente, aporta un beneficio medioambiental al disminuir el uso de materiales como hidrocoloides, siliconas de adicción o condensación, poliéteres, etc…

> Sostenibilidad social: Este trabajo cumple con los criterios de sostenibilidad social dado que las patologías dentales son enfermedades comunes que afectan a la población en general. Siendo obligación de los odontólogos adquirir los suficientes conocimientos para realizar los tratamientos necesarios que mejor se ajusten a cada perfil de paciente.

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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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CLINICAL ARTICLE

Use of extracted anterior teeth as provisional restorations and surgical guide for immediate multiple implant placement: A clinical case report

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Abstract

Objective: The aim of this article is to describe the use of natural anterior teeth as a surgical guide to implant placement and provisional restoration for a young patient with root resorption of upper central incisors and left-lateral incisor.

Clinical considerations: Achieving soft tissue esthetics is quite a challenge in implant dentistry. Here, a case of immediate implant placement using the natural teeth of the patient as an immediate provisional restoration, which achieves satisfactory results in terms of soft tissue architecture.

Conclusions: Post-extraction implant placement in combination with immediate loading of dental implants has been evolving into an appropriate procedure for the treatment of partially edentulous anterior maxilla. Different techniques that include use of the own teeth as provisional implant supported restoration helps to maintain architecture of gingival contour, specially papilla.

Clinical significance: Natural architecture of anterior soft tissue is a big challenge in implant dentistry. Use of natural teeth as a surgical guide and provisional restorations might be helpful to obtain an optimal outcome.

KEYWORDS

dental implant, esthetic zone, immediate dental implant, immediate loading, provisional restoration

1 | INTRODUCTION

Anterior implant restorations are probably one of the most challenging procedures in implant dentistry. Critical analysis of the smile, the type of load and provisional restoration material to be used, and patient's expectations are some of the essential issues to take in account. In addition, predictable success requires a complete presurgical planning regarding the type of restoration needed and the space it will require. Several procedures options had been identified to reach the predictability of the esthetic outcome. These procedures include: the implant position, the communication of the optimal implant position using templates, and the use of implant-supported provisional prostheses.[1] Young patients who lose one or multiple teeth in the esthetic zone may have a psychological and social negative impact. However, the placement of dental implants into a fresh extraction socket followed by an immediate provisional restoration supported by the implant can help to solve this discomforting experience, functionally and esthetically, maintaining the soft tissue contour. Besides, use of patient's own teeth can further provide a comfortably transition to definitive restorations. One of the main complications on anterior implants is mucosal recession; to reduce the risk of this complication, literature suggest keeping facial bone intact in cases with a medium to thick tissue biotype.[2] Regarding provisional and definitive implant-supported restorations, the gold standard, concerning abutment shape, remains the one with a divergent profile to establish an emergence profile similar to a natural tooth[3]; the use of natural teeth could be the better way to use as provisional in terms of morphology to obtain an ideal emergence profile, as has been described by Margeas, in 2006.[4]

2 | CLINICAL REPORT

A 21-year-old female patient was clinically evaluated and presented mobility of the upper central incisors and the left-lateral incisor and were diagnosed with severe external root resorption due to a long

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Eleftherios Grizas

A detailed decision tree to create, preserve, transfer, and support the emergence profile in anterior maxillary implants using custom abutments

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Rehabilitation with implants in the esthetic zone is one of the most demanding tasks due to the importance of obtaining an optimum esthetic result. The aim of this article was to present a workflow to create, preserve, transfer and support the emergence profile in anterior maxillary implants. Different methods are used surgically as well as prosthetically to construct an ideal restoration. When immediate loading can be applied in cases of increased primary stability, a provisional restoration is placed with occlusal contacts. In cases not permitting the above procedure and requiring extensive augmentation, a resin-bonded partial coverage fixed partial denture can be a predictable and reliable treatment option until the final restoration is delivered. Creating or preserving the emergence profile at immediate post-extraction and delayed implants, respectively, is achieved through customized provisional. healing abutments, a combination of prefabricated healing abutments and partial coverage provisional restoration, or utilization of the patient's own tooth crown. Transferring the individualized soft tissue contour to the final restoration can be achieved by modifying the impression coping intraorally with composite resin, fabricating a cast mimicking the soft tissue contour in the laboratory, or by the use of CAD/CAM technology. A customized abutment is necessary in order to maintain the emergence profile that has been created during the previous stages. The objective of this paper was to present a detailed workflow for the restoration of anterior maxillary implants focused on the creation, preservation, support, and transfer of the emergence profile of the soft tissues through a series of clinical cases. *(Quintessence Int 2018;49:349–364; doi: 10.3290/j.qi.a39820)*

Key words: anterior maxillary implants, customized prosthetic components, emergence profile

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Dental implants have been used in the dental practice for more than three decades, and osseointegration can be considered as a predictable biologic phenomenon. Although implant research has been focused on implant survival, today there is a tendency to consider "success" as a goal, with patient expectations playing a crucial role concerning esthetic outcomes. As reported in clinical trials, most patients were satisfied with the

Assessment of Peri-implant Soft Tissue Adaptive Pressure and Time After Provisional Restorations

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Hom-Lay Wang, DDS, MSD, PhD[2]

Using interim restorations to remodel the peri-implant gingiva contour has been a common procedure in esthetic implant treatment. During the interim restoration delivery, the pressure between the restoration and gingiva typically causes ischemia. Adequate restoration should allow the tissue to recover from ischemia over a certain time. To assess the time needed for peri-implant soft tissue recovery, interim restorations were delivered on 25 single implant sites 2 weeks after stage-two surgery, and the gingiva appearance changes after delivery were recorded for 15 minutes using a video camera. Gingiva color changes along the time were measured and analyzed. The color differences between peri-implant mucosa at 10 min and 0 min, as well as between adjacent tooth gingiva, were all within a clinically acceptable range of color difference. The adaptive pressure technique by two-stage contouring exhibited an optimal peri-implant soft tissue profile within 10 minutes of the adaptive time. Int J Periodontics Restorative Dent 2019;39:809–815. doi: 10.11607/prd.4063

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Due to a significant amount of soft and hard tissue resorption after tooth extraction, it remains challenging to achieve pleasant anterior implant esthetics that fulfill a patient's esthetic expectations.[1] Furthermore, the literature shows that there are different anatomical structures between implants and natural teeth,[2] so achieving an esthetically pleasing implant restoration requires greater clinical and technical understanding. For example, in an ideal esthetic implant restoration case, the surrounding implant mucosal margin, color, texture, and contour of the peri-implant soft tissue should be harmonious with the adjacent and contralateral teeth and/or implants.[3] To fulfill the goal of achieving a pleasing esthetic anterior implant restoration, factors such as buccal bone thickness,[4] mucosa thickness,[2] implant position,[5] and the contour of the abutment and prosthesis[6] should be properly controlled since they are known to influence the level of the peri-implant mucosal margin and soft tissue. Despite efforts to develop an ideal profile by subtracting or adding restorative materials for provisional restoration, there is no information currently available on how much pressure and how much time is required to obtain the ideal peri-implant soft tissue profile.[7] The aim of this study was to develop and validate the adaptive pressure for

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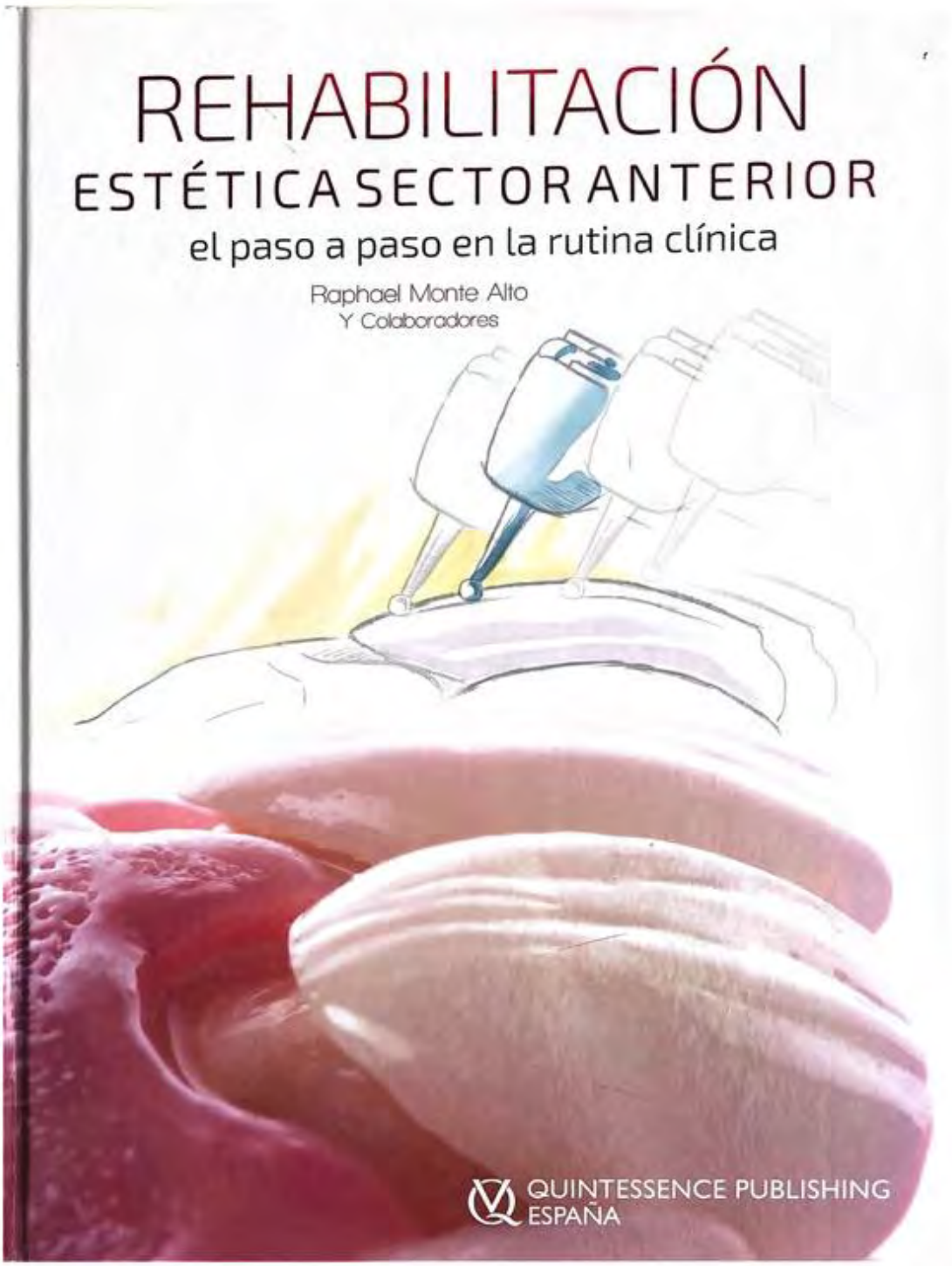
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Using Digital Technique to Obtain the Ideal Soft Tissue Contour in Immediate Implants With Provisionalization

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This paper presents a newly developed digital technique to make a provisional crown that mimics the natural tooth during immediate implant placement. Basically, a digital technique results in a precise transfer tooth emergence profile for provisional restoration in immediate implant placement so that an ideal periimplant soft tissue contour can be maintained. The architecture of extraction socket is obtained digitally before the surgery that allows for implant planning by position of the implant as well as the emergence profile of provisional restoration. The introduction of this approach provides a versatile, precise, and predictable procedure leading to better esthetic outcomes. (Implant Dent 2019;28:411–416)

Key Words: dental implants success, extraction socket, single-tooth implants

Replacing an anterior maxillary tooth by implant therapy continues to be a challenge for many clinicians due to the fact that excellent soft and hard tissue healing is required to have a good esthetic outcome. This includes an implant-supported crown that has a natural appearance and a long-term stable periimplant mucosal soft tissue. Previous studies demonstrated positive esthetic outcomes for replacing a tooth in the esthetic zone by an immediate implant placement and provisionalization (IIPP).[1–3] IIPP is often combined with bone grafts[4,5] and soft tissue augmentation[6–9] to achieve implant esthetics.

Despite the different approaches mentioned beforehand, achieving adequate esthetic outcomes is very technique sensitive, and requires ideal implant positioning and good prosthetic contour,[10] among many other prerequisites. Degidi et al, 2014[11] showed the importance of the provisionalization when proposing the chamber concept: a 3-dimensional biologic space favorable for bone formation around the abutment and limited by the 4 bone lateral walls and a ceiling, specifically the provisional crown. Obtaining an adequate emergence profile of the provisional restoration with a subgingival concave contour is additionally crucial to allow for the establishment of a desirable soft tissue thickness.[8]

However, fabrication of an implant-supported provisional restoration after tooth removal presents several clinical challenges. The periimplant mucosal tissues often immediately collapse, resulting in imprecise capturing of subgingival contours and preextraction state of the tooth.[4,12] Different methods and devices have been developed to create an immediate provisional restoration with the goal of preserving soft tissue architecture.[13] Although they represent great improvements to the concept, they still do not allow the clinician to have the representation of the actual extraction socket beforehand, which would allow for detailed treatment planning and anticipation of the provisional restoration to reduce time needed to complete this during the surgical procedure.

Fig. 1. Initial intraoral view. This is a clinical preoperative labial view of the fractured maxillary left central incisor.

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Research Article

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Bone-level implants placed in the anterior maxilla: an open-label, single-arm observational study

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ABSTRACT

Purpose: This study assessed marginal bone remodeling and soft tissue esthetics after the loading of single bone-level implants in the anterior maxilla.
Methods: An open, single-arm observational clinical trial with 3 years of follow-up was performed, including 22 implants. The patients presented with a single tooth gap in the anterior maxilla (tooth positions 14–24), with natural or restored adjacent teeth. An implant was placed at least 8 weeks post-extraction and healed submerged for 6 weeks. After the second-stage operation, a fixed provisional prosthesis was provided. The final restoration was placed 6 months after the provisional restoration. The time of the provisional crown connection was considered to be the baseline in this study. Esthetic parameters and the marginal bone level were assessed at 6, 12, 24, and 36 months.
Results: All implants were well integrated in the bone. A statistically significant increase was found in the mean implant stability quotient between the time of the provisional prosthesis and the time of the final prosthesis. Most implants (95.5%) revealed marginal bone resorption (<0.5 mm), and just 1 implant (4.5%) showed a change of 2.12 mm from baseline to 36 months (mean 0.07±0.48 mm), while the crestal bone level decreased significantly, from 2.34±0.93 mm at baseline to 1.70±1.10 mm at 36 months. The facial gingival margin and papilla were stable and the esthetic scores indicated high patient and dentist satisfaction.
Conclusions: Platform-switching bone-level implants placed in maxillary single-tooth gaps resulted in successful osseointegration with minimal marginal bone resorption. The peri-implant soft tissue was also esthetically satisfying and stable.

Keywords: Alveolar bone loss; Dental implants; Esthetics

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Periodontology 2000

Clinical relevance of dimensional bone and soft tissue alterations post-extraction in esthetic sites

VIVIANNE CHAPPUIS, MAURICIO G. ARAÚJO & DANIEL BUSER

The development of predictable and innovative implant therapies for optimal esthetic outcomes requires a thorough understanding of the underlying biological processes of bone and soft tissue healing following tooth extraction (16). In the past, research focused on better understanding the osseointegration process, and as a result implant surface topography/chemistry has been profoundly investigated and markedly improved (22, 46, 81, 96). These innovations have contributed to reduced healing periods and the use of short or narrow diameter implants (5, 59). Predictable osseointegration leads to successful implant function over time, which can be assessed by the success criteria proposed by Albrektsson et al. (2), Buser et al. (23) and others. However, successful implant function alone does not fulfill the increasing demands of today's patients and clinicians for pleasing esthetics.

Attaining pleasing esthetics in the anterior maxilla involves many clinical parameters but is principally related to the peri-implant mucosal architecture in comparison with the contra-lateral natural tooth (31). The peri-implant mucosa needs to be supported by an adequate three-dimensional (3D) osseous volume of the alveolar ridge, including an intact facial bone wall of sufficient thickness and height in combination with correct restoration-driven implant positioning (21, 42, 47). Deficiency of the facial bone anatomy has a negative impact on esthetics and is a critical causative factor for esthetic implant complications and failures (28). However, the integrity of the hard and soft tissue dimensions is jeopardized by physiological and structural changes following tooth loss (11). Experimental and clinical research provides important knowledge about related biological events and the extent of dimensional alterations following tooth extraction, as well as how they can be minimized in order to maintain the natural soft and bone tissue architecture of the dentition over time.

The aim of this review is to summarize the degree of tissue alterations in single tooth extraction sites of the anterior maxilla and to identify associated modulating factors in order to assist the clinician in the selection of the most appropriate treatment protocols to facilitate pleasing esthetic treatment outcomes.

Degree of dimensional tissue alterations following tooth extraction

Bone alterations following tooth extraction

Experimental studies

The dimensional and structural alterations following tooth extraction have been studied in detail in mandibular premolar sites of beagle dogs (8, 25) (Fig. 1). These catabolic changes are initiated by the resorption of the bundle bone that lines the extraction socket. The bundle bone, consisting of lamellar bone, has a thickness of 0.2–0.4 mm and is a tooth-dependent structure (79) (Fig. 1A). The catabolic changes have been correlated with the disruption of the blood supply from the periodontal ligament, which subsequently leads to significant osteoclastic activity (8, 25). As the bundle bone is a tooth-dependent structure, it is gradually resorbed following tooth

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ORIGINAL ARTICLE IMPLANT DENTISTRY

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Hard and soft tissue alterations during the healing stage of immediate implant placement and provisionalization with or without connective tissue graft: A randomized clinical trial

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Abstract

Aims: To evaluate the hard and soft tissue alterations of immediately placed and provisionalized implants with or without connective tissue graft (CTG).

Materials and Methods: Single unsalvageable maxillary incisors were replaced with immediately placed and provisionalized implants in 42 participants. The patients were randomly assigned to receive simultaneous CTG (test group) and not receive CTG (control group). Digital impression and cone-beam computed tomography images were obtained before extraction and after 6 months. Mid-facial gingival margin migrations, soft tissue contour changes and hard tissue remodelling were analysed and compared between the two groups using three-dimensional superimposition method.

Results: Forty participants completed the study. The test group showed significantly less buccal tissue collapse in the area 2–5 mm apical to the gingival margin. In both groups, the mid-facial gingival margin migrated in an apico-palatal direction and the socket void, except for a triangular space in the bucco-coronal region, demonstrated radiographic new bone formation without statistically significant differences.

Conclusions: The CTG used with immediate implant placement and provisionalization could compensate for the facial tissue collapse, but it did not benefit maintenance of the mid-facial gingival margin position during the 6-month follow-up. New bone formation observed radiographically can be expected in most areas of the socket void, regardless of CTG use (ChiCTR-1900028494).

KEYWORDS
aesthetics, connective tissue graft, extraction socket remodelling, immediate implant, immediate provisionalization

1 | INTRODUCTION

Immediate implant placement and provisionalization (IIPP) in the extraction socket is an attractive treatment modality that facilitates immediate tooth replacement and reduces treatment time, cost and surgical trauma as compared to delayed approaches (Kan, Rungcharassaeng, & Lozada, 2003; Noelken, Neffe, Kunkel, & Wagner, 2014). However, this treatment concept has been controversial in terms of implant survival (Slagter et al., 2014; Tonetti et al., 2019) and aesthetic outcomes in particular, when anterior

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ORIGINAL ARTICLE

Gingival recession behavior with immediate implant placement in the anterior maxilla with buccal dehiscence without additional augmentation—a pilot study

Veronika Pohl[1] · Lukas Fürhauser[1] · Robert Haas[1] · Sebastian Pohl[2]

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Abstract

Background Immediate implant placement in the presence of intact extraction alveoli has frequently been reported, while hardly any reports on immediate implant placement in missing buccal bone can be found in literature.

Objectives This pilot study evaluates esthetic outcome and soft and hard tissue level changes of immediate implant placement with immediate provisionalization in patients with partially/completely missing buccal bone without any further augmentation procedure in the maxillary anterior zone.

Material and methods Twelve patients (TG) with partially to completely missing buccal bone designated for extraction and flapless immediate implant insertion in the anterior zone of the maxilla were included. Patients randomly selected out of a larger group of patients with immediate implants with intact alveoli served as controls (CG). Immediate provisionalization was done without any further augmentation of the alveolar ridge. Marginal hard and soft tissue levels, PES, and implant success were evaluated during a 1-year observation period.

Results The defect of the buccal alveolar bone was 4.96 mm (min., 2.26 mm; max., 9.68 mm) and the mean mesio-distal extension 4.25 mm (min., 3.2 mm; max., 5.91 mm). Preoperative PES differed significantly between TG (9.68) and CG (12.25) and improved in TG postoperatively with no significant difference to CG after 1 year (TG, 10.91; CG, 11.3). The buccal soft tissue level remained almost unchanged over the observation period (TG preop, 0.86 mm ± 0.90 mm; 1 year, 0.91 mm ± 0.96 mm; CG preop, 0.98 mm ± 0.87 mm; 1 year, 0.98 mm ± 0.87 mm and did not show any correlation with either the mesial/distal bone level or the initial buccal vertical defect at any point of time.

Conclusions These clinical results provide evidence that immediate implant placement without additional augmentation, but with immediate provisionalization might be a viable treatment alternative even with missing buccal plate in the esthetic maxillary zone.

Keywords Missing buccal bone · Flapless · Immediate implants · Immediate loading · No augmentation

Principal findings Both treatment approaches, immediate implantation and immediate provisionalization in intact extraction sockets as well as in alveoli with buccally missing bone rendered similar outcomes with regard to PES, height of the buccal gingival margin, and the peri-implant bone level after 1 year.

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Introduction

Immediate implant placement in the anterior maxillary zone is a potential approach for meeting patients' requests and desires regarding treatment time, treatment costs, and esthetic outcome, especially for cases with single tooth restorations. Immediate placement of an implant in the extraction alveolus is to counteract the extraction-related bone loss: As early as two weeks following tooth extraction, the complete segment of the bundle bone of the buccal plate will be fully absorbed [1] with concomitant resorption of the bony alveolar margins. After 3 months, the loss of bone level will be 0.2 mm lingually and about 0.6 mm in buccal position [1, 2]. Thus, the first year after tooth extraction will be associated with a horizontal loss

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Accepted Article

Correlation between alveolar bone morphology and volumetric dimensional changes in immediate maxillary implant placement: a 1-year prospective cohort study.

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Word count: 3,669; **Figures:** 3; **Tables:** 3; **References:** 48

Running title: Alveolar changes and immediate implants

Summary: The current study illustrated the influence of the buccal bone plate thickness in the dimensional changes that affects the peri-implant tissues after immediate maxillary implant placement procedures. Findings also show the continuous alveolar volume reduction, mainly during the first month of healing.

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Accepted Manuscript

Buccal bone thickness at dental implants in the aesthetic zone: a 1-year follow-up cone beam computed tomography study

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WILEY

ORIGINAL ARTICLE

Buccal bone thickness at dental implants in the maxillary anterior region with large bony defects at time of immediate implant placement: A 1-year cohort study

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Abstract

Background: There is lack of studies regarding preservation and possible changes in BBT at dental implants.

Purpose: To assess, on cone beam computer tomograms, the presence of bone at the time of tooth extraction in the maxillary esthetic region and the mean buccal bone thickness 1 month and 1 year after final restoration placement in patients with large bony defects.

Material and Methods: In a cohort study, patients were selected presenting a failing tooth with a large bony defect (test group [*n* = 20]: *large bony defect*, immediate placed implant and delayed provisionalization). Results were compared with a group in which patients presented a failing tooth without or with a small bony defect: (control group [*n* = 20]: *without or small bony defect*, immediate placed implant and delayed provisionalization). Cone beam computer tomograms were made preoperatively, and 1 month and 1 year after placement of the restoration, and buccal bone thickness was analyzed.

Results: In both groups approximately 1 mm of buccal bone thickness was present after 1 month and 1 year, without a significant difference between the groups.

Conclusion: In patients with large bony defects at a failing tooth it was possible to create a bone layer buccally of the implant and this bone layer remained stable during a 1-year follow-up; there were no significant differences between thickness of buccal bone at 1 month and 1 year in patients with large buccal bony defects and patients without or with small bony defects.

KEYWORDS

bone thickness, cone-beam computed tomography, dental implants, esthetic region

1 | INTRODUCTION

Immediate implant placement in the esthetic region is stated to be a favorable treatment modality for replacing failing teeth.[1–3] Conversely, there are also studies which conclude to be cautious with immediate implant placement, especially if highly esthetic demands are involved.[4] Particularly in the esthetic zone, preservation and establishment of labial mucosa and underlying buccal bone has been shown to be a key factor in achieving optimal results.[5,6]

In the esthetic region, there is data regarding buccal bone thickness (BBT) when the tooth is still in situ.[7,8] Januário and colleagues[7] showed that the buccal bone wall in most cases was less than 1.0 mm thick and even in half of the sites 0.5 mm or less. In the study of El Nahass and Naiem[8] it was reported that usually mean BBT at the central and lateral incisors was less than 1.0 mm. Removal of a maxillary anterior tooth will lead to significant loss of BBT within a few weeks.[9] It has been posed that immediate dental implant placement with augmentation of the space between implant and buccal wall should prevent these dimensional changes, but the results of this preservation

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Periodontology 2000

Implant placement post extraction in esthetic single tooth sites: when immediate, when early, when late?

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In the first 25 years of modern implant dentistry based on the concept of osseointegration (15, 96), implant placement was predominantly performed in healed sites of fully edentulous patients (1, 16). Most of these patients had been edentulous for years and the utilization of dental implants was aimed at improving masticatory function and the quality of life. In the 1980s, the application of dental implants started to be cautiously expanded into partially edentulous patients as well, and the first reports were published with promising results (27, 28, 104). Since then, the percentage of partially edentulous patients in implant dentistry has significantly increased and today, these indications predominate in daily practice, in particular single tooth gaps (12, 19). In the case of single tooth replacement, implant placement into healed sites has today completely lost its dominance, since the thorough understanding of dimensional ridge alterations post extraction (3, 34) revealed that this approach frequently complicates therapy, and a healing period of at least 6 months post extraction prior to implant placement is not really attractive any more to patients in daily practice. Thus, the timing of implant placement has become an important issue in the dental community in the past 15 years, and this topic has been specifically addressed at three consecutive ITI Consensus Conferences (ITI, International Team for Implantology) in the form of narrative or systematic reviews (38, 39, 43), and consensus conferences of other dental organizations (69, 93, 97). Based on these review papers and combined with the clinical experience of attending master clinicians, consensus statements and clinical recommendations have been developed by the ITI (36, 70, 88).

The goal of this review paper is to present a historical analysis of how the topic of implant placement post extraction has evolved over the years, and what clinical approaches are recommended today. The review is limited to single tooth extractions in the esthetic zone, since this is a very frequent indication for implant therapy today (19) and the majority of clinical research in post-extraction implant placement relates to this clinical indication of implant therapy (38, 39). Its structure is based on several time periods defined by review papers of ITI Consensus Conferences.

Development of different implant placement protocols post extraction

Pioneer phase of immediate implant placement (1975–1989)

As already mentioned above, in the 1970s and early 1980s, implant dentistry was dominated by implant placement into healed sites. The credit for the first evaluation of immediate implant placement goes to Professor Wilfried Schulte from the University of Tubingen in Germany, who introduced the so-called Tubinger Immediate Implant in 1978 (98), which was a

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CONSENSUS REPORT

WILEY CLINICAL ORAL IMPLANTS RESEARCH

Group 2 ITI Consensus Report: Prosthodontics and implant dentistry

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Review Article

Periodontal biotype: Basics and clinical considerations

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ABSTRACT

Gingival/periodontal biotype is now known to influence the indications and outcomes of various therapies routinely performed in a dental clinic. The delicate thin biotype is more susceptible to injury and responds in a different way clinically as compared to the sturdier thick biotype. Assessment, identification, and indicated treatment considerations are now becoming the key to achieve predictable results, good esthetics, and stability of soft tissue margins. This review describes the various classifications, methods of assessment and clinical considerations for both the thick and thin tissue biotypes.

CLINICAL RELEVANCE TO INTERDISCIPLINARY DENTISTRY

In the era of evidence-based interdisciplinary dentistry, none of the dental disciplines are mutually exclusive. The treatment plan, treatment response, and prognosis of dental procedures vary greatly between teeth with different biotypes. Hence, the knowledge and assessment of gingival/periodontal biotype has become an important routine in clinical decision-making.

Key words: Gingival biotype, periodontal biotype, periodontal therapy

INTRODUCTION

Gingiva is the part of the oral mucosa that covers the alveolar processes of the jaws and surrounds the necks of the teeth. A well-scalloped gingival line at the cemento-enamel junction (CEJ) of the teeth forms one of the pillars of a beautiful smile. Clinicians handle gingiva in several dental procedures and the resulting gingival architecture is not always ideal. In the era of esthetics-driven dentistry, it is of paramount importance that a clinician should be well-aware of all the factors that may influence the final esthetic outcome of a treatment. One such factor that clinicians should consider before starting any restorative, prosthetic, and periodontal procedure is the "tissue biotype."

Ochsenbein and Ross in their pioneer study indicated that there were two main types of gingiva morphology, namely the scalloped and thin or flat and thick gingiva.[1] The term "periodontal biotype" was later introduced by Seibert and Lindhe to categorize the gingiva into "thick flat" and "thin scalloped" biotypes.[2] In general, the term gingival biotype has been used to describe the thickness of the gingiva in the facio-palatal dimension. Whereas the term "periodontal biotype" encompasses not only the thickness of gingiva, but also other features such as contour of gingiva, alveolar bone contour and thickness, amount of keratinized gingiva present, and crown shape.[3] With the increase in the amount of literature on the topic, it is now understood that different gingival/periodontal biotypes behave in a different manner under similar clinical conditions. Furthermore, the treatment considerations for individuals with different biotypes differ.

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Peri-implant Soft Tissue Conditioning with Provisional Restorations in the Esthetic Zone: The Dynamic Compression Technique

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An optimal esthetic implant restoration is a combination of a visually pleasing prosthesis and surrounding peri-implant soft tissue architecture. This article introduces a clinical method, the dynamic compression technique, of conditioning soft tissues around bone-level implants with provisional restorations in the esthetic zone. The technique has several goals: to establish an adequate emergence profile; to recreate a balanced mucosa course and level in harmony with the gingiva of the adjacent teeth, including papilla height/width, localization of the mucosal zenith and the tissue profile's triangular shape; as well as to establish an accurate proximal contact area with the adjacent tooth/implant crown. (Int J Periodontics Restorative Dent 2013;33:447–455. doi: 10.11607/prd.1268)

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Therapy with endosseous implants in the esthetic zone represents a well-established treatment option. For this indication, similar implant survival and success rates have been reported in comparison to other anatomical regions.[1–5] However, achieving an optimal esthetic outcome with implant-supported crowns in the esthetic zone remains one of the greatest challenges in implant dentistry. The creation of an appealing implant restoration in the esthetic zone is based on detailed treatment planning and consideration of possible risk factors.[6] Even after a successful and meticulous surgical protocol, the prosthodontic finalization remains challenging. The esthetic outcome depends on surgical and prosthetic aspects. Surgical aspects include the correct three-dimensional position of the implant platform and successful build-up of a facial bone wall of sufficient height and thickness.[2] Prosthetic aspects include the quality of the restoration itself and the creation of surrounding peri-implant soft tissues that harmonize with the adjacent dentition. Hence, the crown/implant/tissue complex should

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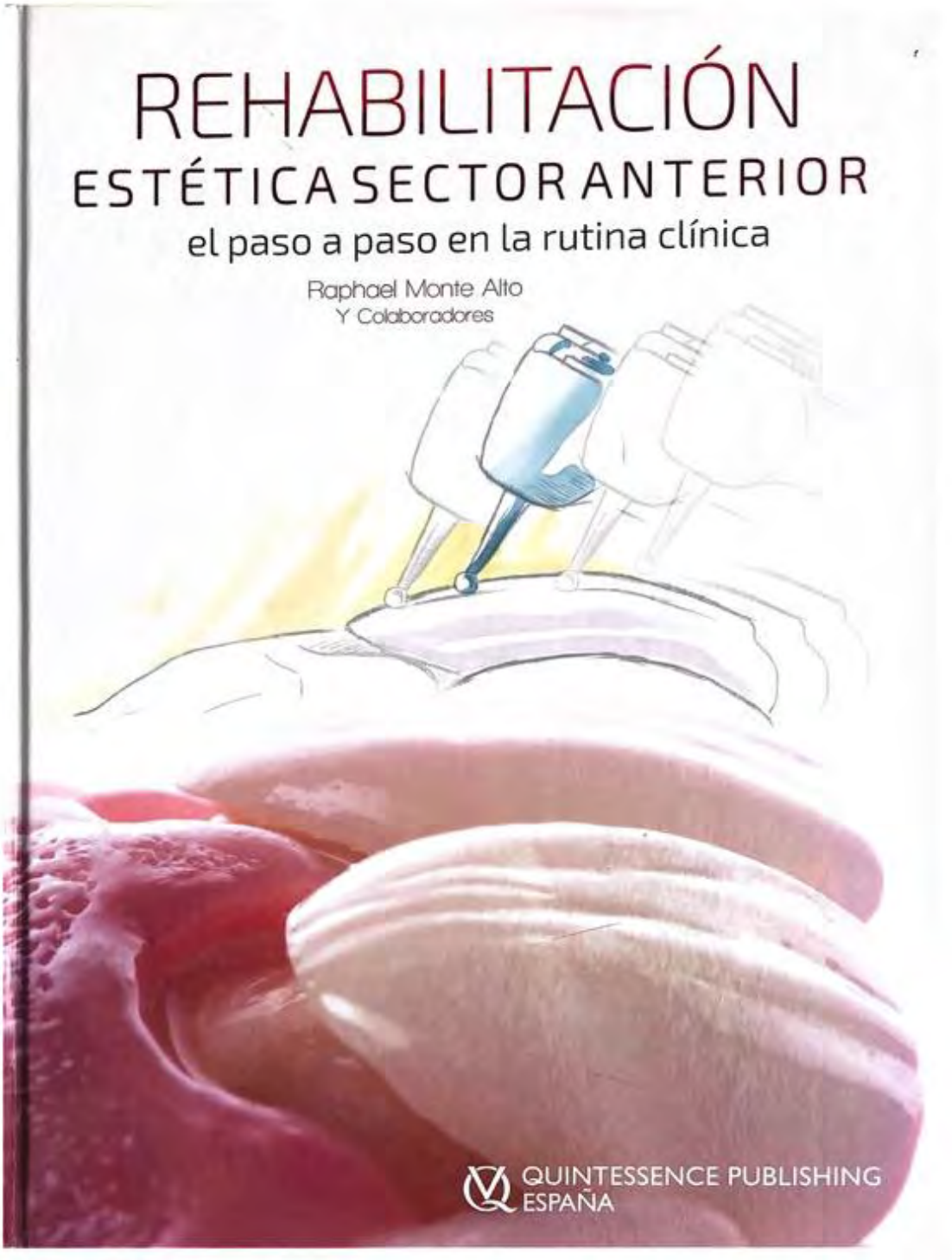
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REVIEW ARTICLE

Is the internal connection more efficient than external connection in mechanical, biological, and esthetical point of views? A systematic review

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Abstract

Purpose This systematic review aimed to evaluate if the internal connection is more efficient than the external connection and its associated influencing factors.

Methods A specific question was formulated according to the Population, Intervention, Control, and Outcome (PICO): Is internal connection more efficient than external connection in mechanical, biological, and esthetical point of views? An electronic search of the MEDLINE and the Web of Knowledge databases was performed for relevant studies published in English up to November 2013 by two independent reviewers. The keywords used in the search included a combination of Bdental implant^ and Binternal connection^ or BMorse connection^ or Bexternal connection.^ Selected studies were randomized clinical trials, prospective or retrospective studies, and in vitro studies with a clear aim of investigating the internal and/or external implant connection use.

Results From an initial screening yield of 674 articles, 64 potentially relevant articles were selected after an evaluation of their titles and abstracts. Full texts of these articles were obtained with 29 articles fulfilling the inclusion criteria. Morse taper connection has the best sealing ability. Concerning crestal bone loss, internal connections presented better results than external connections. The limitation of the present study was the absence of randomized clinical trials that investigated if the internal connection was more efficient than the external connection.

Conclusions The external and internal connections have different mechanical, biological, and esthetical characteristics. Besides all systems that show proper success rates and effectiveness, crestal bone level maintenance is more important around internal connections than external connections. The Morse taper connection seems to be more efficient concerning biological aspects, allowing lower bacterial leakage and bone loss in single implants, including aesthetic regions. Additionally, this connection type can be successfully indicated for fixed partial prostheses and overdenture planning, since it exhibits high mechanical stability.

Keywords Dental implants - Connection - Biomechanical phenomena - Systematic review

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Introduction

Dental implants have been widely used for single-tooth replacements up to full-arch rehabilitations [1,2]. Over the years, some geometries of the implant connection have been developed—with different mechanical, biological, and esthetical characteristics—to maintain the stability of the implant–prostheses interface. Basically, two geometries are available: the internal and external connections. While the external connection usually has an external hexagon on the implant platform, the internal connection can be divided into internal hexagon, internal octagon, and Morse taper connection, which is currently being used extensively [3].

Historically, the external hexagon connection was designed to provide a rotational torque transferring mechanism for implant placement [4,5]. Reversibility and an anti-rotational mechanism are some advantages of this connection. However, the external hexagon allows the existence of a microgap in the implant–abutment interface. Besides, this system is less

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META-ANALYSIS
Implantodontology

Does the implant-abutment interface interfere on marginal bone loss? A systematic review and meta-analysis

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

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Abstract: The objective of this systematic review was to compare the conical internal connection (IC) with the external hexagonal connection (EH) on the occurrence of marginal bone loss (ΔMBL). Different databases were used to carry out the selection of the elected studies. The studies were judged according to the risk of bias as "high", "low" and "unclear" risk. For the meta-analysis we included only studies that could extract the data of ΔMBL, survival rate (SR) and probing depth (PD). No statistically significant differences were found for ΔMBL data at one, three- and five-year survival rates between implant connections ($p < 0.05$), however statistically significant differences were found for PD between EH and IC implants (1-year follow-up) -0.53 [95%CI -0.82 to -0.24, $p = 0.0004$]. This present systematic review demonstrated that there are no significant differences between IC and EH implants for both ΔMBL and SR at 1, 3 e 5 years after functional loading, although better PD values were observed for implants pertaining to the IC connections. Considering the high heterogeneity, more well-delineated, randomized clinical trials should be conducted.

Keywords: Dental Implants; Dental Implant-Abutment Design; Systematic Review.

Introduction

Great scientific evidence (*in vitro*, *in vivo* and clinical trials) has demonstrated that modern oral rehabilitation techniques, based on the use of endosseous dental implants, have recently allowed for the attainment of highly osseointegrated restorations displaying remarkable initial esthetic and mechanical properties.[1-5] Numerous studies, however, have shown that these types of rehabilitations are typically associated with significant bone loss over the course of their service lives. Because of that, marginal bone loss has been considered one of the most important criteria to define the clinical success of dental implants.

According to a consensus reached at the International Congress of Oral Implantology (ICOI), a successful dental implant may display at radiographic assessment, physiological bone losses (i.e., saucerization) smaller than 2.0 mm after the installation of the prosthesis[6] (within the first year) and additional 0.2 mm for each subsequent year of activity.[7,8] Even though saucerization may adversely impact the position of the

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ORIGINAL ARTICLE

WILEY

Esthetic evaluation of single implant restorations, adjacent single implant restorations, and implant-supported fixed partial dentures: A 1-year prospective study

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Abstract

Background: Peri-implant soft tissues esthetics varies and depends on the restoration type such as implant-supported single crowns, adjacent multiple single crowns, and fixed partial dentures (FPD).

Purpose: The aim of this prospective study was to assess the esthetic outcome of the peri-implant soft tissues of (NobelBiocare™) implant-supported single crowns, adjacent multiple single crowns, and FPD. A potential association between the esthetic risk profile and the esthetic outcome was assessed.

Materials and methods: Between 03/11 and 03/17, 300 NobelActive implants were installed in 153 partially edentulous patients. Prior to the fabrication of the final restoration, the esthetic risk profile (ERP) of the patient was determined. The pink esthetic score (PES) and white esthetic score (WES) were assessed by three investigators at 6 and 12 months post-insertion of the final restoration. Patients' appreciation was assessed on a visual analogue scale (VAS) at the 1-year follow-up.

Results: The clinical acceptable limit for PES (≥6) was achieved in 56% to 68% of the single crowns at 6 and 12 months, respectively. Clinically unacceptable PES scores were recorded for 48% of the adjacent multiple single crowns and 63% of the FPDs at both time points. The association of a high ERP with WES and PESWES was noticed for single implant-supported crowns. For the latter restoration type, a ≤5 mm distance between the crestal bone level and the proximal contact positively influenced the PES and combined PESWES scores. No correlation was found between PES or WES and patient satisfaction. Mesial papilla formation was more pronounced compared to the distal one for the single implant crowns and for implant-supported FPD.

Conclusion: When high esthetic demands are expected, assessment of ERP prior to implant treatment is advised in order to estimate a realistic outcome.

KEYWORDS
esthetic risk profile, implant, PESWES (pink esthetic score/white esthetic score), prospective study

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CLINICAL ARTICLE

Achieving the Optimal Peri-implant Soft Tissue Profile by the Selective Pressure Method via Provisional Restorations in the Esthetic Zone

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ABSTRACT

For the successful single-tooth implant therapy in the esthetics zone, achieving an ideal peri-implant soft tissue profile is paramount. It can achieve by the manipulation of the provisional restorations. This clinical report demonstrate the selective pressure method and concave transmucosal profile of the provisional restorations to achieve the ideal and stable gingival profile in esthetic single tooth implant restorations.

CLINICAL SIGNIFICANCE

The selective pressure method and the concave transmucosal profile in implant provisional restorations facilitate stable and harmonized peri-implant gingival tissue in the esthetic zone.

(J Esthet Restor Dent 27:136–144, 2015)

INTRODUCTION

In order to deliver a successful single-tooth implant therapy in the esthetics zone, one of the critical and challenging treatment objectives is achieving an ideal peri-implant soft tissue profile.[1–4] The margin, color, contour, texture, and thickness of the peri-implant soft tissue, as well as the height of the interdental papillae, should be matched and harmonized with the existing adjacent dentition.[5–8] In replacing a failing dentition with a dental implant in the esthetics zone, several important factors should be considered. These include: timing of the implant placement, timing of the provisional restoration placement, and the necessity of the hard and soft tissue grafts.[9]

Provisional restorations play a large role in creating and/or preserving the soft tissue architecture when achieving the ideal profile of the peri-implant gingival tissue.[10] The timing of the provisional restoration placement is dictated by several factors, including the primary stability of implant, the size of defects and/or gaps between implant and buccal plate, and the amount of hard and/or soft tissue grafts. While the main goal of the immediate implant provisional restoration is to preserve the existing dento-gingival tissue, especially at the facial gingival level and at the interdental papilla,[11,12] the utilization of the delayed restoration is to create peri-implant soft tissue architecture that harmonizes with the soft tissue of the adjacent teeth.[10] In most cases, changing the emergence profile could be performed restoratively by adding or subtracting the restorative provisional materials,[10] and/or surgically by the addition of the soft tissue graft, leading to thicker tissue that could hide the shadow effects of abutments and facilitate more stable peri-implant soft tissue.[13–15]

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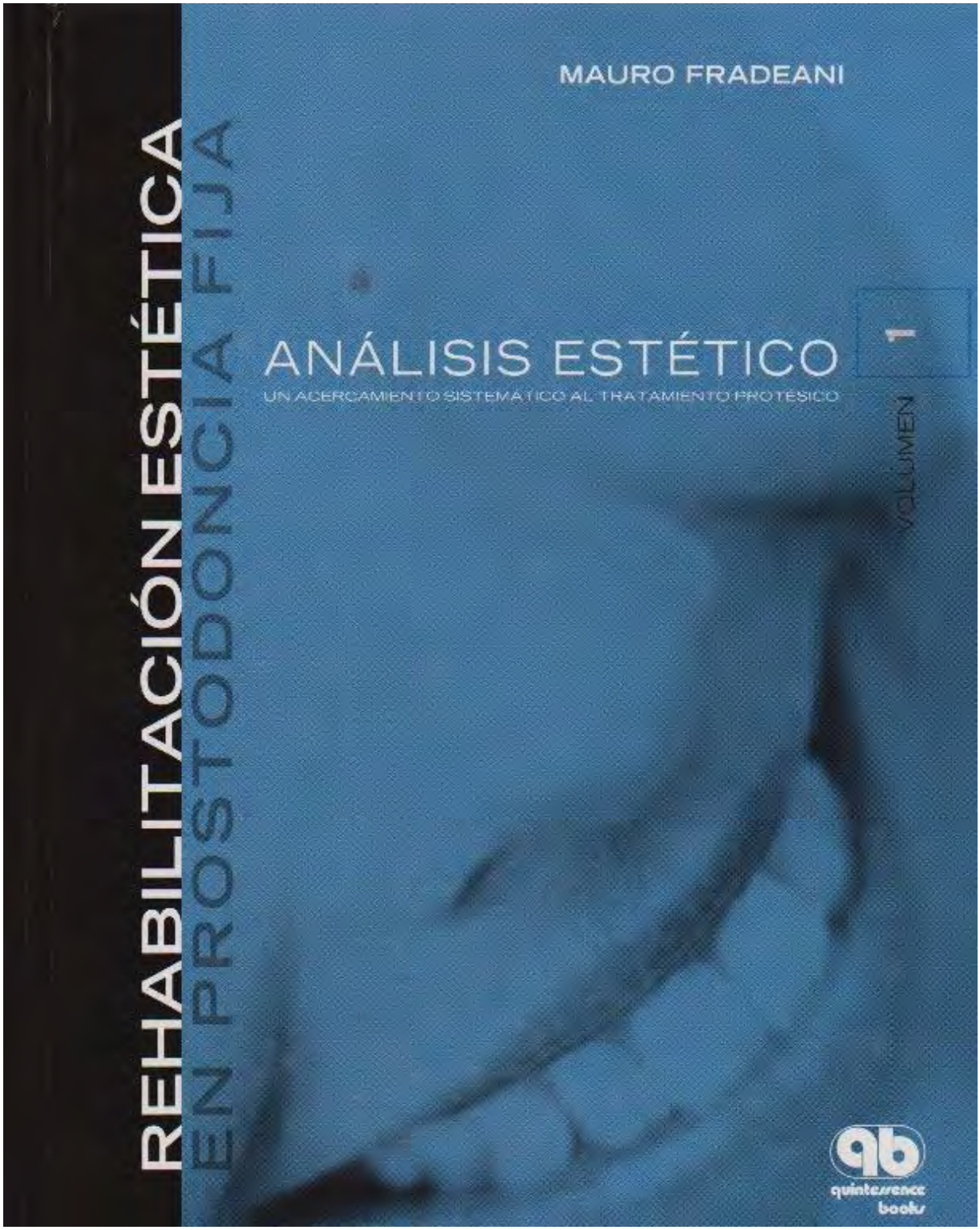
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Case Report

Clinical Application of the PES/WES Index on Natural Teeth: Case Report and Literature Review

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The use of reliable indices to evaluate the aesthetic outcomes in the aesthetic area is an important and objective clinical aid to monitor the results over time. According to the literature various indices were proposed to evaluate aesthetic outcomes of implant-prosthetic rehabilitation of the anterior area like Peri-Implant and Crown Index [PICI], Implant Crown Aesthetic Index [ICAI], Pink Esthetic Score/White Esthetic Score [PES/WES], and Pink Esthetic Score [PES] but none of them was related to prosthetic rehabilitation on natural teeth. The aim of this study is to verify the validity of PES/WES index for natural tooth-prosthetic rehabilitation of the anterior area. As secondary objective, we proposed to evaluate the long-term predictability of this clinical application, one of which is presented below, following the analysis of the most currently accepted literature.

1. Introduction

A goal of modern dentistry is the placement of aesthetically pleasing restorative material. Single-tooth replacement in the anterior area presents a challenge for the clinician. In this region, treatment considerations include shape and shade matching of the crown, interdental spacing, topography of the ridge, contacts of the opposing dentition, parafunctional habits, and esthetic desires of the patient. Facial aesthetics is based on the harmony of both smile and face [1]. Fundamental parameters for an aesthetic smile are the position of the lips, gingival tissue condition, color, shape, and teeth position. Then when a prosthetic rehabilitation has been planned, each of the above-mentioned parameters should be performed [2, 3]. Careful rehabilitation plan and knowledge of the characteristics of the natural dentition are necessary for the rehabilitation of the maxillary anterior teeth. Clinical and radiographic examinations, study of models through diagnostic waxing, and cooperation with other specialists may be the key to have a high aesthetic and functional success [4–7]. The success of a single restoration in the esthetic zone depends mainly on the harmonious integration of the restoration into the patient's overall appearance, especially the peri-implant soft tissue [8, 9].

Both subjective (patients' ratings) and objective (esthetic scores and indices) assessments of implant esthetics are subject to growing interests [10, 11].

In order to achieve satisfactory outcome, it is essential to choose proper materials and techniques, whose quality has improved in dentistry. As a matter of fact, nowadays, zirconia ceramic systems are available; they have both biomechanical and mimetic high-quality properties that allow the clinician to achieve aesthetic and long-lasting results [12]. Longitudinal clinical studies using this system in anterior and posterior teeth show supportive outcomes, proving it can be an alternative to metal-ceramic fixed prostheses [13–15].

This case report presented an anterior zirconia ceramic's fixed prosthesis with changes in size, proportion, shape, color, and texture that prejudiced the smile's harmony. The Visual Analogue Scale (VAS) was recommended as a subjective

CLINICAL ORAL IMPLANTS RESEARCH

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The influence of the emergence profile on the amount of undetected cement excess after delivery of cement-retained implant reconstructions

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Key words: cementation, dental cements, dental implants, peri-implantitis

Abstract
Objective: To test whether or not one of two emergence profile designs (concave or convex) is superior to the other in terms of remaining cement following cementation of reconstructions on individualized abutments and careful cement removal.
Materials and methods: A central incisor with a single implant-supported reconstruction was selected as a model. Six types of abutments (n = 10) with two different emergence profile designs (concave (CC) and convex (CV)) and three crown–abutment margin depths (epimucosal, 1.5 mm submucosal, 3 mm submucosal) were fabricated through a CAD/CAM procedure. Lithium disilicate reinforced ceramic crowns were cemented with chemically polymerized resin cement. A blinded investigator attempted to remove all cement excess. Thereafter, the entire reconstruction was unscrewed and analyzed for the overall amount and the depth of cement excess. Kruskal–Wallis and Mann–Whitney tests were used to investigate differences between groups. When more than two groups were compared between each other, a Bonferroni correction of the P value was performed.
Results: Concave abutments presented significantly more cement remnants than CV abutments when the entire abutment area of the epimucosal margin groups was evaluated (CC0 mm: mean 2.31 mm^2 (SD 0.99) vs. CV0 mm: mean 1.57 mm^2 (SD 0.55); P = 0.043). A statistically significant increase in remnants was detected when the crown–abutment margin was located more submucosally for every abutment studied (0 mm vs. 1.5 mm: P < 0.000, 0 mm vs 3 mm: P < 0.000, 1.5 mm vs. 3 mm: P < 0.000). The buccal quadrant demonstrated the least, whereas the oral and interdental quadrants showed the greatest amount of cement excess.
Conclusions: Concave emergence profile abutments and deep crown–abutment margin positions increased the risk of cement excess. Oral and interdental areas are more prone to cement remnants than other surface areas.

The connection between dental implants and prosthetic reconstructions can be obtained by different means. Implant reconstructions can be either screw-retained or cemented. Both types of fixation render clinically successful long-term outcomes; the five-year survival rates for single-crown screw-retained reconstructions are estimated to be 89.3% (95% CI: 64.9%-97.1%), whereas cemented reconstructions demonstrate survival rates of 96.5% (95% CI: 94.8%-97.7%), without reaching statistically significant differences (Sailer et al. 2012). According to recent systematic reviews (Sherif et al. 2014; Wittneben et al. 2014), each approach has its own advantages and disadvantages. This fact is reflected by their technical and biological complication rates observed during the 5-year follow-up period. The cumulative incidence of technical complications for single-crown screw-retained reconstructions was 24.4%, whereas for cemented reconstructions, the rate was of 11.9%. Moreover, biologic complications, such as marginal bone loss greater than 2 mm, were more frequently associated with cemented than with screw-retained reconstructions (2.8% vs 0%).

Cemented reconstructions offer advantages such as ease of fabrication, reduced costs, increased framework passivity and improved esthetics due to the absence of screw access hole in the occlusal surface of

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ORIGINAL ARTICLE

WILEY

Influence of the fixed implant-supported provisional phase on the esthetic final outcome of implant-supported crowns: 3-year results of a randomized controlled clinical trial

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Abstract

Objectives: The aim of this investigation was to evaluate whether the use of a provisional implant-supported crown improves the final esthetic outcome of implant crowns that are placed within esthetic sites.

Materials and Methods: Twenty endosseous implants were inserted in sites 13 to 23 (FDI) in 20 patients. Following the reopening procedure, a randomization process assigned them to either cohort group 1: a provisional phase with soft tissue conditioning using the "dynamic compression technique" or cohort group 2: without a provisional phase. Screw-retained all ceramic crowns were inserted. Clinical follow-up appointments were completed at 36 months evaluating clinical, radiographic outcomes, and implant success and survival.

Results: After 3 years, all implants survived; one implant-supported crown was excluded from the study due to adjacent tooth failure replaced with a further implant supported crown. Modified pink esthetic score (ModPES) scores were significantly different between groups 1 and 2 (P = .018); white esthetic scores (WES) were not statistically different between both groups (P = .194). Mean values of combined modPES and WES were 15.6 for group 1, with a SD of 3.20. Group 2 had a mean combined modPES and WES of 12.2, with a SD of 3.86. Mean bone loss after 3 year was −0.05 and −0.04 mm for groups 1 and 2 respectively, without being statistically significant.

Conclusion: Fixed implant-supported provisionals improve the final esthetic outcome of the peri-implant mucosa.

KEYWORDS
esthetic, implant, implant supported crown, mucosa, provisional, provisionalization, soft tissue conditioning

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Contour Management of Implant Restorations for Optimal Emergence Profiles: Guidelines for Immediate and Delayed Provisional Restorations

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Adequate management of the implant-supported restoration has become an important task when trying to obtain optimal esthetic outcomes. The transgingival area must be developed to maintain or influence the final appearance of the peri-implant soft tissues. Two distinct zones within the implant abutment/crown can be identified: the critical contour and the subcritical contour. Their design and subsequent alteration may impact the peri-implant soft tissue architecture, including the gingival margin level and zenith, labial alveolar profile, and gingival color. Defining these two areas helps clarify how to process soft tissue contours and may additionally improve the necessary communication with the laboratory. Since there are many protocols for placing implants, it is worthwhile to determine similarities in the contouring and macrodesign of their corresponding provisional restorations. Therefore, the purpose of this paper is to discern the general characteristics of the critical and subcritical contours for provisional restorations made for immediate and delayed implants in order to obtain guidelines for daily clinical practice. Int J Periodontics Restorative Dent 2020;40:61–70. doi: 10.11607/prd.4422

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An implant-supported restoration in the esthetic zone is successful when imperceptibly integrated with the adjacent teeth.[1] The extraction challenges this goal due to the associated ridge resorption.[2] Surgical techniques have been proposed that maintain the volume of the ridge as much as possible or enhanced it if defective.[3] Furthermore, correct implant-positioning guidelines have been documented to help produce a favorable esthetic outcome.[1]

Equally important as the surgical phase is the prosthetic phase. In fact, careful lab work is necessary to replicate the adjacent tooth shape and shade, and the mere placement of the restoration affects the buccal ridge profile.[4] At the level of the crestal bone and mucosa, an implant differs significantly from a tooth in terms of possessing a smaller diameter with a circumferential shape instead of the triangular cross-section observed in natural incisor teeth.[5] Therefore, thoughtful and appropriate management of a temporary restoration may help to develop the shape of the peri-implant soft tissue so that a correct dental emergence profile can be mimicked. Currently, the use of a temporary restoration is a well-accepted means of predictably creating a natural-looking implant-supported restoration in clinical practice.[6] Several anecdotal reports have suggested workflows

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Esthetic Outcome of Implant Supported Crowns With and Without Peri-Implant Conditioning Using Provisional Fixed Prosthesis: A Randomized Controlled Clinical Trial

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ABSTRACT

Background: Achieving an optimal esthetic result using dental implants is challenging. Fixed implant-supported provisional crowns are often used to customize the emergence profile and to individualize the surrounding peri-implant soft tissue.

Purpose: The objective of this study is to evaluate whether the use of a provisional implant-supported crown leads to an esthetic benefit on implants that are placed in the esthetic zone. The null hypothesis is that there is no-difference between the two study groups.

Material and methods: Twenty single implants (Bone Level, Straumann AG, Basel, Switzerland) were inserted in consecutive patients. After reopening, a randomization process assigned them to either cohort group 1: a provisional phase with soft tissue conditioning using the "dynamic compression technique" or cohort group 2: without a provisional. Implants were finally restored with an all-ceramic crown. Follow-up examinations were performed at 3 and 12 months including implant success and survival, clinical, and radiographic parameters.

Results: After 1 year all implants successfully integrated, mean values of combined modPES and WES were 16.7 for group 1 and 10.5 for Group 2. This was statistically significant. Mean bone loss after 1 year was −0.09 and −0.08 for groups 1 and 2, respectively, without being statistically significant.

Conclusion: A provisional phase with soft tissue conditioning does improve the final esthetic result.

KEY WORDS: fixed implant prosthesis, implant, implant-supported crown, randomized controlled trial

INTRODUCTION

Clinical studies show adequate survival rates for the use of endosseous implants and implant-supported restorations over long-term periods[1,2] in partially edentulous patients. However, achieving a successful treatment outcome in the esthetic zone is challenging. Detailed treatment planning and the evaluation of pre-existing risk factors determine the complexity of the case. An optimal esthetic implant restoration is defined as a combination of a visually pleasing prosthesis and surrounding peri-implant soft tissue architecture.[3] Even after a successful surgical intervention including the correct three-dimensional position of the implant platform[4] and a successful build-up of

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The Connective Tissue Platform Technique for Soft Tissue Augmentation

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The presence of a localized alveolar ridge defect, especially in the maxillary anterior dentition, may complicate an esthetic rehabilitation. The goal of this case report is to describe a novel subepithelial connective tissue graft technique for soft tissue augmentation in Class III ridge defects. Surgical intervention consisted of in situ maintenance of a connective tissue "platform" at the edentulous space, which facilitated the stabilization and suturing of the connective tissue grafts used for soft tissue augmentation. Adequate graft thickness to treat the deep horizontal soft tissue loss was obtained by doubling the width of a de-epithelialized free gingival graft that was subsequently folded on itself. The soft tissue conditioning at the level of the pontic began 9 months after surgery by shaping the soft tissue with a bur and filling the space with flowable composite resin applied above the pontic. The final prosthetic phase began 14 months after surgery. A reproduction of the anatomical cementoenamel junction in the provisional and definitive restorations was performed to improve the soft tissue emergence profile. Nine months after surgery, a soft tissue augmentation of 5 mm in the vertical and 4 mm in the horizontal dimension was accomplished. The suggested surgical technique was able to accomplish horizontal and vertical soft tissue augmentation in a single surgical step. (Int J Periodontics Restorative Dent 2012;32:665–675.)

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Postextraction alveolar ridge deformities complicate implant rehabilitations, and prosthetic treatment encounters several problems concerning functionality (phonetic and food impaction under the pontic), esthetics (scalloped outline alteration, loss of papillae and formation of "black" open interdental space, presence of gingival scar tissue, and difficult design of an esthetic pontic), and cleaning. Traditional restorative solutions to reduce the esthetic defect include a long fixed partial denture (FPD) pontic extending to contact the ridge or a long crown on the implant, gingival-like porcelain or acrylic resin on the pontic element or on the crown connecting to the implant, and a removable prosthesis that attempts to simulate the anatomical contour of the edentulous alveolar ridge. These prosthetic solutions may be acceptable from a functional point of view, but they frequently lack realism and are easily recognizable when the patient smiles. For this reason, surgical techniques to correct soft tissue defects have become of great clinical interest.

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Restorative Emergence Profile for Single-Tooth Implants in Healthy Periodontal Patients: Clinical Guidelines and Decision-Making Strategies

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The peri-implant soft tissue seal consists of a connective tissue cuff and a junctional epithelium that is different from the arrangement of periodontium around a natural tooth. However, the peri-implant soft tissue complex lacks Sharpey's fibers, thus offering less resistance to clinical probing and biofilm penetration compared to the natural dentition. Therefore, the proper restorative emergence profile design is essential to facilitate favorable esthetic outcomes and maintain peri-implant health. The aim of this article is to review the currently available evidence related to the design of subgingival (critical and subcritical) and supragingival contours of the implant restorative emergence profile (IREP) as well as provide a flowchart for decision-making in clinical practice. Theoretically, the subgingival contours of the crown/abutment complex should mimic the morphology of the root and the cervical third of the anatomic crown as much and as often as possible. However, this is highly dependent upon the three-dimensional spatial position of the implant relative to the hard and soft tissue complex, in addition to the location of the definitive restoration. Frequently, a convex critical contour is required on the facial aspect of a palatally or incisally positioned implant to support an adequate gingival-margin architecture. Conversely, if the implant is placed too far facially, then a flat or concave contour is recommended. In instances where soft tissue support is not needed, the subcritical area may be undercontoured to increase the thickness, height, and stability of the soft tissue cuff. Int J Periodontics Restorative Dent 2020;40:19–29. doi: 10.11607/prd.3697

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The restorative emergence profile (REP) is defined as "tooth and crown contour as they traverse soft tissues and rise toward the contact area interproximally and height of contour facially and lingually."[1] On a natural tooth, it represents the contour of a tooth or restoration as it emerges from the gingiva. In the case of an implant-supported restoration, the implant restorative emergence profile (IREP) represents the contour of the implant abutment/crown complex as it arises from the implant restorative platform and emergence from the peri-implant soft tissues.

Ideally, the IREP contour should mimic that of the extracted tooth while supporting a harmonious, esthetic gingival architecture that mimics the surrounding natural dentition from a level (facial and proximal) and morphologic standpoint.[2] Unfortunately, the presence of an implant, even if it was correctly placed, in conjunction with possible bone and soft tissue grafting procedures, will induce biologic changes that alternate the dynamics of the peri-implant gingiva (gingival thickness; horizontal and vertical contour). Therefore, to achieve an esthetic implant gingival architecture that emulates that of the contralateral tooth, the IREP contour often requires significant modification and customization, which may not be as simplistic as mimicking the natural anatomy of

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Considerations of Implant Abutment and Crown Contour: Critical Contour and Subcritical Contour

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Adequately contoured implant restorations need to transition from the circumferential design of the implant head to the correct cervical tooth anatomy. The implant abutment may be used to effect this transition provided there is sufficient running room. Implant restorations have been described as overcontoured, flat, and undercontoured. It has been shown that overcontouring will generally cause apical positioning of the gingival margin, while undercontouring will induce the opposite effect. However, these terms have been applied arbitrarily and without allocating specific determinants. Furthermore, the concept of "contour" as originally adapted from tooth-supported restorations needs to be redefined as it pertains to implant dentistry. Two distinct zones within the implant abutment and crown are defined as critical contour and subcritical contour. Any alteration of critical or subcritical contour can modify the soft tissue profile. The purpose of this paper is to determine the effect of abutment contour modifications at these zones on the peri-implant soft tissues, including the gingival margin level, papillae height, gingival architecture, labial alveolar profile, and gingiva color. (Int J Periodontics Restorative Dent 2010;30:335–343.)

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To achieve an optimal esthetic implant restoration, the correct implant placement into an adequately prepared site is critical. Several publications have advocated approaching ideal implant placement from a three-dimensional perspective. Some of the recommended parameters include: *(1)* apicocoronal: the implant position should be 2 to 4 mm apical to the expected gingival margin position; *(2)* faciolingual: 2 mm of facial bone is recommended to prevent the loss of facial tissue, and the implant should be positioned slightly palatal to the incisal edge; and *(3)* mesiodistal: the implant should be 2 mm away from adjacent teeth, and a 3-mm space between implants is recommended.[1–8] Ideally, the implant abutment should mimic a full crown preparation. Use of a customized abutment in cases of anterior implants has been a successful practice for a number of years. The importance of transitioning from a circumferential implant neck to a proper cervical anatomy has been emphasized to create a natural-looking implant-supported restoration.[7] Bichacho and Landsberg[9] emphasized the use of a cervical contouring concept utilizing

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CLINICAL ARTICLE

WILEY

The esthetic biological contour concept for implant restoration emergence profile design

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Abstract

Objective: Emergence profile design is important for stable peri-implant tissues and esthetically pleasing results with dental implant restorations, influenced by factors, such as, implant position and surrounding soft tissues. Different aspects of the emergence profile have been described, but detailed explanations of the different zones and corresponding designs are missing. This article describes the esthetic biological contour concept (EBC), differentiating important areas of the emergence profile and recommending particular designs for those zones.

Overview: The EBC concept considers specific parameters for proper design of the emergence profile of implant-supported restorations. Understanding the different zones of the emergence profile and their relation to factors like implant position, implant design, and soft tissue thickness is key. The suggested guidelines are geared toward providing more stable and esthetic results when restoring dental implants in the esthetic zone.

Conclusions: Each of the zones described in the EBC concept have a specific function in the design of the emergence profile. Understanding the importance and specific design features of the EBC zones facilitates esthetic and biologically sound treatment outcomes with interim and definitive implant restorations.

Clinical significance: Proper emergence profile design supports esthetic outcomes and provides favorable biological response to implant-supported restorations.

KEYWORDS

CAD-CAM abutments, dental implants, emergence profile, esthetic dentistry, implant provisionals

1 | INTRODUCTION

An esthetic implant-supported restoration emerges through the surrounding tissues like a natural tooth.[1,2] The transition between the restoration and the soft tissues must appear natural, and the emergence profile (EP) often requires customized modification.[3,4] Many techniques to condition the peri-implant soft tissues during the implant healing process have been described: immediate provisional restorations, custom healing abutments, as well as provisionalization techniques after the implant has integrated.[5-9] The three-dimensional (3D) position of the implant and quantity of soft tissues available are factors that influence the shape of the EP.[5,10-12] The final contour of the provisional restoration is essential to achieve an esthetic result.[10,13]

The concept of the critical and subcritical contours of the implant emergence profile was described by Su et al.,[14] who focus on the importance of shaping two different areas of the EP to achieve the desired outcome in the peri-implant tissues. However, there is still much confusion about the subcritical contour design when different soft tissue environments are present. Developing an adequate emergence profile by manipulating the peri-implant tissues should be done during the provisionalization stage. The technique used will depend

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A Novel Prosthetic Device and Method for Guided Tissue Preservation of Immediate Postextraction Socket Implants

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Preservation of the surrounding hard and soft tissues associated with an immediate postextraction socket implant to replace a nonrestorable tooth in the esthetic zone is one of the greatest challenges facing the dental team. Several studies have documented the biologic and esthetic benefits of bone graft containment with either a custom healing abutment or provisional restoration. Use of a prefabricated shell that replicates the extracted tooth at the cervical region can help achieve guided tissue preservation and sustainable esthetic outcomes in an easy, simple, consistent, and less time-consuming way. The following case report of a hopeless maxillary right central incisor in a female patient possessing adjacent teeth with a thin periodontal phenotype illustrates this new treatment device, method, and concept. (Int J Periodontics Restorative Dent 2014;34(suppl):s9–s17. doi: 10.11607/prd.2129)

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Placement of implants into anterior postextraction sockets has gained popularity since the introduction of this approach in 1989.[1,2] It condenses treatment procedures at the time of tooth removal, decreasing the overall treatment period and enhancing the total patient experience. When immediate postextraction implant placement (with or without provisional restoration) was compared to delayed protocols, equivalent survival rates were reported.[3–9] The esthetic ramifications of immediate implants, especially for single anterior teeth in the esthetic zone, are therefore of increasing significance. The thickness of peri-implant mucosal tissues affects abutment materials selection, all of which must be in balance to achieve a predictable and sustainable esthetic outcome.[10–15]

Several clinical obstacles may complicate fabrication of an implant-supported provisional restoration following tooth removal. The peri-implant mucosal tissues often immediately collapse after tooth extraction, socket debridement, and implant placement, complicating the task of capturing the

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applied sciences

MDPI

Case Report

Immediate Implant Placement and Provisionalization in the Esthetic Zone Revisited: The Marginal Migration Concept (MMC)

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Abstract: Immediate implant placement and provisionalization in the esthetic zone is a desirable approach that presents several advantages but at the same time embosses several risk factors that can lead to severe esthetic complications. The purpose of this article was to propose a new protocol that could allow for the maintenance and even the improvement of the hard and soft tissue topography, leading to superior esthetic results. The proposed protocol, when certain criteria are met, could be applied even for cases where the extraction socket morphology is currently proposed as a contra-indication for immediate implant placement and provisionalization.

Keywords: extraction socket; immediate implant; provisional; esthetic zone

1. Introduction

Immediate implant placement and provisionalization at the time of extraction in the esthetic zone is today a common treatment modality [1]. The literature outlines the non-interventionist healing process of a post-extraction socket, or in combination with a socket preservation technique, including bone and/or soft tissue grafting, as well as with or without simultaneous implant placement [2–7]. While many protocols have been suggested to achieve the establishment of an esthetic and natural result post extraction in the anterior region, challenges persist [8–10]. Primary among the challenges faced by clinicians are predictability and reproducibility of esthetic outcomes. Especially, as they relate to the volumetric changes that occur to the labial plate of the socket housing post-extraction, both in the bucco-lingual and apico-coronal aspect. These volumetric osseous changes in turn often result in labial gingival recession, as well as negative optical manifestations of the soft tissue due to concavities. Studies have also shown successful results in intact type I sockets, ideal bone and soft tissue profiles (Salama and Salama 1993) at onset, utilizing a combination of bone replacement graft (BRG) and a temporary prosthesis at the time of extraction and implant placement [11–13]. In addition, simultaneous connective tissue grafting grafting in order to increase the stability and predictability of an esthetic outcome have also been suggested [14,15]. Furthermore, there is also evidence that in type I, the labial root fragment can be maintained to biologically stabilize the labial osseous and soft tissue (Partial extraction therapy) [16,17]. However, most immediate implant treatment protocols specifically address only type I sockets, where no hard or soft tissue deficiencies exist prior to extraction [18,19].

Esthetic Assessment of Implants Placed into Fresh Extraction Sockets for Single-Tooth Replacements Using a Flapless Approach

Roni Kolerman, DMD;* Eitan Mijiritsky, DMD;† Eitan Barnea, DMD;‡ Areeje Dabaja, DMD;§ Joseph Nissan, DMD;¶ Haim Tal, DMD, PhD**

ABSTRACT

Background: To validate the concept of immediate implant placement and nonfunctional loading for use in the esthetically sensitive anterior maxilla, clinical trials should ideally include objective esthetic criteria.

Purpose: This study analyzed procedural results as graded by the pink esthetic score and white esthetic score (PES/WES).

Methods: Thirty-nine suitable patients (mean follow-up 44.82 ± 28 months) were evaluated.

Results: Thirty-eight implants fulfilled stringent criteria for successful osseointegration: absence of peri-implant radiolucency, implant mobility, suppuration, and pain. The mean total PES/WES was 15.50 ± 2.67 (range: 10–20). The mean total PES of 7.92 ± 1.60 (range: 5–10) indicated favorable overall peri-implant soft-tissue conditions. Root convexity and texture (1.63 ± 0.54) and curvature of the facial mucosa (1.68 ± 0.47) and distal papilla (1.66 ± 0.48) had the highest mean values, whereas acceptable levels of facial tissue (1.53 ± 0.73) and mesial papilla (1.42 ± 0.64) were the most difficult to fully achieve. The mean mesial and distal bone loss at data collection was, was 1.19 ± 0.54 and 1.15 ± 0.51, respectively. Periodontal disease severity (advanced chronic and aggressive periodontitis) was significantly associated with a low total PES ($p = .048$).

Conclusions: Objective PES/WES assessment validated immediate anterior maxillary single-tooth replacement and restoration as being a successful and esthetically predictable treatment modality in sites where the buccal bone had been preserved during the extraction at 1 year of follow-up.

KEY WORDS: flapless implant surgery, immediate placement, radiographic data, single-tooth implants

INTRODUCTION

Advances in biomaterial technology over the past three decades have led to redefinitions of the term "osseointegration" based on patients' increasing expectations for reduced treatment time and improved esthetics and comfort. The advantages associated with reduction of healing time by immediate implant placement into fresh extraction sockets has been previously described.[1–6] It has been claimed that survival rates of immediate implants are comparable to those of delayed implants providing that good primary stability is achieved.[1–6] In addition to reducing the number of surgical procedures, immediate implantation reduces or even eliminates the load-free healing period following implant placement. The promising results reported thus far have led to further studies that concentrated on the progressive shortening of the healing period for maxillary multiunit implant reconstruction[7–10] and for single-tooth implants, resulting in the immediate connection of an

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Estabilización de los tejidos periimplantarios mediante provisionalización inmediata atornillada de contorno subgingival cóncavo: una propuesta técnica

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Resumen: Para obtener buenos resultados en rehabilitación implanto-soportada que comprenda el sector anterior estético, varias técnicas y conceptos deben ser manejados e integrados para proveer de predictibilidad a nuestro tratamiento. Este artículo describe una técnica específica de provisionalización inmediata atornillada para restauraciones sobre implantes con el contorno subgingival cóncavo que puede mejorar la estabilización de los tejidos periimplantarios y que se integra perfectamente con el resto de conceptos actuales que buscan potenciar dicho efecto. **Palabras clave:** restauración provisional, restauración inmediata, estética.

Introducción

La reposición de piezas en la zona anterior estética mediante prótesis sobre implantes osteointegrados es un reto habitual al que los clínicos se enfrentan en la práctica diaria. En los años más recientes, se ha producido un cambio gradual tanto por parte del paciente como por parte del profesional, desde conseguir una buena función en cuanto a la parte repuesta hasta conseguir buenos resultados estéticos[1]. Esto ha estimulado el interés para el desarrollo científico en este sentido y en estos años se ha producido mucha literatura en el campo de la implantología dental, tanto a nivel de conocimiento de ciencias básicas, especialmente en relación a la biología de los tejidos periimplantarios, como a nivel de protocolos clínicos.

Por un lado, técnicas como los implantes inmediatos postextracción, la carga inmediata con provisionales implanto-soportados[2] y el manejo del tejido blando a través de la modificación de los provisionales[3]; y por otro lado, conceptos como el cambio de plataforma y la preservación de hueso periimplantario[4] nos obligan a conocerlas bien, integrarlos y manejarlos con precisión para proporcionar estética y predecibilidad a las restauraciones. Pero aun así, después de una exitosa fase quirúrgica, manejar correctamente la prótesis en la zona estética continúa presentando una gran dificultad. Para tal fin, la fase de provisionales es una etapa prolongada y crucial en el tratamiento restaurador con implantes[5].

Hay autores que han señalado la posibilidad del uso de aditamentos cóncavos a nivel cervical[6], o incluso diseños cóncavos en la propia porción cervical del propio implante[7] para aumentar el volumen de tejido y minimizar la reabsorción ósea periimplantaria en restauraciones cementadas. Igual de escasa es la literatura científica en relación a técnicas para el correcto desarrollo del perfil de emergencia a través de la misma restauración provisional[8]. En relación con el perfil de emergencia y en esta línea, algunos autores han definido dos áreas dentro del contorno gingival de la restauración y cómo la modificación de las mismas puede afectar a los parámetros estéticos establecidos[9,10].

El propósito del presente artículo es proponer una técnica para la provisionalización inmediata de restauraciones implanto-soportadas atornilladas que presenten un diseño con el contorno subgingival cóncavo que mejore la estabilización del complejo formado por la restauración implanto-soportada y los tejidos periimplantarios y discutir sus posibles beneficios.

Descripción de la técnica

Antes de abordar un tratamiento implantológico que compromete la estética del frente anterior se debe llevar a cabo un estudio prequirúrgico donde se tengan en cuenta multitud de variables que podemos agrupar en consideraciones estéticas, biológicas y oclusales. Estas nos obligan a elegir el camino terapéutico que más nos acerque al éxito en el tratamiento y su mantenimiento.

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DENTAL TECHNIQUE

Digital workflow to provide an immediate interim restoration after single-implant placement by using a surgical guide and a matrix-positioning device

Kyung Chul Oh, DDS, PhD,[a] Changjoo Jeon, DDS,[b] Ji-Man Park, DDS, MSD, PhD,[c] and June-Sung Shim, DDS, PhD[d]

ABSTRACT

This article describes a workflow based on a top-down approach to provide a fixed-type immediate interim restoration after placing a single implant using a digitally driven surgical guide and a matrix-positioning device. A characteristic of the technique is that both the surgical guide and the matrix-positioning device are fabricated from a single diagnostic virtual trial restoration designed on computer-aided design (CAD) software. This workflow may shorten the time required for chairside placement of an interim restoration and enhance esthetics when rehabilitating anterior teeth. (J Prosthet Dent 2018;■:■-■)

Advances in the designs and surface characteristics of dental implants have led to radical changes in the guidelines for implant treatment.[1] Together with a conventional loading protocol, providing an immediate interim restoration with or without functional loading after an implant surgery has been suggested as a valid and predictable treatment option, showing favorable clinical outcomes with minimal peri-implant bone loss and stable soft tissue.[2-12]

An immediate interim restoration or nonfunctional immediate loading refers to a restoration free of all contacts, both in centric occlusion and during eccentric movements, which is inserted within 48 hours of implant surgery.[13,14] It is differentiated from immediate loading or immediate functional loading, in which the interim restoration receives occlusal function within 48 hours of implant surgery.[13,14]

Placing an interim restoration immediately after single-implant placement provides patients with esthetic, functional, and psychological benefits.[15-18] Direct application of acrylic resin to a prefabricated abutment in the oral cavity after implant surgery has been one method of making immediate interim restorations.[19] Other methods have used impression copings with polyether or polyvinyl siloxane impression materials to provide interim restorations immediately.[5,20,21]

The development of digital technologies for implant treatment has enabled a prosthetically driven top-down approach.[22] A diagnostic trial restoration is necessary to achieve this goal.[23] First, the shape and position of the definitive restoration are predicted by digital diagnostic trial restoration in computer-aided design (CAD) software. Then, the diameter, length, and 3-dimensional (3D) position of the implant are determined after superimposing cone-beam computed tomography (CBCT) data with digital trial restoration data in implant planning software. A surgical guide is designed and fabricated by using the implant planning software to place the implant in the preplanned position. Meanwhile, interim restorations can also be fabricated with the aid of CAD software.

The purpose of this article was to introduce a digital workflow that enables an immediate interim restoration to be made after single-implant placement by using a matrix-positioning device and a surgical guide, which

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ORIGINAL ARTICLE

WILEY CLINICAL ORAL IMPLANTS RESEARCH

The role of immediate provisional restorations on implants with a hydrophilic surface: A randomised, single-blind controlled clinical trial

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Abstract

Objectives: To compare the radiographic bone changes, clinical parameters and aesthetic outcomes of immediately provisionalised and conventionally restored implants at 12- and 24-months post-implant placement.

Material and methods: In 24 patients, 24 bone level implants with a hydrophilic (SLActive) surface were placed in healed sites and they were either immediately provisionalised with a non-occluding temporary crown (test group) or left without a crown (control group). In both groups, the definitive restoration was placed 16 weeks after implant placement. Clinical and radiographic parameters were calculated at 12- and 24-months post-implant placement, together with implant success/survival rates according to three different sets of criteria. The aesthetic outcome was evaluated through the Papilla Fill Index and the Pink Aesthetic Score.

Results: The mean marginal bone loss at 1 year was −0.73 mm (SD 0.83 mm) in the test group and −0.22 mm (SD 0.46 mm) in the control group ($p > .05$). Whilst 100% survival rate and positive aesthetic outcomes were recorded in both groups, three patients of the test group did not fulfil all success criteria.

Conclusions: Immediate provisionalisation may represent a viable option for the replacement of single missing teeth, with radiographic, clinical and aesthetic results comparable to those of conventionally loaded implants at 2 years of follow-up.

KEYWORDS
bone level implants, dental implants, hydrophilic surface, immediate provisionalisation, immediate restoration, implant loading, modSLA, randomised controlled trial, SLActive

1 | INTRODUCTION

High long-term success rates of dental implants have been documented in well-designed long-term studies (Albrektsson, Donos & Working, 2012; Jung, Zembic, Pjetursson, Zwahlen & Thoma, 2012; Rasperini et al., 2014) and have led to the widespread acceptance and use of dental implants for the rehabilitation of partially edentulous patients. To address the expectations of both patients and clinicians, new clinical protocols have been applied with the aim to shorten the overall treatment duration and reduce the number of visits and interventions. These protocols suggest a reduction in the time frame between tooth extraction, implant placement and delivery of the implant-supported prosthesis in comparison with the traditional clinical guidelines. Currently, implant loading protocols are classified as follows: *immediate* loading, when the prosthesis is connected within 1 week after implant placement; *early* loading, when the prosthesis is connected between 1 week and 2 months after implant placement; and *conventional* loading, when more than 2 months are waited

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Research Article

Influence of Immediate Implant Placement and Provisionalization with or without Soft Tissue Augmentation on Hard and Soft Tissues in the Esthetic Zone: A One-Year Retrospective Study

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The purpose of this clinical research was to evaluate peri-implant marginal changes around immediate implants placed either with the application of SCTG or XCM or without soft tissue grafting. A total of 48 patients requiring a single implant-supported restoration in the anterior jaw were selected for inclusion. Three surgical procedures were performed, as follows: type 1 implant with subepithelial connective tissue graft (SCTG), type 1 implant with xenogenic collagen matrix (XCM), and type 1 implant without soft tissue augmentation (NG) (control group). The marginal change of peri-implant soft tissue, facial soft tissue thickness (FSTT), peri-implant health status, esthetics, and patient satisfaction were assessed at one year after surgery. All of the placed implants showed a survival rate of 100%. No significant differences in FSTT were recorded between the SCTG group and the XCM group after treatment ($P > 0.05$), while the NG group presented a significant difference ($P < 0.05$). Patients in the NG group lost significantly more in the buccal marginal level than did patients in the SCTG group and those in the XCM group ($P < 0.05$). The favourable success rate recorded in all groups confirmed immediate tooth replacement as a choice of treatment for a missing anterior single tooth. The NG group presented significant changes of FSTT and buccal marginal level, while XCM constituted a viable alternative to SCTG.

1. Introduction

After having a tooth taken out, biological occurrences happen while the extraction socket heals, causing marked changes in the hard and soft tissue volumes [1, 2]. Regarding esthetics, teeth replacement can be performed with implants, following various clinical protocols, when there is a necessary amount of bone and when there is a favourable volume of the alveolar ridge [3, 4].

In the literature, a lot of interest has taken place regarding type 1 implants, which are placed immediately after extraction and provisionalized within 24 hours (IIPP) [1, 4, 5]. Among the advantages of this approach exist the possibilities of lowering the amount of surgeries and the time required without affecting the predictability in terms of survival [1, 2, 4, 6]. However peri-implant tissue stability is a key factor that can impact the success of implant restorations because the postoperative tissue remodelling has the potential to

Screw- Versus Cement-Retained Restorations for Provisionalization of Implants

Athanasios Ntounis,* Michael Nguyen,* and Stavros Pelekanos†
Sandra J. O'Neal‡ and Perng-Ru Liu‡

Clinical Approach #1

Clinical Approach #2

Type of Case: The fabrication of provisional prostheses is a treatment modality that is used to support and develop soft-tissue contours and improved health of a dental implant site before final restoration. The use of a provisional restoration may improve the esthetics and allow evaluation of the crown anatomy and soft-tissue interface. Developing the crown and soft tissue in the provisional phase allows the practitioner, patient, and laboratory technician to evaluate the potential for achieving the desired outcome. This paper contrasts the two predominant methods for fabricating provisional restorations and assesses their use in implant dentistry.

Clinical Approach #1 (AN, MN, and SP): There is very limited evidence on selecting different types of connection for implant provisional restorations. Although basic restorative principles apply, the selection between screw- over cement-retained provisional restorations is still based on empirical criteria. The use of cement-retained provisional restorations provides superior esthetics, even when implant position is not favorable. Conversely, the use of screw-retained provisionals eliminates the deleterious effects of cement. This approach aims to provide the indications for the different types of connection and to critically analyze their advantages and disadvantages.

Clinical Approach #2 (SJO and P-RL): Provisional restoration of implants in the esthetic zone improves the retention of hard and soft tissues and results in overall improved esthetic. Additionally, the fabrication of a provisional at the time of implant placement is a patient-centered treatment and shortens duration of treatment. This approach identifies important objectives for fabrication techniques. Various methods for fabricating cemented provisional prostheses are discussed, including numerous commercially available prefabricated abutments. The advantages and disadvantages are presented for each technique. Inherent technique difficulties and recommendations to avoid cement retention and timely fabrication are presented. Clinical scenarios are used to illustrate the inherent advantage of cemented restorations over screw-retained approaches *Clin Adv Periodontics* 2012;2:200-216.

Key Words: Dental implants; dental restoration, temporary; dentistry; esthetics; osseointegration; wound healing.

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Screw retained vs. cement retained implant-supported fixed dental prosthesis

JULIA-GABRIELA WITTNEBEN, TIM JODA, HANS-PETER WEBER & URS BRÄGGER

Implant-supported fixed dental prostheses (FDP) represent a well-established treatment option that has evolved to become a standard of care in dental medicine over the past four decades. This success is based on the phenomenon of osseointegration, which has been enhanced through progress in surface technology, refined surgical techniques, the improvement of the stability of interfaces between the implants, abutments and dental prosthesis, as well as the establishment of lifelong prophylactic efforts to prevent biologic complications and failures (1, 4, 8, 35–37, 39, 50). The main focus in prosthetic research is now the development of materials with better biomechanical characteristics and the optimized use of digital pathways for the production of the suprastructures.

In a retrospective study with 303 partially edentulous patients, 511 implants and 367 FDPs were re-examined after 10 years (6, 48). The 10-year survival rate was 98.8% for the implants and 95.5% for the implant-supported prostheses (6, 48). However, when the literature was analyzed using a systematic approach in another study, pooled data from 72 clinical studies revealed 5-year survival rates of 96.03% and 95.55% for cemented and screw retained reconstructions, respectively ($P = 0.686$) (49). For the pooled data, the failure rates at 5 years were comparable to the rates reported in the retrospective clinical study after 10 years, but the results can still be considered good because they reflect the fact that in 72 studies, different patient risk profiles were present. However, the total event rate of technical and biological complications was significantly higher with cemented prostheses (49). This systematic review indicated that the choice of retention type (cemented or screw retained) might not have a crucial influence on the overall survival of the prosthesis, but may be responsible for the development of a certain complication.

Nowadays, clinicians from general dentists to specialists perform restorations using dental implants. An important clinical decision remains the choice of the connection type – cement or screw retained. This connection can have an impact on the prognosis of the overall reconstruction. Which retention system is appropriate for the individual patient depends on diverse factors, including the indication, advantages and disadvantages, 'retention' provided, retrievability, esthetics and the clinical performance (failures and complications). In fact, in combination, it is difficult to consider the factors objectively, and therefore criteria are singled out to present the effect of a specific retention type. The aim of this review is to present an overview of factors influencing the overall outcome of screw vs. cement retention for implant-supported FDPs.

Indication, advantages/ disadvantages and retention

Both retention types have been applied for single, multiple and cross-arch fixed dental prostheses. Long-span prostheses should preferably be screw retained for easier maintenance – it has been discussed in the literature that long-span restorations have a higher risk of complications (34, 38). This should also apply for cantilevered FDP designs due to the fact that these prostheses require more maintenance and service (3, 38). It might also be easier to achieve sufficient retention for compensation of the leverage of the extension.

A modified technique for extraoral cementation of implant retained restorations for preventing excess cement around the margins

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The major drawback of cement-retained restorations is the extrusion of the excess cement into the peri-implant sulcus, with subsequent complications. Insufficient removal of the excess cement may initiate a local inflammatory process, which may lead to implant failure. This article presents a method of controlling cement flow on implant abutments, minimizing the excess cement around implant-retained restorations. ***[J Adv Prosthodont 2014;6:146-9]***

KEY WORDS: Excess cement; Cement retained restorations; Peri-implant disease

INTRODUCTION

The introduction of osseointegration and the use of endosseous implants provide alternative treatment options to clinicians for all indications of edentulism.[1] Implant-supported, fixed restorations are usually classified as screw- or cement-retained.[2,3] The advantage of screw-retained restorations is the combination of a rigid connection between the restoration-abutment complex and its retrievability. However, these restorations are usually more expensive than cement-retained restorations because of the use of extra components and laboratory costs.[4] Cement-retained restorations were introduced to compensate for problems of screw loosening and the lack of esthetics of screw-retained restorations.[4] The lack of fastening screws in cement-retained restorations reduces the possibility of preload stress and screw loosening.[5] The major advantages of cement-retained restorations are the passive fit of frameworks, enhanced esthetics resulting from lack of screw access holes, and reduced complexity of laboratory procedures and chair-side time.[6-8] The disadvantages of cement-retained restorations include the requirement for extra time for cementation, removal of residual excess cement, limited design possibilities for superstructure, and the reduced possibility for modifying treatment in case of periimplantitis.[9]

The existence of residual excess cement in peri-implant sulcus is a common complication of cement-retained implant prostheses.[10,11] If there is excess cement located in the soft tissue deeper than 3 mm, it might be difficult to observe and remove. Insufficient removal of excess cement may result in swelling, soreness, exudation or bleeding on probing, and can initiate a local inflammatory process, which is evidence of peri-implant disease and can ultimately lead to implant failure.[12-14] Moreover, removal of excess cement may cause scratching and gouging on the implant surfaces when plastic and metal scalers are used.[15] Several authors have reported on techniques regarding procedures used to assist in minimizing residual excess cement extrusion.[16-19]

This article describes a method of controlling cement flow, using stock or custom implant abutments, when cement-retained implant-supported restorations are utilized. The method can be used easily and quickly at chair-side by the use of daily restorative and laboratory materials. The use of die spacers results in a uniform space between the crown restoration and the implant abutment.

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CLINICAL ARTICLE

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Peri-implant tissue management after immediate implant placement using a customized healing abutment

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Abstract

Objective: The unavoidable extraction of teeth in the esthetic area can be overcome through different treatment modalities. Recently, immediate implants appeared as a minimally invasive approach to resolving these cases; however, immediate implant loading is not always possible or indicated. In these cases, an innovative approach through customized healing abutments could be used to preserve the soft tissue contour, eliminating the need for reopening surgery and the use of provisional restorations to condition the mucosal contour.

Clinical Considerations: The present cases describe a simplified chairside approach to use customized healing abutments for immediate implants placed after tooth extraction in the anterior and posterior areas in order to maintain the soft tissue contours while reducing the clinical steps until delivering the final restorations.

Conclusions: This technique seems to be effective to guide the soft tissue healing around dental implants allowing a natural emergence profile with implant-supported restorations, reducing the number of treatment steps.

Clinical Significance: The use of customized healing abutments prepares soft tissue for the prosthetic stage preserving its contours and eliminating the need for reopening surgery.

KEYWORDS
customized healing abutment, emergence profile, immediate placement, soft tissue management

1 | INTRODUCTION

Physiological events such as imminent loss of the periodontal ligament and the resorption of the codependent bundle bone may occur after tooth extraction.[1] These events may lead to morphological, structural, and compositional changes that may result in reduction of the volume of surrounding soft and hard tissues.[2,3] The resorption process varies greatly among patients and may be affected by patient-related and surgery-related factors, such as soft tissue thickness,[4,5] implant position,[6] location of the implant-abutment interface,[7,8] trauma during the extraction of teeth,[6,9] and others. Nowadays, different clinical approaches have been proposed with the purpose of minimizing the problem described above, and there has been a growing demand for less invasive procedures that allow a favorable prognosis, resulting in more aesthetic and functional implant-supported prostheses.[10]

Minimally invasive tooth extraction, avoiding flap release,[11] followed by immediate implant placement,[12] and provisional restoration have been considered appropriate treatment for maintaining the architecture

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Predictable immediate implant placement and restoration in the esthetic zone

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Abstract

This article describes a comprehensive step-by-step protocol for immediate implant placement and restoration in the esthetic zone. Clinical Considerations Immediate implant placement into fresh extraction sockets and immediate restoration have become widely accepted, demonstrating long-term success rates that are comparable with traditional delayed implant protocols. However, they are technique sensitive and require proper treatment planning as well as meticulous execution to be predictable and successful in the long term. This is particularly important in the esthetic zone, where even minor aberrations and mistakes can have devastating consequences, and especially in younger patients, where esthetic and functional outcomes should remain stable for years and possibly decades to come. The eight critical steps for predictable immediate implant placement include: provisional restoration of the failing tooth and presurgical phase, atraumatic tooth extraction, initial implant osteotomy, 3D bone graft packing, guided implant placement with a surgical guide, customized abutment insertion, provisional crown relining, and placement of a connective tissue graft from tuberosity. Immediate implant protocols in the esthetic zone require thorough planning and execution in the proper sequence. Each one of the critical steps discussed in this article has its own importance and challenges, which are critically assessed based on current scientific evidence.

KEYWORDS
CAD/CAM, digital dentistry, implants, periodontics/prosthodontics

1 | INTRODUCTION

Endosseous dental implants have excellent long-term success rates.[1,2] Besides restoring intraoral function and biology, esthetic considerations are key when replacing missing or failing teeth in the anterior areas of the jaw. The ultimate goal is to replace missing teeth with implant restorations that are indiscernible from the surrounding dentition in terms of shape, morphology, and color, but also to restore and maintain a natural hard- and soft-tissue architecture, which is considered the frame for any restoration.[3] Soft-tissue aberrations, defects, and deficiencies will render even the most beautiful restoration unsuccessful, not just in the beginning, but also when they happen long after completion of treatment. This is likely the most challenging aspect in implant dentistry, especially in younger patients, where despite any possible orthodontic, biologic, and morphologic changes, functional and esthetic outcomes are expected to be stable over time.

Traditional implant protocols suggest a several-month-long healing period of the crestal bone after tooth extraction and before surgical implant insertion. A similar healing time is recommended before the implant is uncovered and, after another few weeks or months,

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SYSTEMATIC REVIEW

Immediate versus early or conventional loading dental implants with fixed prostheses: A systematic review and meta-analysis of randomized controlled clinical trials

Jie Chen, DDS,[a] Min Cai, DDS,[b] Jiajun Yang, DDS,[c] Taghrid Aldhohrah, DDS, MSD,[d] and Yan Wang, DDS, MSD, PhD[e]

ABSTRACT

Statement of problem. Immediate loading of dental implants has gained widespread popularity because of its advantages in shortening treatment duration and improving esthetics and patient acceptance. However, whether immediate loading can achieve clinical outcomes comparable with those of early or conventional delayed loading is still unclear.

Purpose. The purpose of this systematic review and meta-analysis was to compare the efficacy of immediate loading versus early or conventional loading implants in patients rehabilitated with fixed prostheses.

Material and methods. Electronic searches of CENTRAL, EMBASE, and MEDLINE were supplemented by manual searches up to October 2018. Only human randomized controlled trials (RCTs) comparing immediate with early or conventional loading dental implants were included. Quality assessment was performed by using the Cochrane Collaboration tool. For the meta-analysis, the dichotomous and continuous variables were pooled and analyzed by using risk ratios (RRs) and weighted mean differences (WMDs), with 95% confidence intervals (95% CIs). The outcomes assessed included survival rate, marginal bone level changes, peri-implant gingival level, probing depth, and implant stability. The subgroup analyses included healing methods, implant time, occlusal contact, number of missing teeth, and tooth position.

Results. Thirty-nine trials (49 articles) were included from the initial 763 references evaluated. When compared with conventional loading, with implants regarded as a statistical unit, a statistically significant lower survival rate was observed in the immediate loading dental implant (RR=0.974; 95% CI, 0.954, 0.994; P=.012). Regarding other outcomes, including marginal bone level changes, peri-implant gingival level, probing depth, and implant stability, no statistically significant differences were observed when comparing immediate versus early or conventional loading (P>.05).

Conclusions. Compared with early loading, immediate loading could achieve comparable implant survival rates and marginal bone level changes. Compared with conventional loading, immediate loading was associated with a higher incidence of implant failure. (J Prosthet Dent 2019;122:516-36)

The conventional approach dictates that to achieve proper osseointegration, implants need to be submerged without any load for 3 to 4 months in the mandible and 6 to 8 months in the maxilla.[1] However, shortening the treatment period is beneficial for patients and dentists.

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A new index for rating aesthetics of implant-supported single crowns and adjacent soft tissues – the Implant Crown Aesthetic Index

A pilot study on validation of a new index

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Key words: aesthetic aspects, dental implants, single tooth

Abstract

Objectives: The important item of aesthetics is rarely included in evaluation studies. The aim of this study was to develop and validate an index for rating aesthetics of implant-supported single crowns and adjacent soft tissues.

Material and methods: Nine items were selected, which have an influence on the aesthetic result. The items are based on the anatomic form, colour and surface characteristics of the crown and on the anatomic form, colour and surface characteristics of the peri-implant soft tissues. Two oral-maxillofacial surgeons and two prosthodontists rated 24 implant-supported single-tooth restorations and adjacent soft tissues on a form with the nine items of the rating index. The rating was carried out twice by each of the examiners. Weighted Cohen's κ was calculated to express the intra- and interobserver agreement.

Results: Intraobserver results indicated that the agreement between the first and second rating of both the prosthodontists was good (both 0.7) and that the agreement of the oral-maxillofacial surgeons was moderate (0.49 and 0.56). The best interobserver agreement was found between the two prosthodontists (0.61, good agreement).

Conclusions: The Implant Crown Aesthetic Index is an objective tool in rating aesthetics of implant-supported single crowns and adjacent soft tissues. The rating is best be carried out by one prosthodontist to have the highest reliability.

Dental implants are generally placed in human beings to support single crowns, fixed partial bridges, fixed full bridges or removable overdentures (Esposito et al. 1998). Reasons for use of these dental implants in prosthetic treatment is an improvement in function and aesthetics of the prosthetic restoration (Belser et al. 1998). Literature studies show excellent survival rates of single-tooth restorations on dental implants, varying from 96.1% to 98.9% after 7.5 years in function (Creugers et al. 2000). Other criteria of function, which are often evaluated, are radiographic bone loss, sulcus probing depth, peri-implant hygiene and prosthetic complications (Henry et al. 1996; Malevez et al. 1996; Scheller et al. 1998; Wannfors & Smedberg 1999; Johnson & Persson 2000). However, the important item of aesthetics is rarely included in evaluation studies. Aesthetics can be rated in a subjective and an objective manner. A subjective method is the use of questionnaires, which must be completed by the patient (Moberg et al. 1999). An objective method with a rating score, which has to be carried out by a professional observer has never been described in the field of dental implants. There is an index for conventional crowns (California Dental Association 1977), but this index is not applicable to implant-supported

Esthetic Evaluation of Implant Crowns and Peri-Implant Soft Tissue in the Anterior Maxilla: Comparison and Reproducibility of Three Different Indices

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ABSTRACT

Background: A successful implant reconstruction with optimal esthetics consists of a visually pleasing prosthesis and complete and healthy surrounding soft tissue. In the current literature, numerous indices used to qualitatively assess esthetics have been described. However, studies comparing the indices and their reproducibility are scarce.

Purpose: The aim of this study was to compare three different esthetic indices for the evaluation of single implant-supported crowns.

Materials and Methods: A total of 10 prosthodontists (P), 10 orthodontists (O), 10 general dentists (G), and 10 lay people (L) independently performed the same assessment using 30 photographs and corresponding casts with three different esthetic indices (Peri-Implant and Crown Index [PICI], Implant Crown Aesthetic Index [ICAI], "Pink Esthetic Score/White Esthetic Score [PES/WES]) and repeated the evaluations 4 weeks later.

Results: The PES/WES and the PICI showed significantly higher esthetic scores (pink, white, total) and clinical acceptance compared with the ICAI in all four groups and in both assessments. The highest intraobserver agreement was achieved using the PES/WES and the least with the ICAI. The mean Kappa per group ranged from 0.18 (group L with ICAI) to 0.63 (group G with PICI).

Conclusion: In comparison with the ICAI, the PES/WES and PICI were more reproducible. Therefore, PES/WES and PICI seem to be more suitable as esthetic indices for single implant crowns.

KEY WORDS: aesthetic, dental implant, esthetic, esthetic index, ICA, ICAI, implant crown, implant-supported crown, PES/WES, PICI, pink, white

INTRODUCTION

The use of endosseus dental implants represents a treatment modality with high survival rates of both implants and their prosthetic reconstructions.[1–3] The goal of achieving an optimal esthetic outcome with implants located in the esthetic zone remains a major challenge in

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Esthetic evaluation of periimplant soft tissue of immediate single-implant placement and provisionalization in the anterior maxilla

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Case Series

Outcome Evaluation of Early Placed Maxillary Anterior Single-Tooth Implants Using Objective Esthetic Criteria: A Cross-Sectional, Retrospective Study in 45 Patients With a 2- to 4-Year Follow-Up Using Pink and White Esthetic Scores

Urs C. Belser,* Linda Grütter,* Francesca Vailati,* Michael M. Bornstein,† Hans-Peter Weber,‡§ and Daniel Buser†

Background: *To validate the concept of early implant placement for use in the esthetically sensitive anterior maxilla, clinical trials should ideally include objective esthetic criteria when assessing outcome parameters.*

Methods: *In this cross-sectional, retrospective 2- to 4-year study involving 45 patients treated with maxillary anterior single-tooth implants according to the concept of early implant placement, a novel comprehensive index, comprising pink esthetic score and white esthetic score (PES/WES; the highest possible combined score is 20), was applied for the objective esthetic outcome assessment of anterior single-tooth implants.*

Results: *All 45 anterior maxillary single-tooth implants fulfilled strict success criteria for dental implants with regard to osseointegration, including the absence of peri-implant radiolucency, implant mobility, suppuration, and pain. The mean total PES/WES was 14.7± 1.18 (range: 11 to 18). The mean total PES of 7.8± 0.88 (range: 6 to 9) documents favorable overall peri-implant soft tissue conditions. The two PES variables facial mucosa curvature (1.9 ± 0.29) and facial mucosa level (1.8 ± 0.42) had the highest mean values, whereas the combination variable root convexity/soft tissue color and texture (1.2 ± 0.53) proved to be the most difficult to fully satisfy. Mean scores were 1.6 ± 0.5 for the mesial papilla and 1.3 ± 0.5 for the distal papilla. A mean value of 6.9 ± 1.47 (range: 4 to 10) was calculated for WES.*

Conclusions: *This study demonstrated that anterior maxillary single-tooth replacement, according to the concept of early implant placement, is a successful and predictable treatment modality, in general, and from an esthetic point of view, in particular. The suitability of the PES/WES index for the objective outcome assessment of the esthetic dimension of anterior single-tooth implants was confirmed. However, prospective clinical trials are needed to further validate and refine this index.* J Periodontol 2009;80:140-151.

KEY WORDS

Case series; clinical trial; dental implants; outcome assessment; single-tooth implants.

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materials

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Article

Peri-Implant Soft Tissue Conditioning by Means of Customized Healing Abutment: A Randomized Controlled Clinical Trial

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Abstract: Introduction: An optimal aesthetic implant restoration is a combination of a visually pleasing prosthesis and adequate surrounding peri-implant soft tissue architecture. This study describes a novel workflow for one-step formation of the supra-implant emergence profile. Materials and Methods: Two randomized groups were selected. Ten control group participants received standard healing screws at the surgical stage. Ten individualized healing abutments were Computer aided Design/Computer aided Manufacturing (CAD/CAM)-fabricated out of polyether ether ketone (PEEK) restoration material in a fully digital workflow and seated at the surgical stage in the test group. The modified healing abutment shape was extracted from a virtual library. The standard triangulation language (STL) files of a premolar and a molar were obtained considering the coronal anatomy up to the cement-enamel junction (CEJ). After a healing period ranging from 1 to 3 months depending on the location of the surgical site, namely, mandible or maxilla, a digital impression was taken. The functional implant prosthodontics score (FIPS) and the numerical rating scale (NRS) of pain were recorded and compared. Results: The mean FIPS value for the test group was 9.1 ± 0.9 while the control group mean value was 7.1 ± 0.9. In the test group, pain assessment at crown placement presented a mean value of 0.5 ± 0.7. On the contrary, the control group showed a mean value of 5.5 ± 1.6. Conclusions: Patients in the test group showed higher FIPS values and lower NRS scores during the early phases compared to the control group.

Keywords: CAD/CAM; dental implant; emergence profile; soft tissue; custom healing abutment

1. Introduction

Nowadays, fulfilling the aesthetic expectations of patients is one of the most challenging tasks in implant dentistry [1]. Factors that influence the aesthetic outcome of an implant-supported rehabilitation include, amongst others, the position of the implant [2], the quantity and quality of hard and soft tissues, and their adaptation over time [3].

Since the aesthetic result plays a pivotal role in the success of implant rehabilitations, several indices have been developed in order to evaluate the aesthetics of a single restoration over time [4]. These evaluations are based on photographs and models and give credit to the peri-implant soft tissue frame, showing its importance to the final aesthetic outcome [4]. A method that is commonly used

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of the keratinised mucosa at 1 year post-loading was 2.8 (1.5) mm for the definitive abutment group and 2.8 (1.7) mm for the repeated abutment changes group (difference = -0.0; CI 95%: -0.8, 0.7); $P = 0.966$. Up to 1 year after initial loading, there were no statistically significant differences between the two procedures, with the exception of 0.16 mm more marginal bone loss at implants subjected to three abutment removals.

Conclusions: One-year post-loading data showed that repeated abutment changes significantly increased bone loss of 0.16, but this difference cannot be considered clinically relevant, therefore clinicians can use the procedure they find more convenient for their specific patient. In addition, immediately non-occlusally loaded dental implants are a viable alternative to conventional loading.

Conflict-of-interest statement: *This trial was partially funded by Dentsply Sirona Implants, the manufacturer of the implants and other products evaluated in this investigation. However, data belonged to the authors and by no means did the manufacturer interfere with the conduct of the trial or the publication of the results with exception of rejecting the proposal of changing the protocol, after the trial was started, allowing the use of indexed abutments.*

■ Introduction

Implant-supported prostheses are an effective and reliable treatment for replacing missing teeth. The success of implant-supported prostheses is mainly based on the ability of the bone to integrate and stabilise dental implants[1]. This process is known as 'osseointegration' and implants can be submerged unloaded for the duration of the healing period. After several months, implants are exposed and healing or provisional abutments are connected to them for the period necessary to complete the restorative procedures. Depending on the procedures used, healing or temporary abutments may have to be disconnected and reconnected several times, and it was concluded, based on the results of an experimental study performed on five dogs[2], in which five abutment disconnection-reconnections were made, that 0.7 mm more marginal peri-apical bone loss occurred in implants subjected to repeated abutment disconnection. If this observation is correct, then it would be better in clinical practice to minimise the number of abutment disconnections by placing a definitive abutment immediately, which preferably should not be removed thereafter. On the other hand, there might be clinical situations where it could be a disadvantage to immediately place a definitive abutment, since it is not always possible to predict the amount of soft tissue shrinkage. Therefore, it would be good to retain the possibility of changing abutments, when necessary, without causing too much disruption of the peri-implant tissues.

One randomised controlled trial[3] reported 0.2 mm higher peri-implant marginal bone levels by not removing definitive abutments at immediate post-extractive implants, 3 years after loading, which was statistically significant. Such a procedure was therefore termed as the 'one abutment at one time concept'. From a clinical point of view, a statistically significant mean difference of 0.2 mm may not be clinically noticeable and should not discourage clinicians to change abutments if needed or even to use healing and/or provisional abutments. Another controlled but non-randomised study tested the same hypothesis[4] in posterior edentulous mandibles and found no statistically significant difference in marginal bone loss 3 years after implant placement, in implants treated according to the 'one abutment at one time' concept compared to abutments disconnected four times. Two randomised controlled trials (RCT) by the same group[5,6] reported 0.3 and 0.5 mm more bone loss, respectively, after 1 year for implants in which abutments were disconnected multiple times. Both differences were statistically significant, while no significant differences were observed in another RCT[7].

Another interesting aspect of the rehabilitation with implant-supported prostheses is the possibility to load implants immediately without waiting

Comparison of Marginal Bone Loss Between Implants with Internal and External Connections: A Systematic Review

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Enric Jané-Salas, MD, DDS, PhD[2]/José López-López, MD, DDS, PhD[3]

Purpose: *The objective of this systematic review was to compare the loss of marginal bone between implants with internal and external connections by analyzing results reported in studies published after 2010.* ***Materials and Methods:*** *A literature search in MEDLINE with the keywords "dental implant connections, external internal implant connection, bone loss implant designs, internal and external connection implant studies in humans" was conducted. Clinical trials on human beings, comparing both connections and published in English, from 2010 to 2016 were selected. Their methodologic quality was assessed using the Jadad scale.* ***Results:*** *From the initial search, 415 articles were obtained; 32 were chosen as potentially relevant based on their titles and abstracts. Among them, only 10 finally met the inclusion criteria. A total of 1,523 patients with 3,965 implants were analyzed. Six out of 10 studies observed that internal connections showed significantly less bone loss compared with external connections. The remaining four articles did not find statistically significant differences between the two connections.* ***Conclusion:*** *According to this systematic review and considering its limitation due to the degree of heterogeneity between the included studies, both internal and external connections present high survival rates. To assess whether marginal bone loss differs significantly between the two connections, more homogenous clinical studies are needed with identical implant characteristics, larger samples, and longer follow-up periods. Studies included in this review and characterized by long-term follow-ups showed that the external connection is a reliable connection on a long-term basis.* Int J Oral Maxillofac Implants 2018;33:580–589. doi: 10.11607/jomi.6190

Keywords: *bone loss, external connection, implant design, internal connection*

Implant dentistry has undergone major development and expansion since the 1960s, when Brånemark introduced the concept of osseointegration.[1] The use of implants to replace missing teeth and restore function has presented a high success rate and long-term survival. For this reason, rehabilitation with implants has become standard and well accepted by patients, who increasingly demand treatments offering greater comfort and esthetics.[2,3] Implant-based treatments must fulfill a range of physiologic, functional, and esthetic criteria before they can be considered successful. These criteria include osseointegration stability and duration, absence of pathologic processes, and esthetics that satisfy patient expectations.[4]

There are diverse types of implants and corresponding systems that connect the implant to the prosthesis. They fall into two main groups:

- External connection: It can have the shape of a hexagon or an octagon, among others, located on the implant platform. This design was developed to facilitate the placement of components such as abutments and impression copings providing an anti-rotation capacity of the elements.[5] The weakness of this system is attributed to the limited height of the hexagon; when subjected to high

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Technique for controlling the cement for an implant crown

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Cementation of an implant prosthesis is an accepted protocol. Less demanding surgical placement of the implant, simpler laboratory techniques, passive fit, esthetics, and control of the occlusion are among some of the advantages.[1] However, disadvantages include unpredictable retention and resistance and the detrimental effect of cement flow into the soft tissues that can be difficult to remove. The soft tissue attachment onto the implant surface is more delicate than that seen at the natural tooth surface due to the lack of Sharpey fiber insertion, the reduced number of collagen fibers, and the direction in which these fibers run.[2]

Cement extrusion into the sulcular area may result in soft tissue swelling, soreness, and bleeding or exudation on probing.[3] In some instances, the excess cement has been considered to be the cause of implant failure.[4] Removal of excess cement with plastic and metal scalers may result in scratches and gouges on the implant surfaces.[5]

Control of cement volume has been documented previously using the ITI solid abutment (Straumann USA, Andover, Mass).[6] This requires an implant analog or practice abutment, as described by the authors.[6] When a custom abutment is to be used under the crown, this becomes more challenging. The dental laboratory may be instructed to make a duplicate analog using an acrylic resin, but this is time consuming for the technician and involves additional laboratory costs.

A method of controlling cement flow using a copy abutment with smaller dimensions, which can be quickly, easily, and economically fabricated at the time of implant abutment/crown insertion, is described. The use of polytetrafluoroethylene (PTFE) tape provides a space of approximately 50 μm, which represents the cement space and may be used for both custom and prefabricated abutments.

PROCEDURE

1. Ensure fit of implant restoration and abutment complex.
2. Line the intaglio surface of the implant restoration with polytetrafluoroethylene (PTFE) tape, commonly known as Teflon tape, plumber's tape, or TFE (tetrafluoroethylene) threaded seal tape (Oatey Co, Cleveland, Ohio).
3. Place the implant restoration

1 A, Fill intaglio of restoration with VPS material using smaller diameter tip. B, Compare and contrast abutment to VPS copy; in particular, irregularities should be noted as additional cement should be added to compensate for voids.

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Effect of platform connection and abutment material on stress distribution in single anterior implant-supported restorations: A nonlinear 3-dimensional finite element analysis

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Statement of problem. Although various abutment connections and materials have recently been introduced, insufficient data exist regarding the effect of stress distribution on their mechanical performance.

Purpose. The purpose of this study was to investigate the effect of different abutment materials and platform connections on stress distribution in single anterior implant-supported restorations with the finite element method.

Material and methods. Nine experimental groups were modeled from the combination of 3 platform connections (external hexagon, internal hexagon, and Morse tapered) and 3 abutment materials (titanium, zirconia, and hybrid) as follows: external hexagon-titanium, external hexagon-zirconia, external hexagon-hybrid, internal hexagon-titanium, internal hexagon-zirconia, internal hexagon-hybrid, Morse tapered-titanium, Morse tapered-zirconia, and Morse tapered-hybrid. Finite element models consisted of a 4 × 13-mm implant, anatomic abutment, and lithium disilicate central incisor crown cemented over the abutment. The 49 N occlusal loading was applied in 6 steps to simulate the incisal guidance. Equivalent von Mises stress (σ_{vM}) was used for both the qualitative and quantitative evaluation of the implant and abutment in all the groups and the maximum (σ_{max}) and minimum (σ_{min}) principal stresses for the numerical comparison of the zirconia parts.

Results. The highest abutment σ_{vM} occurred in the Morse-tapered groups and the lowest in the external hexagon–hybrid, internal hexagon–titanium, and internal hexagon–hybrid groups. The σ_{max} and σ_{min} values were lower in the hybrid groups than in the zirconia groups. The stress distribution concentrated in the abutment-implant interface in all the groups, regardless of the platform connection or abutment material.

Conclusions. The platform connection influenced the stress on abutments more than the abutment material. The stress values for implants were similar among different platform connections, but greater stress concentrations were observed in internal connections. (J Prosthet Dent 2014;■:■-■)

Clinical Implications

For anterior implant-supported restorations, regardless of the platform connection, a zirconia abutment attached to a titanium base or a titanium abutment provides better mechanical behavior than pure zirconia abutments.

Because of its esthetic and functional requirements, the maxillary anterior single crown is still one of the most challenging restorations. The replacement of missing teeth with dental implants is well documented as a feasible treatment with high success rates.[1,2] Nevertheless, esthetic enhancements are still needed, mainly in

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