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Resumen

Con la realización de este trabajo, se pretende responder a dos objetivos: describir las diferentes técnicas quirúrgicas usadas sobre los implantes para aumentar o mantener el tejido queratinizado y explicar la importancia de este tejido alrededor de los implantes no solo desde un punto de vista funcional sino también estético.

La búsqueda para seleccionar los artículos fue realizada en diferentes revistas científicas y diferentes motores de búsquedas como: PubMed, Medline, Wiley online library, American journal of periodontics, Europe PMC, Journal of oral implantology y muchos mas.

Las palabras claves fueron: implantes, cirugía plástica periodontal, injerto de encía libre, injerto de tejido conectivo, colgajo reposicionado coronalmente, técnica de túnel, Edel, Raetze, cubrimiento radicular.

El numero total de los artículos utilizados fue de 37 mas un libro.

Los criterios de inclusión fueron: idioma Ingles, técnicas mucogingivales aplicada sobre implantes, reporte de casos documentados, uso estético y funcional de técnicas mucogingivales.

Hoy la terapia implantar se ha movido desde la atención sobre la osteointegración a los diferentes tipos de técnicas para el tratamiento de los tejidos blandos en modo de mimetizar los implantes a la dentición natural. Los tratamientos de los tejidos blandos no tienen como idea solo la mimetización sino también la preservación y regeneración de estos tejidos para asegurar la supervivencia de los implantes.

Al menos 2 mm de tejido queratinizado son necesarios para mantener y alcanzar a un estado de salud de los tejidos peri-implantarios.

Entre las cuatro técnicas descritas en este trabajo no hay una que prevalezca sobre otra, ya que cada caso debería ser individualizado dependiendo de la situación.

Factores como el conocimiento y la experiencia de cirujano junto a las solicitudes del paciente pueden jugar un papel importante en el momento de tomar la decisión entre el tipo de cirugía da actuar.

Debido al numero limitado de artículos usados este trabajo debe tomarse con precaución.

Abstract

This essay was performed in order to answer two objectives: describe different mucogingival surgical techniques applied over implants to augment or maintain the keratinized tissue and to explain the importance of the keratinized tissue around the implants not only from a functional point of view but also from an aesthetical one.

The research to select the articles were performed into different scientifical journals and different scientifical interfaces between them there are PubMed, Medline, Wiley online library, American journal of periodontics, Europe PMC, Journal of oral implantology and a lot more.

Key words as: implants, periodontal plastic surgery, free gingival graft, connective tissue graft, coronally repositioned flap, tunnel techniques, Edel, Raetzke, root coverage, were used.

The total number of articles used was of 37 plus one book.

The inclusion criteria were English language, mucogingival techniques applied over implants, documented cases report, aesthetical and functional use of mucogingival techniques.

Today the attention in implant therapy has shift from the implant's osteointegration to the different types of treatment's techniques of soft tissue in order to mimic them to natural dentition. The treatment of the soft tissue not only has the camouflage aim but also the preservation or regeneration of those soft tissue to ensure the survival of the implant.

At least 2 mm of keratinized tissue is required to achieve and maintain the health status of peri-implant soft tissue.

Between the four techniques described into this essay there is not one which will work better than the others due to fact that each case need to be individualize based on the necessities of the situation.

Factors as the knowledge and the experience of the surgeon together with the request of the patient will play an important role in the decision-making process.

Due to the limited number of articles used to describe the different approaches all the knowledge should be taken with caution.

Index

1. Introduction

Friedman describes for the first time in 1957 the term “mucogingival surgery” related to any surgery "designed to preserve attached gingiva, to remove frenulum or muscle attachment, and to increase the depth of the vestibule". For him the principal aim of this type of procedure is to maintain the physiological amount of keratinized gingival tissue and to avoid the loss of attachment. (1)

During the 1960s and the 1970s the position of mucogingival surgery was directed towards the treatment of mucogingival defects especially in case of reduction of the keratinized tissue in thickness and height. The reason why there was the focus over the keratinized tissue (KT) preservation was because the absence of this tissue could influence the periodontal health as described by Friedman. (2)

Lang and Loe in 1972 described the crucial role played by the keratinized tissue in the process of maintaining a good health state. Analysing this concept, the mucogingival surgery was concentrated on the process of augmentation of the amount of KT in situations where it was considered not adequate. (2)

During that period, the free gingival graft (FGG) described by Edel 1974, Miller 1982, Bjorn 1968, Nabers 1966 and Pennel 1969 was the highest procedure performed. FGG consists on the removal of the tissue through a spilt thickness technique from the fibro mucosa present in the palate or in an edentulous ridge and the placement of the graft to cover root recession. (2)

Forward studies make clear that the health state of the periodontum associated to the maintaining of the level of the attachment is related more to the plaque removal, which can reduce the inflammation, than on the coverage by the KT. (2)

FGG as described by Miller gave results non predictable so they start to pass to the laterally repositioned flap introduced by Warren and Grupe in 1956 and the coronally advanced flap described by Norberg and modified by Bernimoulin in 1975 and Allen & Miller in 1989. (2)

During that period, the use of the mucogingival surgery was applied to the treatment of gingival recession. It's possible to define gingival recession as an apical migration, from its physiological limit, of the of the gingival margin respect to the CEJ (cementoenamel junction) with an exposition of the root. All sides of the tooth can be affected by a recession but the usual most treated for aesthetical reasons is the buccal side. (3) (4) (5)

Patients will describe recession as an elongated aspect of the tooth respect the nearby teeth; it will be the professional the one in charge to diagnosticate if real apical migration of epithelium from CEJ has occurred or not. Between the recession's aetiology it's possible to observe:

- trauma related recession: by hard brushing technique or an excessive flossing; the use of the piercing;
- a wrong occlusal contact;
- orthodontic or prosthodontic treatment;
- viral or bacterial causes;
- a mixed aetiology bacterial and traumatic. (3) (4) (5)

Gingival recession can be classified follow Miller instruction (1985) related to the outcome for root coverage in: class I-II-III-IV. (5) (6)

The difference between the first two classes is that in class II the recession expands apical to the mucogingival junction (MGJ) respect to the class I where the recession not overpass the MGJ. Both classes are found in teeth with a periodontal interdental support in a health condition.

(5) (6)

An important characteristic of these two first classes is the absence of rotation or malposition of the tooth affected and the interdental space is completely covered by the papillae up to the contact point. In both classes a complete root coverage can be achieved. (5) (6)

Talking about class III and class IV it's observed in both the extension of the recession apical to the mucogingival junction plus the loss of bone in the interdental area. In the class III there is less bone lost associated with not severe tooth malposition leading to a future root coverage with a better prognosis respect to class IV where there is the exposition of more than one root's surfaces plus an higher bone loss in the interproximal area and a severe malposition of the tooth promoting a difficult treatment with an unfavourable prognosis. (5) (6)

Forward studies conducted by Wennström and Lindhe (1983) illustrates the use of mucogingival surgery to solve aesthetical problems and the term "Periodontal Plastic Surgery" started to enter in use to describe surgical procedures identified with the correction or elimination of anatomical, developmental or traumatic deformities of the gum or alveolar mucosa. (1)

As more indications for the term "Periodontal Plastic Surgery" it's possible to observe:

- gingival augmentation procedures to stop recession of marginal tissue caused by the inflammation of the periodontum, by a wrong tooth-brush technique, taking place naturally or after an orthodontic treatment;
- root coverage;
- augmentation of edentulous ridge to prepare the following treatment of a fix implant supported prosthesis when function and aesthetic are not adequate;
- aberrant frenulum;

- prevention of ridge collapse;
- crown lengthening;
- loss of interdental papilla. (1) (2) (7)

A new step forward was made in 1996 by the American Academy of periodontology which propose a new concept for mucogingival surgery: “a therapy which main aim is to correct in a surgical or non-surgical way the defect in:

- morphology;
- position;
- amount of soft tissue;
- underlying bone around the teeth”. (1)

This definition can also be proposed in the peri-implant tissue procedures. The surgical term in this last definition refers to prevent or correct anatomical, developmental traumatic or disease induced defect of the alveolar mucosa, bone or gum. (1)

A more recent approach to the mucogingival surgery is described by Fürhauser and Belser in 2009; due to the advances in implantology techniques the treatment of the soft tissue is becoming years after years more relevant especially in aesthetical areas where soft tissue control at the moment of implant placement and the following integration of the final restoration with the soft tissue play a critical aspect for the success of the treatment and it will improve the stability of peri-implant soft tissue over time as is also reported by Belser and Grunder. (3)

Implants are considered surrogate to teeth and it’s not always easy to apply mucogingival surgery technique designed for teeth to them. (3) (8)

Entering more in details on the soft tissue management multiple opinions show differences about the role of keratinized tissue around the implant: Berglundh talk about the use of KT to create a barrier against the infections, Zarb & Symington not find a correlation between the fail of the implant treatment and the presence of KT; follow Albrektsson and Wennström the presence of the keratinized tissue around the implant wont influence the long-term survival rate but is highly recommended to achieve an easier plaque control, a better peri implant soft tissue stability and better aesthetical and prosthetic result. (3) (8)

It's described by Carranza & Carraro that the presence of a non-appropriate gingiva can increase the plaque formation because it's possible to observe the incorrect pocket closure and a less resistance of tissue, producing soft tissue recession and attachment loss. (9)

It's possible to detect that the response to plaque of the soft tissue around implant and teeth it's very similar nevertheless if the plaque accumulation is prolonged in time the destruction of the peri-implant tissue will be higher than in the periodontal one. (9)

The functional and anatomical variance between teeth and implant related to the absence of the periodontal ligament and of a vascular system, can be the explanation of the higher tissue destruction observed in implant. (1) (2) (10)

In the tooth are detected between the gum and the cement the principal fibres which run perpendicularly to the surface of the root but in the observation of the fibres around an implant their direction is parallel or oblique to the surfaces of the titanium and not create a network around the implant's body. (1) (2) (10)

Nevertheless, it's possible to deduct that KT around the implants' neck will:

- facilitate the surgery;
- help in the following prosthodontic treatment;

- promote better aesthetic and maintenance. (8)

Additional important aspect regarding the keratinized tissue around the implant is the function that this tissue will produce: working as a functional barrier across the implant and the oral tissue. (10)

When a tooth has extracted it will be produced a decrease of surrounding bone and keratinized tissue which will produce the lack of the latter in the following implant procedures. (10)

Regarding implant and peri-implant soft tissues the inflammation of the areas around the implant, recession of marginal tissue and level of attachment joined with probing depth are classified as important parameters to check the status of the soft tissue around the implants. An augmented probing depth, loss of attachment, recession or bleeding on probing are sign of a periimplantitis. (10)

In the previous paragraphers are described the important aspects played by KT in the plaque deposit and how important is the correct oral hygiene in the preservation of the health of the tissues around the implant. (10)

Multiples studies suggest than in case of less than 2 mm of keratinized mucosa plaque deposit is higher respect in area in which it's detected more than 2 mm of keratinized mucosa. Other studies suggests that the there is no difference of plaque deposit in relation with the KT amount, this is due to the fact that other factors are needing to take into account as: implant position, implant surface texture, patient dental hygiene and prosthetic rehabilitation design which can be related with the control of the plaque. (10)

In rehabilitation cases with dental implant crucial points are going to be played also by the optimal bone volume and an adequate position of the implant together with the soft tissue aesthetic. In the long-time survival rate of the implant an important part is related with connective

tissue and gingival tissue management. Today “peri-implant plastic surgery”, also named “peri-implant soft tissue management/augmentation” which is considered an advancement of the “mucogingival surgery”, is routinely used to correct defects of the soft tissue. (1) (11)

“Peri-implant plastic surgery” has as aim the achievement of the correct peri-implant structure in order to produce tissue able to support the forces caused by the occlusion and create peri-implant keratinized tissue. One other objective of this type of surgery is the treatment of possible hard structure defects created after the placement of the implant. (1) (11)

Looking to an aesthetical point of view and KT level an important parameter in implant surgery is represented by the presence of a natural papillae in the implant site which resemble the papillae of adjacent teeth. (12)

It’s has been observed that the papillae in a single implant between teeth with a good prosthetic restoration will regenerate in 1-3 years without the use of soft tissue manipulation and the reason to this is that the papillae is determined in an implant restoration by the bone level of the nearby teeth (Tarnow’s studies). (12)

The important of the knowledge of the soft tissue in this case is that a good soft tissue approach will regenerate in less time the papillae and that if a small flap is designed without touching the papilla it’s possible to preserve it and its soft tissue below respect to a flap in which the papilla is elevated. (12)

Regarding the importance of KT and trying to maintain it Wang et al describe the technique of palatal roll envelop flap which main objectives in case of implant surgery are:

- the respect of the maxillary papillae;
- restore the convex appearance;
- obtain the mucosal buccal level close to the implant restoration.

This approach will also decrease the risk of scars on buccal side. It can be use alone or together with regenerative augmentation procedure. (12)

Aesthetical results nowadays play a very important role in the patient acceptance of the treatment: so soft tissue around the area in which implant is placed should resemble the soft tissue present around the adjacent teeth. (12)

A vertical defect in the peri-implant tissue in the buccal zone of the implant can require a longer crown or a horizontal defect can lead to concave profile or flap profile which can produce food accumulation and retention of bacteria. (12)

In case of observing lack of KT in the area around the implant placement it's possible to perform with a preventive approach an apically positioned flap or laterally positioned flaps and free gingival graft to augment KT. The most used surgical technique will be the apical positioned flap with an application of a graft of the palatal mucosa. (1) (12)

As described at the beginning FGG was introduced by Nabers and nowadays this term is associated to a soft tissue graft free epithelialized. At the beginning this technique used rest of tissue remaining after performing a gingivectomy but the evolution along the time is headed towards the use as a donor site of the masticatory or palatal mucosa. (13)

An important aspect in this technique is related to the thickness of the graft used: between 0.8 and 0.5 mm is defined as thin, 0.9 to 1.4 mm average and 1.5 to 2 mm thick. (13)

To obtain an increasement of the KT the thin one can be a good option also because the colour will fit better respect to a thick graft to the recipient site. The relation between the graft and the recipient area should be very complete with an untouched blood supply. The healing process is very fast but it's observed an high secondary shrinkage. (13)

The average type graft is used universally unless there is the needing of root coverage. The aesthetic is not as good as the thin one but is acceptable with also a better prognosis regarding future possible episodes of recession. (13)

The 1.5mm graft instead can suffer a huge primary contraction but the secondary one will be smaller due to the presence of a think connective tissue and also a thick flap will resist more to the possibility of occurrence of recession in the future time. In the healing process this graft can end with a different colour respect to adjacent tissue and it will resemble the aspect of the donor site. Being the donor site the palatal mucosa in most of the cases we can end up with an not aesthetical final result especially in the anterior sector of the upper jaw. (13)

The technique will be different depending of the number and the location of implants that require the augmentation of the KT, the amount of the KT needed and can be performed before the implant surgery, in the moment of the second surgery or later to the prosthesis placement. The period waited in case of FGG previous the implant surgery or during the second stage surgery will be higher for the final treatment rehabilitation. (14) (15)

Another approach to augment the KT's width is described by Edel and Faccini which through the application of palatal or gingival connective tissue generate keratinization by the proliferation of epithelial cell. This procedure use an autologous connective tissue graft and it consists on the elaboration of a partial thickness envelop flap in the place where the following connective tissue graft will be placed and the following suturing of the flap over the connective tissue more less in the same position as before the incision was made. The stimulation of the keratinization of the epithelial cells from the nearby tissue is going to occur, augmenting the KT. This technique will be use to obtain for example a primary closure around the implant. (1) (8) (16) (17)

At the beginning the CTG has the aim of augment the KT, today it's will be used to perform:

- coverage of root in case of recession;
- edentulous areas soft tissue augmentations;
- thickening of tissue around implants and teeth;
- aesthetic treatment as reconstruction of papillas or correction of scars. (17)

Together with the CTG we can observe another surgical approach which will be the CTG plus the coronally advanced flap. Burkhardt uses this approach with a single incision harvesting technique to obtain subepithelial CTG which then will be placed on the connective tissue on the recipient area over the abutment implant junction. The coronally advanced flap partial thickness is moved over the MGJ and in order to cover the graft a suture is then applied. (18)

In case of applying the coronally advanced flap in recession treatment it has been demonstrated that the stabilization of the coronal portion of the flap is achieved along the time if there is the maintenance of the interdental attachment level. (18)

Zucchelli and De Sanctis has been developed in cases of multiple root recession the multiple coronally advanced flap to achieve a complete coverage than translated also on the implants as also described by Grunder. (18) (19)

This technique is focused on prevention of scars derived from incision in aesthetical zones in fact it's possible to avoid the vertical incisions which can be the cause of a scar white line tissue when the healing process has finished, there is a better preservation of the vascularization of the tissue and is achieved a coronally tissue stabilization. The incisions are performed on the mesial and distal two adjacent teeth because the lack of the vertical incisions need to be balance out with a greater extension of the flap covering more teeth number. The vascularization of the flap is respected in this technique due to the fact that it's possible to observe intrasulcular or midcrestal incisions in zones where there is present a terminal vascularization avoiding the

damages to big vessels. A better healing is achieved and less risk of haemorrhage during the surgery is present. (3) (18)

During this essay it has been talked of surgical options to augment or maintain keratinized tissue around the implant by technique where it has been assumed the performance of incisions in the act of implant placement; to cover all the aspects related with the implant procedure it could be important highlight also another option present: the flapless technique. In cases where a lot of bone is present, good KT is observed and a sufficient bone contour is detected this can be an option. In this technique is required the use of a tissue punch which will have multiples diameter to reach the ridge. Possible advantages are the preservation of the vascularization together with less patient discomfort and an easier convalescence. (3)

Disadvantages arising with the use of a flapless technique are associated with the fact that the surgeon cannot have a direct view of the anatomical structure below the mucosa, possible positioning errors can occur, bone overheating and the incapacity of soft tissue handling, leading to the possible loss of Keratinized tissue during the process of making the punch. (3)

2. Objectives

Primary objective: The aim is to compare different techniques of mucogingival surgery in order to maintain or augment KT due to its importance form a functional and aesthetic point of view

Secondary objective: compare the importance of the KT around the implant from an aesthetical and functional point of view.

3. Materials and methods

The collection of articles for this essay was done entering to: PubMed; Medline; American journal of periodontics; Wiley online library; Research gate; Journal of periodontal & Implant science; The official journal of the international congress of oral implantologists; Europe PMC; International Journal of Contemporary Dental and Medical Reviews; Dental implantology update; Journal of oral implantology; Revista odontologica Mexicana; Springer link; Sage journals; Science direct Elsevier; Journal of Indian society of periodontology. The use of one book "Mucogingival esthetic surgery" by Gori Guido and Giovanni Zucchelli was adopted into the redaction of this essay.

The key words used were: recession, periodontal and peri-implant plastic surgery, connective tissue grafts, mucogingival technques; implants; flaps; flaps design; Langer and Langer, Allen, Bernimoulini, Raetzke, Edel, keratinized tissue; root coverage, tunnel technique, coronally repositioned flap, free gingival graft.

In total the articles searched were 58 but 10 of them were eliminated due to the topic which was not strongly related with the aim of this paper: they analyse the mucogingival techniques applied over teeth without any references to implant procedure, 1 was eliminated because the title was in English and the articles was written in Chinese, 1 was eliminated because the study was made over animals, 5 were eliminated because not documented cases were presented but just a brief description of the technique was explained and 5 were eliminated because the articles were related only to aesthetical surgical techniques. So the total articles selected for this study are of 36 articles and one book. Four articles were from 1970 to 2000 and they were included into this

project due to their high relevance provided; the rest of the articles, 32, were from the last 20 years. The language selected for the articles was English.

4. Discussion

Despite the main objective is to compare different techniques of mucogingival surgery another objective is to compare the importance of KT around the implant from an aesthetical and functional point of view.

4.1 Importance of keratinized tissue

As it has been previously discussed the important of the KT around the implants is a highly debated topic for both an aesthetical and functional point of view: lack of KT is associated with a state of unhealthy mucosa follow Kent and Block and in studies performed on animals conducted by Warrer at al. the presence of higher recession and loss of attachment in areas where not adequate amount of KT around implants is observed respect to those areas where there is a good amount. (20)

In common with Warrer in cases where the KT is present but less than 2 mm, Chung et al. and Chang, Lin and Wang analyse the possibility of observing inflammation of the gum together with plaque deposit which can lead to attachment lost and recession. (21) (22)

Three of the studies used to write this essay support the previous two thesis describing that when less than 2 mm of KT is present at following up period of six months to one year high bleeding and high plaque scores will be observed in association with an higher tissue recession. (23) (11) (24)

In Agreement with Chung et al. also Lang and Loe, state that at least 2 mm of KT are needed to achieve the maintenance of a health condition of the gum without taking in consideration the patient hygiene. (21)

In contrast with this thesis one study analyse that for the final success of the implant therapy the control of the plaque will be more important that the right amount of KT. (21)

Chiu et al. suggest also the individualization prior to an implant therapy of each case analysing the hygiene of the patient, the KT present, and the aesthetical demands. Cases where the low KT is present or not good hygiene is observed together with high aesthetical needs will represent situations where conservation or regeneration of KT can help the patient in the hygiene control, will help the implant stability and provide a good aesthetical outcome. (10)

In contrast with what said until now one study analyses the possibility that, in case of lack of keratinized tissue not affectation of the implant therapy outcome will be present. The author pay more attention on the fact that having the right amount of KT will condition more the following prosthetic treatment, the aesthetic and the control of plaque than the implant itself. (15)

In cases where there is not prior amount of keratinized mucosa on the place where the surgeon decides to place the graft once it is located it will be covered just by alveolar mucosa and when the graft heals it will as non-keratinized mucosa. To allow the keratinization of the graft other techniques are require that will be described in the following pages as an apically positioned flap. (13)

4.2 Mucogingival techniques

In this essay the main aim will be focus on four different mucogingival techniques used in preservation or regeneration of the keratinized tissue around the implant paying attention of the use of those options to achieve aesthetical and functional outcomes.

Following the type of soft tissue procedures in the peri-implant areas it has been decided to divide four groups of treatment options:

- palatal roll envelop flap;
- apically positioned flap;
- free gingival graft;
- coronal advanced flap plus connective tissue graft.

4.2.1 Apically positioned flap (APF)

Two of the articles selected regarding the use of APF analyse the use of this technique without any grafts in a second surgical stage implant surgery. (25) (26)

As described by Park in 2010 during second stage implant surgery, one option can be lingualized the incision with an important improvement of KT at 1 year follow up period around 3.95 mm of it. (25)

Following always Park this technique lack the use of grafts or complex sutures so it's possible to observe the lowering of pain and will decrease the time for the procedure compared to, for example, CTG and CAF. (25)

Nevertheless, when using the APF the surgeon needs to perform suture at the periosteum level which is considered to be a difficult procedure and also there is no presence of vertical pressure on the flap which can induce to vascularization problem leading to necrosis. With the technique described by Park et al. an implant-retained stent was applied to surpass those defects. (25)

The implant stability will be achieved with the attachment of the sent on the provisional abutment. (25)

It is worth notice that this study was performed on two cases so it can be not really reliable due to the fact of the small number of patients present in the sample. (25)

Two articles analyse the problem with the use of the stent which can be associated to the risk of infection in case of poor patient's hygiene or in case of aesthetical areas to possible aesthetical problems. (25) (26)

Another point of view is described in the second article took into consideration regarding APF written by Ping-Yuen Fu, during the second stage surgery the using of APF can be performed but if there is not stability of the flap it will create deep pockets leading to mucositis and periimplantitis. (26)

However the author analyse that APF with good stabilization of the flap is considered a simple surgery which will be the chosen method in the procedure of increase the width of KT without the use as Park suggests of a stent or as other authors explain the use of sling suture to reposition the flap with the production of flap relapse during the process of healing. (26)

Ping-Yuen propose a new approach called FAST (Fu Abutment Stabilization Technique), when the buccal area not present a good amount of KT: the second surgical stage surgery to remove the healing screw and place the healing/prosthetic abutment is performed with a partial thickness flap lingualized respect to the crest, then the author propose the elevation of flap to the buccal area and the placement of the abutment with the following closing of the flap to the abutment's buccal side. On the mesio-distal area of the flap simple interrupted sutures are performed while in correspondence of the buccal area of the flap close to the abutment a single stich is performed having one short and one long ends. The author than screw off the abutment and the suture is looped for two turns around the implant-abutment connection. Then the healing

abutment is screwed to its final position, after 2 weeks the removing of suture unscrewing the abutment is performed. (26)

In contrast with the previous option described by Park, the FAST approach will be performed with less time consuming and with an easy procedure showing less coronal migration of the flap having also a good vascularization of the area due to the fact the keratinized mucosa is stable on the periosteum. There is no needing of extra tools as in Park's option showing also less patient's discomfort. (26)

Three articles used to draw up this essay propose the use of APF with a FGG. All of them states that the use of FGG will increase the amount of KT respect to the cases when APF is performed alone. The article written by Lee, Kim an Jang specify that FGG will work in a predictable and effective way however as describe also by the previous two articles there will be an increase in discomfort of the patient due to the fact that a palatal wound is performed to take the sample. Lee states also that in following up period of four weeks in both cases the presence of KT was reached but in cases where FGG was used more KT was observed respect to the APF alone. (25)(26)(27)

In common to what said by the previous articles related to APF without grafts and Lee's article the other two articles selected to analyse the use of APF plus FGG describe that higher level of discomfort is present in patient where the FGG is taken from the palate respect to the APF alone. The reason while this discomfort is high is the anatomical location of the area where the sample is taken: the palate, where keratinized mucosa is present and anaesthetic injection will be painful together to the fact that the patient will have not only the surgery for the graft but also another surgical site open for the graft. (28) (11)

A new option not described until now with the use of APF and FGG was described by Jun-Beom Park where the graft was placed in the most apical position respect to the other articles discussed until now, leaving also an exposed periosteum. He also explains a new reflection not taken into consideration by the previous articles: the shrinkage of the graft which will require a correction procedure. Between the articles selected it is the only one who talk about a pre and post-operative distance between the coronal and apical keratinized tissue. In the post-operative distance big changes in keratinized tissue was observed of about a 44% of shrinkage in twenty-six weeks check-up from the beginning but in common with the previous three articles also here an increase in KT was present. (29)

All the studies analysed until this point state that if there is there is FGG together with an APF it's possible to observe an high chair patient time due to the reason of the opening of the surgical site for the graft, it's suture and the following placement of the graft on the needed area. (11)(25)(26)(27) (28)(29)

4.2.2 Free gingival graft (FGG)

At this point of the essay a deep analysis on the use of FGG, first described by Nabers, will be performed not only relating FGG with APF, as it has been described in the previous section, but also to other options.

The FGG can be performed before the surgery for the implant placement, during the reopen surgery to collocate the abutment or later to the prosthesis placement. (14) (30) (31) (32)

Three articles describe the use of the FGG prior to the implant placement based on the concept of the higher predictability of this technique however the author Grover et al. were unable to perform a proper following up period after the placement of the prosthesis on the implant nevertheless at the moment of implant placement good amount of keratinized tissue was

regenerated through FGG. The thesis of the good predictability of this technique was also confirmed by Se-Lim Oh et al. not only to increase KT in healthy implant but also in the treatment of periimplantitis. (31)

In agreement with what demonstrate until now Cakmak et al. describe the use of FGG with an high success rate but with a new variant: a geriatric patient where due to the age of the patient possible decrease in the success of the treatment was expected, however the patient maintain a good hygiene and the success of the treatment was achieved with an high amount of KT achieved and not inflammatory sites were presented. (32)

Nevertheless, problems of discomfort due to the pain and long period of treatment were expressed from the patient. In this article as in the previous one the FGG was performed prior to implant placement due to the fact that possible problems in healing procedures could be possible due to the age of the patient if the graft was been performed after the implant surgery. (32)

At eight months following up period not big changes were observed in the patient confirming what Grover and Se-Lim state in the previous articles however it's also important to analyse that this article is a case report of one single case with an ideal patient. (32)

In contrast with what said until now there is the concept described by Marin et al. They analyse the problem that can occur in cases with FGG prior to implant placement: multiples surgery places need to be perform increasing the discomfort for the patient together with the fact that more time is needed to end up with the complete procedure. Another important aspect is related to the impossibility of the wearing of the prosthesis during the graft period of healing resulting in functional problem. (14)

In this last article discussed the authors suggest to perform the graft to treat two conditions: in cases where the patient express problem in maintain the hygiene of the prosthesis and pain after the placement on the implant supported prosthesis. (14)

In contrast with this concept, in all the previous articles the authors state that to prevent the possible problems associated with lack of KT the grafting should be performed in advance.

It might also be noted that in all the studies described until now the patient express high level of discomfort due to the fact of two surgical sides open but with the integration of a proper pharmacological therapy, following up at fifteen day and a good flap stabilization the pain can be limited. (30) (31) (32)

4.2.3 Palatal roll envelop flap

Three articles were selected to discuss another option to increase the soft tissue amount around the implant related to the use of a palatal roll envelop flap. This technique was described by Abram and it consists on the opening of a palatal flap and a pedicle is moved to the implant's buccal side. To rectify the defect present on the buccal-lingual aspect of the crest the pedicle is then rolled under the incision on the buccal area in the zone of deficiency. (12) (33) (34)

In the first article used Guglielmi describe a procedure which consists: after the augmentation of soft tissue the use of a instant provisional crown and after six weeks the final crown. A good aesthetical result was achieved, and high stability of the procedure was verified at 4 years check-up. (33)

Also, the second article shows the achievement of a good increase of soft tissue and a good KT of the buccal area of the implants, with also a stable long term results between three months to three years. (34)

In common with those two previous articles also the last one written by Man, Y. Wang, Y. Qu,P. Wang and P. Gong states that this type of technique will provide aesthetic result in anterior area when it used in combination with a single implant placement. The authors indicate that the papillae was improved and the buccal mucosa was adapted to the grade of the contra-lateral natural teeth. Following check-up visit was performed at three months a stable result was observed as in the previous two studies. In this last study were also evaluated others two parameters not present in the previous as: an advantage of this option is the low discomfort performed to the patient and the low possibility of shrinkage and scars on the buccal area. (12)

4.2.4 Coronal advanced flap (CAF)

Regarding the eight articles taken into account concerning the coronal advanced flap three of them, the one written by Zucchelli and De Sanctis, the other written by George R. Deeb, and Janina Golob Deeb, and the last one by Zucchelli, G., Mazzotti, C., Mounssif, I., Marzadori, M., & Stefanini, M. agree on the same concept regarding the use of vertical incisions in the CAF which will generate problems of vascularization creating unaesthetically scars even if those vertical relieving can increase the field area. (3) (13) (19)

So in 2005 Zucchelli and De Sanctis developed a variant called multiple advanced coronal flap which can be apply on implants avoiding scars tissue in aesthetical areas hiding in the gingival margin the vertical incisions and preserving the vascularization due to the fact that the incisions are performed intrasulcular or midcrestal where are not present major vessels. (19)

A study conducted by Zucchelli et al. in 2009 analyse in 32 patients the use of this technique including or not a vertical incision. It was shown for both cases the presence of healing problems even if on the flap where not vertical incisions where made the post-operative process shows better healing and also due to the fact the less incisions are performed less time during the surgery was observed. (19)

A significant higher rate on presence of pain, bleeding and swelling was present in patients with vertical incisions made respect to the other group. (19)

In the use of this technique, follow Zucchelli, an important role is played by the incision performed on the papillae on nearby teeth: using an oblique partial thickness flap at papillae's base and a de-epithelialization of the rest of the papillae will help the coronal position on connective exposed tissue of the new created papillae. Avoiding the muscle attachment in the base the split thickness incision will give the opportunity of a flap coronal movement which passively can arrive in the new position. (19)

The problem that can arise following Grunder and Cochran which describe this option in the case of one and two stage implant placement is the shrinkage of the soft tissue. Chances into the reduction of the probability of shrinkage on the implant area will be the elevation of a full thickness flap arriving to the periosteum, having so more depth in the crucial area lessen the recession's risk. (19)

Nevertheless an important advantage of the coronal displacement flap will be also present in case where, in the zone of the placement of the implant the adjacent teeth show exposed root surfaces: in one single surgical act there is the opportunity of the insertion of the implant and the coverage of the recession on the teeth. (3)

Another option of the use of the CAF is, in case of implants having on the buccal site soft tissue recession described in the article written by Levine, Huynh-Ba and Cochran: the coronal advanced flap with the help of the connective tissue graft used by Burkhardt et al. (18)
The CTG will be selected with a single incision harvesting technique and then will be placed on the abutment-implant junction. In this case it's possible to observe the lack of tissue to cover the graft so a partial thickness flap will be move coronally and sutured to hold the graft. At the

end of the procedure the previous areas where recessions were observed will have a complete coverage but in the following six months this positive result won't be maintained. (18)

Around the first month 75% of coverage will be maintained to decrease then between 70 to 66% in the following check-up visit at 3-6 months. So, the authors analyse the possibility of the improvement of the recession around implants when CTG plus CAF is used but non complete coverage will be obtained. (18)

In contrast with what said by Burkhardt et al., the author of the first articles discussed here: Zucchelli describe that with this approach a 75% of coverage at one-year follow-up visit was achieved. Zucchelli and his equips attributes this increasement of coverage to a different approach, in the first month pre-surgical act they remove the crown placed on the implant and polishing assisted with reshaping of the abutment was performed. At the moment of the surgery the new provisional was took out. Zucchelli's approach will create more space for the CTG placement achieving a superior adjustment of the graft and the abutment leading to that favourable outcome respect to Burkhardt. (18)

In contrast with Zucchelli approach, which is true to have better outcome, Burkhardt procedure not need of a supplementary prosthetic therapy decreasing the cost for the patient and the time of the procedure. (2) (18) (35)

Other two studies where was described the use of CAF and CTG in the treatment of recession around implant has been taken into consideration but they don't give objective result while just outcome based on the successful of the treatment based on the opinion of the patients. (36) (37)

5 Conclusion

It’s possible to consider that the amount of keratinized tissue around the implants is a very discussed topic regarding its functional and aesthetical action.

It’s worth noting that better hygiene control, less amount of plaque accumulation and inflammation along with the possibility of showing less recession and lost of attachment are observed in following up period when keratinized tissue is located around the implant.

Implant stability and its integration, together with the future restoration, in the oral environment disguising natural dentition will achieve better outcome when keratinized tissue is present.

Regarding the amount of keratinized tissue 2 mm will be consider the right one to achieve all the condition described before.

Four different mucogingival procedures to preserve or regenerate keratinized tissue has been described, using a graft or working just with the incision design.

It’s possible to state that in cases where there is the use of a graft more pain and discomfort are experienced by the patient and high chair time is needed; nevertheless better outcomes are achieved.

In cases where it’s has been decided to not use the graft supplemental devices or techniques are going to be applied as: the stent, sling suture or FAST option.

There is not a technique which will work better than the others due to the fact that each patient need to be individualize respect to the needs require for the specific situation.

The use of the free gingival graft or palatal roll envelop flap have been stated as a predictable outcome procedure.

In areas where the implant together with nearby teeth present recessions, following this review, the option chosen is the coronally advanced flap with the connective tissue graft.

In case of the second stage surgery the apically repositioned flap is consider a low traumatic and discomfort procedure.

The decision process in the moment of the choice of the treatment plan will be not only based on the individualization of each case from a functional and aesthetical point of view, but also on the personal knowledge of the surgeon, on his/her experience developed along the time, on the final outcome required by the patient and even if in an ideal condition money should not influence the decision process, also on the financial resources of the patient will affect the treatment plan.

6 Responsibility

The problem of the teeth replacement was present since the pre-Columbian era when with rudimentary tools they try to replace teeth.

During the 50's Brånemark was the one who realize the possibility of the osteointegration of the titanium and since that time a lot of steps forward has been conducted moving the attention from the osteointegration towards the different soft tissue techniques to maintain and augment those soft tissues around the implant to prolong its survival.

It was decided to debate about the topic “mucogingival surgical techniques applied to implantology” due to the fact that the soft tissue management is a part of dentistry which is in continuous evolution. Multiple options are described by different authors but just 4 were described here the ones considered most important in the KT management.

The essay is oriented towards dentist which want to have a briefly overview about the importance of KT around the implant and techniques to maintain or augment it.

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8 Annex 1

Abbreviations	Explanation
KT	Keratinized tissue
FGG	Free gingival graft
APF	Apically positioned flap
CTG	Connective tissue graft
CEJ	Cementoenamel junction
CAF	Coronal advanced flap
FAST	Fu Abtument Stabilization Technique

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Advances in mucogingival surgery

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Affiliations + expand

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Abstract

The term Mucogingival Surgery was proposed by Friedman in 1957 to indicate any surgery "designed to preserve attached gingiva, to remove frena or muscle attachment, and to increase the depth of the vestibule". The aim of this type of surgery was to maintain an adequate amount of attached gingiva and to prevent continuous loss of attachment. This philosophy was supported by many horizontal observations in humans that confirmed the need for a certain band of attached gingiva to maintain periodontal tissue in a healthy state. Subsequently, clinical and experimental studies by Wennström and Lindhe (1983) demonstrated that as long as plaque buildup is kept under careful control there is no minimum width of keratinised gingiva necessary to prevent the development of periodontal disease. These observations reduce the importance of Mucogingival Surgery. Surgical techniques are used mostly to solve aesthetic problems, since the term "Periodontal Plastic Surgery" has been suggested to indicate surgical procedures performed to correct or eliminate anatomical, developmental or traumatic deformities of the gingiva or alveolar mucosa. More recently the Consensus Report of the American Academy of Periodontology (1996) defines Mucogingival Therapy as "non surgical and surgical correction of the defects in morphology, position and/or amount of soft tissue and underlying bone". This assigns importance to non-surgical therapy and to the bone condition because of its influence on the morphology of the defects. In this respect the Mucogingival Therapy includes: Root coverage procedures, Gingival augmentation, Augmentation of the edentulous ridge, Removing of the aberrant frenulum, Prevention of ridge collapse associated with tooth extraction, Crown lengthening, Teeth that are

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Flap approaches in plastic periodontal and implant surgery: critical elements in design and execution

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de Sanctis M, Clementini M. Flap approaches in plastic periodontal and implant surgery: critical elements in design and execution. J Clin Periodontol 2014; 41 (Suppl. 15): S108–S122. doi: 10.1111/jcpe.12189.

Abstract

Aim: To identify critical elements in design and execution of coronally advanced flap, lateral positioned flap and their variations for the treatment of facial gingival recessions or peri-implant soft tissue dehiscences.

Materials and Methods: Clinical studies were identified with both electronic and hand searches, and examined for the following aspects: flap design and incision techniques, flap elevation, root conditioning, flap mobility, flap stability and suturing. Moreover, prognostic factors for complete recession coverage were identified.

Results: Some critical elements are evident in flap design and execution: the dimension and the thickness of tissue positioned over the denuded roots; the use on root surface of enamel matrix derivate; the stability and suturing of the flap in a position coronal to the cemento-enamel junction. The pre-determination of the clinical cemento-enamel junction, smoking status, operator surgical skills and the compliance to a supportive care programme have a role in obtaining and maintaining a complete root coverage.

Conclusions: Different flap approaches are available when performing periodontal plastic surgery, resulting in a great variability in clinical outcomes. The possibility of using pedicle flaps alone to achieve complete soft tissue coverage of facial implant dehiscence has not yet been investigated.

Key words: complete root coverage; coronally advanced flap; flap design; gingival recession; lateral positioned flap; peri-implant plastic surgery; periodontal plastic surgery; prognostic factors; semilunar flap; soft tissue dehiscence

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Periodontal plastic surgery is the definition adopted by the American Academy of Periodontology (AAP) proposed by Miller in 1988 (Miller 1988) to substitute mucogingival surgery; these surgical procedures are performed to correct or eliminate anatomic, developmental or traumatic deformities in morphology, position and/or amount of gingiva (AAP 1996). Conversely, the same definition can now be applied to peri-implant tissues, namely peri-implant mucosa.

In the 1960s and 1970s the aim of mucogingival surgery was essentially to treat so-called mucogingival defects, in particular a dimensional reduction both in thickness and height of keratinized tissue (KT). The rationale for this type of surgery stemmed from the perception that the presence or absence of KT influenced periodontal health (Friedman 1957). At that time, Lang & Löe (1972) demonstrated a relationship between the inflammatory state of marginal tissue and the amount of KT, asserting the need for a critical amount of KT to maintain a good state of health. Following this evidence, surgery was performed to augment the amount of

Conflict of interest and source of funding statement

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A novel surgical technique for soft tissue management in aesthetic areas of the mouth at implant placement

A case report

Une technique chirurgicale innovante pour la gestion des tissus mous dans les zones esthétiques lors de la pose d'implant

À propos d'un cas clinique

ABSTRACT

A new flap design, the multiple coronally advanced flap, originally designed for mucogingival surgery, is proposed for a different clinical indication: access flap for single implant insertion in areas of esthetic relevance.
Clinical features of multiple coronal advanced flap are the absence of a vertical releasing incisions, a variable thickness, combining areas of split and full thickness and the coronal repositioning of the flap.

RÉSUMÉ

Un nouveau tracé de lambeau, le lambeau multiple déplacé coronairement, dessiné à l'origine pour la chirurgie mucogingivale, est proposé pour une indication clinique différente: un lambeau d'accès pour l'insertion d'un implant unitaire dans les zones esthétiques.
Les particularités cliniques du lambeau multiple déplacé coronairement résident dans l'absence d'incisions verticales de décharge, une épaisseur variable, associant des zones d'épaisseur partielle et d'épaisseur totale, et le déplacement coronaire du lambeau.

Treatment of recession and mucogingival defects using connective tissue grafts on teeth and implants

Bueno Rossy, Luis *, Ferrari, Roberto**, Shibli, Jamil ***

Abstract

Gingival recession is a common clinical finding that entails an esthetic problem, causes hypersensitivity and hinders effective dental plaque control.

In the case of implants, recession causes esthetic problems and its progression does not seem to be so frequent (1).

Periodontal plastic surgery procedures are indicated in these cases. These techniques must be adapted to treat peri-implant areas (1).

While the literature presents different treatment approaches, connective tissue grafts have become the gold standard as they provide a higher rate of success and predictability.

Keywords: recession, periodontal and peri-implant plastic surgery, connective tissue grafts.

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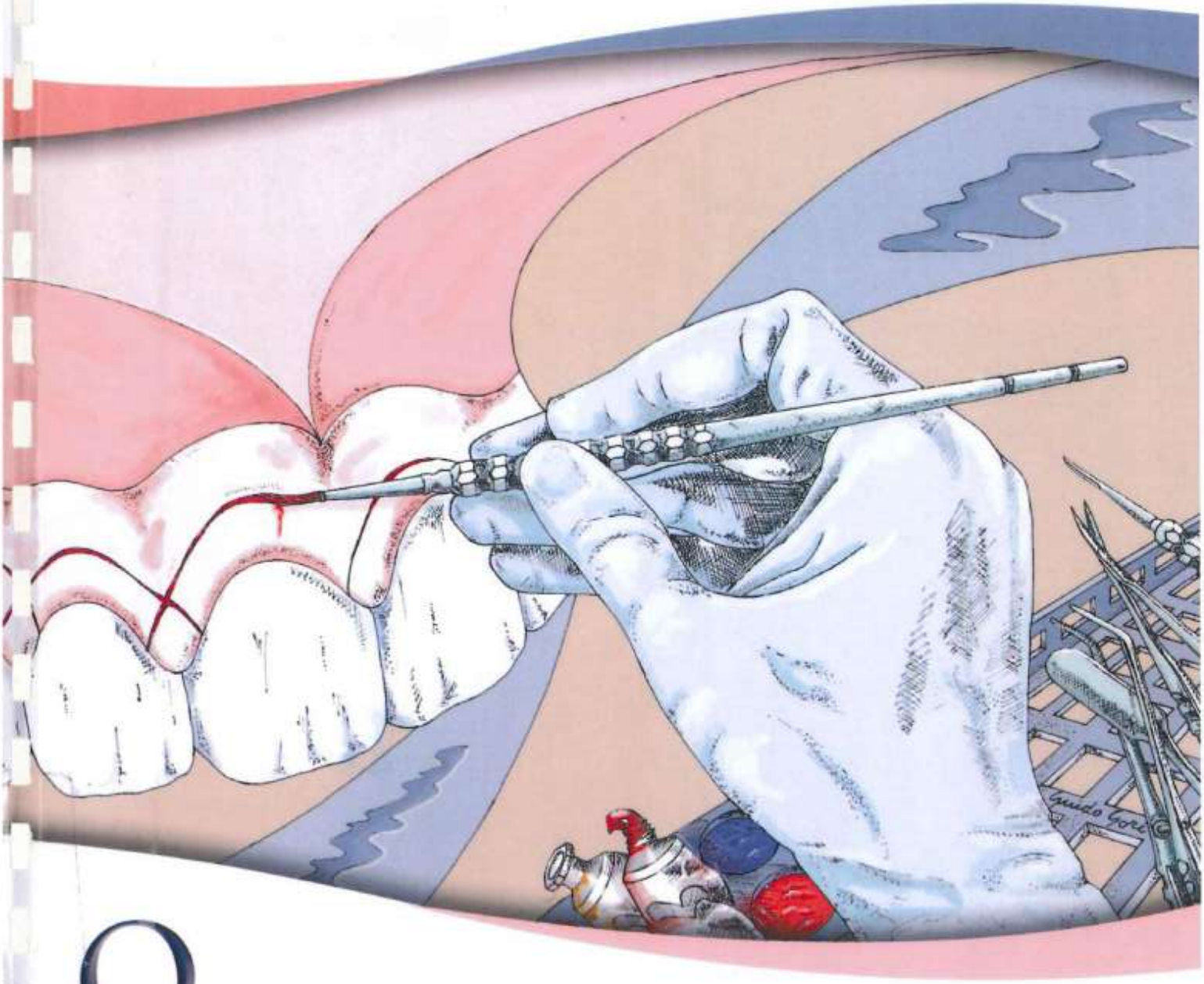
Mucogingival Esthetic Surgery



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ORIGINAL ARTICLE

Surgical management of gingival recession: A clinical update

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Abstract Gingival recession is defined as the apical migration of the junctional epithelium with exposure of root surfaces. It is a common condition seen in both dentally aware populations and those with limited access to dental care. The etiology of the condition is multifactorial but is commonly associated with underlying alveolar morphology, tooth brushing, mechanical trauma and periodontal disease. Given the high rate of gingival recession defects among the general population, it is imperative that dental practitioners have an understanding of the etiology, complications and the management of the condition. The following review describes the surgical techniques to treat gingival recession.

1. Introduction

Gingival recession is the exposure of the root surface resulting from migration of the gingival margin apical to the cemento-enamel junction (CEJ). It may be localized or generalized and can be associated with one or more tooth surfaces (Kassab and Cohen, 2003).

Epidemiological studies show that more than 50% of subjects in the populations studied have one or more sites with recession of at least 1 mm, buccal sites being most commonly affected. Higher levels of recession have been found in males than females (Susin et al., 2004). Recession at the buccal surfaces is common in populations with good oral hygiene (Serino et al., 1994; Neely et al., 2005; Sangnes and Gjermo, 1976) whereas with poor standards of oral hygiene it may affect other tooth surfaces (Baelum et al., 1986). Gingival recession at the lingual surfaces of lower anterior teeth showed a strong association with the presence of supragingival and subgingival calculus (van Palenstein Helderman et al., 1998).

The etiology of the condition is multifactorial and may include plaque-induced inflammation, calculus and restorative iatrogenic factors, trauma from improper oral hygiene practices, tooth malpositions, high frenum attachment, improper periodontal treatment procedures, and uncontrolled orthodontics movements (Wennstrom, 1996; Tugnait and Clerehugh, 2001). Gingival recession is also a common outcome of the therapies delivered to treat periodontal disease.

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Chapter 1: Definition and Objectives of Periodontal Plastic Surgery

Serge Dibart and Mamdouh Karima

Periodontal plastic surgery procedures are performed to prevent or correct anatomical, developmental, traumatic, or plaque disease–induced defects of the gingiva, alveolar mucosa, and bone [American Academy of Periodontology (AAP) 1996].

THERAPEUTIC SUCCESS

This is the establishment of a pleasing appearance and form for all periodontal plastic procedures.

INDICATIONS

Gingival augmentation

This is used to stop marginal tissue recession or to correct an alveolar bone dehiscence resulting from natural or orthodontically induced tooth movement. It facilitates plaque control around teeth or dental implants, or is used in conjunction with the placement of fixed partial dentures (Nevins 1986; Jemt et al. 1994).

Root coverage

The migration of the gingival margin below the cemento-enamel junction with exposure of the root surface is called *gingival recession*, which can affect all teeth surfaces, although it is most commonly found at the buccal surfaces. Gingival recession has been associated with tooth-brushing trauma, periodontal disease, tooth malposition, alveolar bone dehiscence, high muscle attachment, frenum pull, and iatrogenic dentistry (Wennstrom 1996). Gingival recessions can be classified in four categories based on the expected success rate for root coverage (Miller 1985):

- Class I: A recession not extending beyond the mucogingival line; normal interdental bone. Complete root coverage is expected.
- Class II: A recession extending beyond the mucogingival line; normal interdental bone. Complete root coverage is expected.
- Class III: A recession to or beyond the mucogingival line. There is a loss of interdental bone, with level coronal to gingival recession. Partial root coverage is expected.
- Class IV: A recession extending beyond the mucogingival line. There is a loss of interdental bone apical to the level of tissue recession. No root coverage is expected.

Root-coverage procedures are aimed at improving aesthetics, reducing root sensitivity, and managing root caries and abrasions.

Augmentation of the edentulous ridge

This is a correction of ridge deformities following tooth loss or developmental defects (Allen et al. 1985; Hawkins et al. 1991). It is used in preparation for the placement of a fixed partial denture or implant-supported prosthesis when aesthetics and function could be otherwise compromised. Ridge deformities can be grouped into three classes (Seibert 1993):

- Class I: A horizontal loss of tissue with normal, vertical ridge height
- Class II: Vertical loss of ridge height with normal, horizontal ridge width
- Class III: Combination of horizontal and vertical tissue loss

Aberrant frenulum

This is used to help close a diastema in conjunction with orthodontic therapy. It is used in treating gingival tissue recession aggravated by a frenum pull (Edwards 1977).

Prevention of ridge collapse associated with tooth extraction (socket preservation)

The maintenance of socket space with a bone graft after extraction will help reduce the chances of alveolar ridge resorption and facilitate future implant placement.

Crown Lengthening

This is used when there is not enough dental tissue available or to improve aesthetics (Bragger et al. 1992; Garber & Salama 1996).

Exposure of nonerupted teeth

The procedure is aimed at uncovering the clinical crown of a tooth that is impacted and enable its correct positioning on the arch through orthodontic movement.

Loss of interdental papilla

No technique can predictably restore a lost interdental papilla. The best way to restore a papilla is not to lose it in the first place.

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Periodontal plastic and mucogingival surgery

GIOVANPAOLO PINI PRATO, CARLO CLAUSER & PIERPAOLO CORTELLINI

Traditional mucogingival surgery has focused mainly on the preservation or reconstruction of attached gingiva. The definition proposed by Friedman (51) included surgery "designed to preserve attached gingiva, to remove frena or muscle attachment and to increase the depth of the vestibule". The rationale was based on clinical studies that concluded that an "adequate" amount of keratinized tissue was necessary to maintain periodontal health, to prevent continuous loss of attachment (53, 63, 80, 90, 101), and to eliminate frenum pull (53, 107). It was originally believed that "inadequate" or thin gingiva together with a shallow vestibule could favor subgingival plaque accumulation (52) and food particle impaction, thus hindering oral hygiene procedures (35, 39, 128). Moreover, Goldman (55) and Ruben (129) suggested that a thick marginal connective tissue could prevent the apical progression of plaque-associated periodontal lesions.

Mucogingival surgery was also used for the treatment of gingival recessions to arrest the progression of the lesion and to cover denuded root surfaces (60, 68, 143). Clinical and experimental studies have shown that any amount of marginal gingiva is adequate to maintain periodontal health in the absence of bacterial plaque accumulation (154, 156). The results of these studies have greatly reduced the need for mucogingival surgery. Nevertheless, cosmetic rehabilitation is still an area in which free gingival grafts and pedicle flaps are frequently employed.

Recently, a series of different procedures referred to as "surgical procedures performed to correct or eliminate anatomic, developmental or traumatic deformities of the gingiva or alveolar mucosa" have been included in the field of mucogingival procedures (100). Miller included procedures such as the correction of ridge deformities, exposure of unerupted teeth for orthodontic treatment and crown lengthening.

Allen (5) considered the treatment of gingival pigmentation and discoloration and the correction of flat marginal contours, "gummy" smile and gingival asymmetry also pertinent to mucogingival surgery.

On the basis of the above-mentioned studies, the American Academy of Periodontology (54) has replaced the term "mucogingival surgery" with the more general term "soft tissue plastic surgery" to describe surgical procedures designed to correct defects in the morphology, position or amount of gingiva surrounding the teeth.

This chapter focuses on the surgical approaches consistent with the American Academy of Periodontology definition.

Periodontal plastic and mucogingival surgery and gingival recession

The most significant factors causing gingival recession are considered to be periodontal disease and improper oral hygiene measures, along with some predisposing factors such as thin gingiva, a prominent root surface, buccally positioned teeth, frenum pull and bone dehiscences (88).

Tissue augmentation to prevent or arrest the progression of gingival recession is still controversial. In fact, it has been shown that there is no requirement for a certain minimal width of gingiva to maintain periodontal health (154, 156), and that the lack of or the presence of minimal amounts of attached gingiva does not necessarily result in the development of soft tissue recession (155), if a proper plaque control regimen is established. On the other hand, the Consensus of Section VII (Gingival augmentation/ Mucogingival surgery) of the World Workshop in Clinical Periodontics (64) states that when recession is progressive and is associated with the absence or a minimal dimension of gingiva, augmentation should be considered.

However, recession of the gingival margin is an

CLINICAL ORAL IMPLANTS RESEARCH

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Significance of keratinized mucosa around dental implants: a prospective comparative study

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Key words: dental implants, inflammatory cytokines, peri-implant crevicular fluid, keratinized mucosa

Abstract

Objective: The aim of this investigation was to evaluate the significance of keratinized mucosa (KM) around dental implants both clinically and biochemically for 12 months.

Material and methods: Fifteen edentulous patients treated with implant-retained overdentures in edentulous mandible (four implants per patient). Based on the presence of keratinized mucosa on the buccal surfaces, implants were divided into two groups: Implants having minimal 2 mm of KM on their buccal surfaces and implants having no KM on their buccal surfaces. Thirty-six implants were included in the evaluations; 19 implants in 15 patients had minimal 2 mm of KM on their buccal surfaces and 17 implants in 15 patients had no KM on their buccal surfaces. Clinical measurements of Plaque Index, Gingival Index, probing depths, and Bleeding on Probing were performed and peri-implant crevicular fluid (PICF) were collected immediately before loading (baseline) and at 6th, 12th months after loading. Interleukin-1 beta (IL-1 β) and tumor necrosis factor-alpha (TNF-α) have been assessed in the crevicular fluid. Results were analyzed by repeated-measures of variance (ANOVA) and Wilcoxon signed rank tests.

Results: After 12 months of evaluation the results of ANOVA showed that implants with KM had lower levels of TNF-α total amounts than implants without KM ($P < 0.05$). Additionally, TNF-α total amounts were significantly higher at 12th month compared to baseline for implants without KM ($P < 0.05$). Plaque index and Gingival index values were also found significantly higher for implants without KM ($P < 0.05$). For IL-1 β and PICF volume levels the differences between the implant groups were non significant, whereas the differences between the periods were significant. ($P < 0.05$) Additionally, both of the groups had higher levels of PII and BoP scores when compared to baseline ($P < 0.05$).

Conclusions: The results of this study showed that an adequate band of keratinized mucosa was related with less plaque accumulation and mucosal inflammation as well as pro-inflammatuar mediators, suggesting that it may be critical especially for plaque control and plaque associated mucosal lesions around dental implants.

The presence of an adequate zone of gingiva was considered critical for the maintenance of marginal tissue health (Carranza & Carraro 1970; Hall 1981; Matter 1982). It was believed that an inadequate zone of gingiva would facilitate subgingival plaque formation due to improper pocket closure (Carranza & Carraro 1970) and the apical spread of plaque-associated gingival lesions because of less tissue resistance resulting attachment loss and soft tissue recession (Ruben 1979).

There are different opinions about what could be regarded as being an "adequate" or "sufficient" dimension of gingiva. Bowers et al. (Bowers 1963) suggested that not less than 1 mm of gingiva may be sufficient, while Corn et al. (Corn 1962) claimed that minimum 3 mm of keratinized tissue ought to exist. The other opinion is a more biologic approach that any dimensions of gingiva may be sufficient which maintain gingival health and prevents retraction of the gingival margin during movements of alveolar mucosa (de Trey & Bernimoulin 1980).

A number of studies on various clinical indications have documented high success rates for dental implant therapy (Branemark et al. 1977; Buser et al. 1990, 1997; Heijdenrijk et al. 2006). The structure and function of the mucosa around implants has been also investigated (Lindhe & Berglundh 1998) and the soft tissue response to plaque was found similar around natural teeth and dental implants (Leonhardt et al. 1992; Lindhe et al.

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Review Article

Significance of the width of keratinized mucosa on peri-implant health

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Abstract

In implant therapy, the adequate state of peri-implant tissue health and soft-tissue aesthetics is the essential criterion of restorative success. The need for keratinized mucosa for the maintenance of peri-implant health and soft-tissue integration remains a debated issue. The aim of this paper is to provide a narrative review of the current literature concerning the significance of keratinized mucosa with respect to the clinical parameters of monitoring oral hygiene practice and tissue status. The published studies revealed that there were conflicting results with regard to the influence of keratinized mucosa on plaque score and soft-tissue inflammation. Most studies showed that the amount of soft-tissue recession was significantly increased at implant sites with narrow keratinized mucosa, but the amount of keratinized mucosa had little effect on deepening of peri-implant pockets. The evidence related to the effect of keratinized mucosa on the changes of attachment or bone levels is limited, and conclusions could not be drawn at present. Further, this review found that a band of keratinized mucosa was not absolutely necessary for the maintenance of peri-implant tissue, whereas lack of adequate keratinized mucosa around the implant might impede proper oral hygiene performance and compromise the aesthetic results. In conclusion, because there is a wide variety of clinical features in patients pursuing implant therapy, individual consideration of treatment strategies for the patient with minimal keratinized mucosa is recommended.

Keywords: clinical parameters; dental implants; keratinized mucosa; peri-implant soft tissue

1. Introduction

The peri-implant keratinized mucosa is firmly bound to the underlying bone and constitutes a functional barrier between the oral environment and underlying dental implants. However, after teeth are extracted, the resorption of surrounding bone and keratinized gingiva occurs, which may result in deficiency of keratinized mucosa during subsequent implant placement.

The need for keratinized mucosa around dental implants has been widely discussed. During the early development of endosseous dental implants, the establishment of a dense connective tissue around the implant collar for long-term implant stability was repeatedly addressed.[1–3] Nevertheless, a number of subsequent studies showed that implants had a high survival rate irrespective of the presence or absence of keratinized mucosa.[4–6] Nowadays, in addition to achieving high implant survival following implant therapy, maintenance of functionally loaded implants in an adequate status of health and aesthetics had become a prerequisite for long-term success of implant restoration. The need for keratinized tissue around the dental implant to maintain health and tissue stability is therefore becoming of increasing concern.

In the beginning years of implant dentistry, few comparative studies investigated the relationship between the width of keratinized mucosa and the health of peri-implant tissues. In

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Peri-Implant Plastic Surgical Approaches to Increasing Keratinized Mucosa Width: Which to Use and When?

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The long-term efficacy of adequate keratinized mucosa (>2 mm) in dental implants is controversial. Peri-implant plastic surgeries are currently used because they increase keratinized mucosa width (KMW), helping to regain peri-implant health and maintaining it over the long-term. We present the clinical findings using free-gingival-graft (FGG) and free-periosteal-graft (FPG) techniques in peri-implant plastic surgery for implant rehabilitation patients. We included 20 patients with implant indications of inadequate KMW (KMW < 2 mm for postimplantation) in the maxilla and mandible. All underwent clinical and radiographic measurements and a treatment protocol was prepared for implant rehabilitation and subsequent peri-implant plastic surgery. A decision as to whether and when FGG or FPG techniques would be used was made. FGG/FPG was performed pre-implantation (before monocortical block-bone augmentation) or postimplantation (before/during/after stage 2 surgery). KMW was ≥ 2 mm after application of FGG/FPG pre- or post-implantation. Moreover, peri-implant tissue health was regained/maintained in all cases from 6 months to 4 years. Peri-implant plastic surgery techniques can prevent hard- and soft-tissue problems after implant rehabilitation and during treatment of developing problems. However, surgical design and timing, and an interdisciplinary perspective determine the success of peri-implant plastic surgery.

Key Words: clinical study, implant, peri-implant plastic surgery techniques, keratinized mucosa width, soft tissue augmentation

INTRODUCTION

Scientific developments in dental implantology have gradually improved both the success rate and the ability to meet patient expectations. Dental implant rehabilitation is no longer confined to restoration of mastication and phonetic function. The attainment of "ideal" treatment results with structural and aesthetic "regeneration" of edentulous areas is an important goal in modern implant dentistry.[1,2] The long-term functional and aesthetic success of dental implants depends on a balance between hard structures and soft tissues. Thus, peri-implant health should be considered important in resistance against mechanical forces, and bacterial plaque and also mucosal stress must be eliminated.[1–4]

For ideal dental implant rehabilitation, an adequate bone volume, optimal implant position, aesthetic soft tissue contours, and stable and healthy soft tissue are required.[1,5] In particular, soft-tissue defects, such as gingival and connective tissue, play crucial roles in long-term implant success.[2–4] Periodontal plastic surgery techniques are now routine treatments for various soft-tissue defects. The peri-implant plastic surgery concept has been proposed due to the adaptation of these techniques to dental implantology; this is also known as peri-implant soft tissue management/augmentation."[1–3,6]

Peri-implant plastic surgery approaches facilitate the development of healthy peri-implant structures that are able to withstand occlusal forces and mucogingival stress, while providing satisfactory aesthetic results in both soft and hard tissues.[1,2] The treatment of hard structure and soft-tissue problems that arise post-implantation is another important goal of peri-implant plastic surgery.[1–3] Peri-implant plastic surgery enables the creation of the peri-implant keratinized mucosa (KM).[2] KM comprises of dense, collagen-rich connective tissue, lined by a keratinising epithelium. No free elastic fibers are found in the connective tissue, and the lamina propria is firmly and directly attached to the bone periosteum.[4]

Whether the presence of a KM zone around dental implants is required for peri-implant health is controversial.[4,7,8] While significantly higher plaque[9–13] and bleeding scores [10–15] and more soft-tissue recession in the early phase (6–12 months after prosthesis)[12,16] have been reported in regions with inadequate KM width (KMW, <2 mm), other researchers reported the opposite.[4,7] Moreover, although interproximal bone level[12] and implant loss[17] were not detected in such cases, these evaluations could not be completely assessed due to methodological limitations. Therefore, even though no significant

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Clinical Paper
Dental Implants

A palatal roll envelope technique for peri-implant mucosa reconstruction: a prospective case series study

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Y. Man, Y. Wang, Y. Qu, P. Wang, P. Gong: A palatal roll envelope technique for peri-implant mucosa reconstruction: a prospective case series study. Int. J. Oral Maxillofac. Surg. 2013; 42: 660–665.

Abstract. The aim of this study was to evaluate peri-implant soft tissue changes after performing a palatal roll envelope technique. Twelve patients, presenting a labial flat or concave profile before second-stage surgery, underwent soft tissue augmentation using the palatal roll envelope technique with papilla reservation design. The convex profile on the facial aspect, Jemt papilla index, facial mucosal level, marginal bone level, proximal bone levels of the adjacent teeth, and surgical/prosthetic complications were evaluated before surgery as the baseline, and then reevaluated at 1 week, 3 months, and 6 months after surgery. Data were analyzed using the Friedman test and Wilcoxon signed-rank test. Results indicated that the convex profile and the average papilla index score were improved, while the facial mucosal level was adjusted to a level similar to that of the contralateral tooth at 3 months and then remained stable for the follow-up visit. With the limitations identified in this report, the palatal roll envelope technique can be considered an alternative method to augment the soft tissue during second-stage surgery. This technique obviates the need for another surgical site and papillae area, and also reduces the risks of graft shrinkage and scarring on the labial site.

Key words: palatal roll envelope technique; peri-implant mucosa; soft tissue augmentation; convex profile; facial mucosal level; jemt papilla index.

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Dental implants have been used successfully to replace missing teeth.[1,2] With rapid developments in this area, emphasis has shifted from implant osseointegration towards predictable aesthetic success.[2,3] In order to achieve pleasing aesthetic results, the soft tissue contour around implant-supported restorations should be identical or similar to the contralateral tooth or in harmony with the adjacent natural teeth or artificial restorations. An inadequate vertical dimension of the buccal peri-implant tissue might otherwise lead to an unusually longer crown, and missing volume in the horizontal direction at the buccal aspect could cause a flat or concave profile in the respective region, resulting in food retention and bacterial trap. Therefore, soft tissue management and peri-implant aesthetics have become a focus of implant dentistry.[4,5]

The pink aesthetic score (PES)[6] is an objective aesthetic criterion comprising five parameters. The five parameters can generally be categorized into two main parts: papilla parts (mesial and distal papillary scores) and facial parts (the curvature of the facial soft tissue, the level of the facial peri-implant mucosa, and the convex profile on the facial aspect). Besides bone augmentation, various flap designs[7,8] and free connective tissue

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Soft Tissue Grafting Around Teeth and Implants

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KEYWORDS

• Free gingival graft • Subepithelial connective tissue graft • Recession • Soft tissue defect • Allograft • Xenograft

KEY POINTS

- Esthetic appearance and functional longevity for teeth and implants often requires conversion of unfavorable soft tissue traits to more favorable ones.
- Improvement of tissue quality and quantity can be accomplished with many different techniques and materials, and largely depends on clinical presentation of the case and the familiarity of the clinician with the procedures and materials available.
- Identification of causal factors, selection of appropriate surgical technique, and evidence-based material selection lead to predictable success when improving soft tissue characteristics around teeth or implants.

THE IDEAL CHARACTERISTICS OF THE SOFT TISSUE TOOTH/IMPLANT INTERFACE

The presence of healthy attached tissue at the tooth and implant soft tissue interface correlates with long-term success and stability in function and esthetics. Not only can a lack of keratinized tissue facilitate plaque aggregation around teeth and implants but it can also lead to recession of free soft tissue margin in the esthetic zone. The thicker periodontium is less prone to recession, because of the thickness of the cortical bone as well as the thickness of the surrounding gingiva.

Treatment of mucogingival deficiencies has become a large part of practices involving teeth and implants. The ramifications of not having an adequate keratinized tissue surrounding teeth have been studied extensively for decades,[1,2] and have also extended into implantology. The presence of gingiva is strongly correlated with optimal soft and hard tissue health.[3] However, in patients maintaining proper plaque control, the absence of attached gingiva around teeth does not result in an increased incidence of soft tissue recession.[1,4] It has been shown in long-term studies that even minimal amounts of keratinized tissue can provide long-term stability of soft tissue margin in the presence of good plaque control.[1]

Early studies suggested that the recession of soft tissue margin around implants may be the result of the remodeling of the periimplant soft tissue barrier. Lack of masticatory mucosa and the mobility of periimplant soft tissue were related to more pronounced soft tissue recession around implants.[5] Plaque-induced inflammation has been shown to cause recession when mucosal margins, rather than gingiva, are surrounding implants.[6] Thicker keratinized tissue facilitates plaque removal around implants. Plaque has been found as the causal factor in periodontal diseases[7] as

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Case Report

Free Gingival Graft to Increase Keratinized Mucosa after Placing of Mandibular Fixed Implant-Supported Prosthesis

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Insufficiently keratinized tissue can be increased surgically by free gingival grafting. The presence or reconstruction of keratinized mucosa around the implant can facilitate restorative procedure and allow the maintenance of an oral hygiene routine without irritation or discomfort to the patient. The aim of this clinical case report is to describe an oral rehabilitation procedure of an edentulous patient with absence of keratinized mucosa in the interforaminal area, using a free gingival graft associated with a mandibular fixed implant-supported prosthesis. The treatment included the manufacturing of a maxillary complete denture and a mandibular fixed implant-supported prosthesis followed by a free gingival graft to increase the width of the mandibular keratinized mucosa. Free gingival graft was obtained from the palate and grafted on the buccal side of interforaminal area. The follow-up of 02 and 12 months after mucogingival surgery showed that the free gingival graft promoted peri-implant health, hygiene, and patient comfort. *Clinical Significance.* The free gingival graft is an effective treatment in increasing the width of mandibular keratinized mucosa on the buccal side of the interforaminal area and provided an improvement in maintaining the health of peri-implant tissues which allows for better oral hygiene.

1. Introduction

Fixed implant-supported prosthesis is an alternative treatment in prosthodontics mandibular rehabilitation [1]. However, the maintenance and health of the peri-implant soft tissue is necessary for the longevity of dental implants [2] and prosthesis. The soft tissue healing following implant surgery may result in the establishment of a border tissue composed of either keratinized or nonkeratinized mucosa [3].

A study showed that an amount ≥2 mm of keratinized mucosa (KM) is needed to maintain the health of periodontal tissues providing a soft tissue seal around natural teeth [4]. However, peri-implant health with presence or absence of a minimal zone of keratinized tissue around dental implants has been studied and the literature showed divergent theories [5]. A literature review showed no significant association between "inadequate" keratinized tissue with higher plaque scores and mucosal inflammation [3]. Other studies showed that absence of adequate KM around dental implants is associated with increased plaque accumulation, mucosal inflammation, mucosal recession, and attachment loss [6, 7]. Furthermore, patient discomfort when performing oral hygiene was reported to be painful as a result of KM absence surrounding the implant, as well as mechanical irritation due to the mobility of the nonkeratinized tissue under function [3, 8, 9].

The weak sealing ability of the peri-implant nonkeratinized tissue [10], the critical bacterial plaque control in some patients [7], pain, and discomfort are the main reasons for justifying a gingival graft on the implant site [11] with absence

The Importance of Keratinized Tissue Around Implants

Enhancing Soft Tissue Parameters Around a Single Tooth Implant

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Reem N. Atout, BDS, DDS, MS, FRCD(C)

Abstract

Controversy exists over the need to augment or add keratinized tissue around implant fixtures. This case report illustrates the use of a connective tissue graft to augment the zone of keratinized gingiva and the resultant stability of the soft tissue margin and decrease in discomfort for the patient when brushing over the implant area.

Key Words: dental implant, connective tissue graft, keratinized tissue, oral hygiene, mucogingival

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The use of a connective tissue graft for closure over an immediate implant covered with an occlusive membrane

Edel A. The use of a connective tissue graft for closure over an immediate implant covered with an occlusive membrane.
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Complete wound closure over an immediate implant is considered to be a desirable goal. This case report describes for the first time the use of a connective tissue autograft placed under the existing flap margins of an extraction socket to successfully achieve closure over an immediate implant covered with an occlusive membrane. The rationale of the method is described. Healing was uneventful and epithelization of the graft surface from surrounding tissues was achieved. This technique created an increased width of keratinized tissue and avoided the need to disrupt the normal anatomical relationships of the surrounding buccal tissues, in contrast to current techniques. The advantages of the technique, together with factors that may influence healing and predictability, are discussed.

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Key words: connective tissue graft – flap closure – immediate implant – wound healing

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The immediate placement of an implant into an extraction site can reduce the time interval from tooth extraction to implant-supported restoration (Lazzaro 1989). However, due to the discrepancy of size and form between the extraction socket and implant, a space very often exists around the implant, especially in the coronal portion. Recent studies (Lazzaro 1989; Nyman et al. 1990; Becker et al. 1991) have demonstrated that the use of an occlusive membrane according to the principles of *guided tissue generation can result in bone-form*ing cells populating the peri-implant space and subsequent osseointegration.

The question as to whether the membrane should be covered completely or not during the regenerative period has been a topic of controversy, but a recent study in monkeys (Warrer et al. 1991) would indicate that predictable complete osseointegration of dental implants placed into fresh extraction sockets only occurred when the membrane remained covered throughout the regenerative healing period.

Primary closure can be achieved over the immediate implant and membrane by the method described by Bowers & Donahue (1988), using a periosteal releasing incision and vertical incisions to achieve sufficient mobility of the buccal flap. The buccal flap is then approximated to and sutured to the palatal flap. This technique has the disadvantage of moving any existing buccal attached gingiva coronally and results in a discrepancy between the mucogingival junction of the treated site and adjacent sites. This may require correction at a later stage and can result in aesthetic problems, especially if the site is located in the anterior maxilla.

A modified technique utilizing a rotated buccal flap from an adjacent tooth site to achieve primary closure has been described (Becker & Becker 1990). This technique also results in a discrepancy in the mucogingival junction and also requires an adequate width of attached gingiva to be present preoperatively at the donor site.

If an inadequate width of buccal attached keratinized gingiva does not exist preoperatively at the extraction site or adjacent areas, these techniques are severely compromised. If additional width of keratinized gingiva is desired, this requires a further procedure to be performed at some later stage.

The connective tissue graft was introduced in

Connective Tissue Grafts in Periodontal Surgery

Sonja Böhm, Dietmar Weng, Jörg Meyle

The application of connective tissue grafts has become a widely accepted therapeutic option in aesthetically oriented periodontal plastic surgery. The harvesting techniques as well as the fields of application have changed and further developed since the first description of a free connective tissue graft three decades ago. This article will provide an overview of techniques for graft harvesting and its therapeutic use as well as future developments.

Key words: connective tissue graft, periodontal plastic surgery, recession coverage, soft tissue augmentation

INTRODUCTION

The autologous connective tissue graft (CTG) is an indispensable therapeutic tool in mucogingival periodontal surgery and implantology from the functional and aesthetic point of view. Since it was first described by Edel in 1974, the technique has continued to develop steadily in terms of its indications, usage and harvesting methods. While it was originally used only to increase the width of the keratinised gingiva, its current range of uses has now expanded to include coverage of gingival recessions, soft tissue augmentation in edentulous areas, tissue thickening around teeth and implants and cosmetic measures (papilla reconstruction, scar correction, etc.).
With the aid of clinical examples, this article will provide an overview of techniques for graft harvesting, indications and success rates as well as future prospects relating to possible alternatives to the free CTG.

HARVESTING TECHNIQUES

The original publication by Edel (1974) not only described the possibility of harvesting a free CTG but also presented three different harvesting techniques:

- the palate using a three-sided 'trapdoor' incision
- from the underside of a mucoperiosteal flap and
- from the crestal area of an edentulous maxillomandibular saddle

Palatal harvesting in the region between canine and first molar has now become established as the standard procedure and, to enhance postoperative patient comfort, the graft is usually harvested from the same side as the recipient area. Periodontal prophylaxis in relation to the teeth adjacent to the harvesting area demands a distance of 3–4 mm between gingival margin and the first incision along the palatal course of the dental arch. Other anatomical limitations to connective tissue harvesting are the area of the palatine rugae (anteriorly), the palatal root of the first molar (posteriorly) and the neurovascular bundle emerg-

Soft Tissue Augmentation Procedures for Mucogingival Defects in Esthetic Sites

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Purpose: *This systematic review was performed to address the focus question: "In adult patients with soft tissue deficiencies around maxillary anterior implants, what is the effect on esthetic outcomes when a soft tissue procedure is performed?" In addition, this paper reviews the importance of presurgical esthetic risk assessment (ERA) starting with comprehensive team case planning prior to surgical intervention and a restorative-driven approach.* ***Materials and Methods:*** *A thorough Medline database search performed on related MeSH terms yielded 1,532 titles and selected abstracts that were independently screened. Out of the 351 abstracts selected, 123 full-text articles were obtained for further evaluation. At each level, any disagreements were discussed until a consensus was reached.* ***Results:*** *A total of 18 studies were included in this systematic review of esthetic outcomes following soft tissue procedures around implants with soft tissue deficiencies. A preliminary analysis of the included studies showed that the vast majority were case series studies with most not providing objective outcomes of their results. Moreover, only one randomized controlled trial was identified. Therefore, quantitative data analysis and subsequent meta-analysis could not be performed. The included studies were grouped according to the intervention on the peri-implant soft tissue performed and six groups were identified. The periodontal procedures performed around dental implants gave initial good results from the inflammation involved in wound healing, but in virtually all cases significant recession occurred as healing resolved and the tissues matured.* ***Conclusions:*** *Although success of implant therapy is similar in the anterior maxilla and other areas of the mouth, the majority of studies evaluating this therapy in the esthetic zone are lacking literature support, few in number, devoid of long-term follow-up and number of patients, and are subject to inclusion bias. The use of the ERA tool for all esthetic zone cases can benefit both the clinician and the patient to avoid any miscommunication and problems of expectation upon completion. All the available knowledge on this topic, including the approaches described in this paper, is based on a very limited literature support and thus should be addressed with caution. These concerns should encourage long-term good clinical trials for better assessment of those issues.* Int J Oral maxillofac Implants 2014;29(Suppl):155–185. doi: 10.11607/jomi.2014suppl.g3.2

Key words: *keratinized mucosa, mucogingival surgery, peri-implant mucosa, recession*

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Long-term clinical studies have shown that functional osseointegration is a predictable outcome when endosseous implants are placed in the treatment of missing teeth.[1–5] However, the success of dental implant therapy is no longer based only on functional osseointegration but positive patient outcomes of creating an illusion that the tooth replacement is in esthetic harmony with the remaining dentition upon smiling. Patients expect not only the ability to function long term with their restored implants but also to have a reasonable esthetic result. The knowledge base has significantly improved over the last two decades when it comes to clinicians' understanding of the biology and healing of the oral hard and soft tissues, with the esthetic zone being studied extensively over this time period. Although the success of dental implants is

Esthetic Treatment of Peri-implant Soft Tissue Defects: A Case Report of a Modified Surgical–Prosthetic Approach

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A major esthetic concern is soft tissue defects around implant restorations, which often result in an extra long prosthetic crown. This report describes a modified prosthetic–surgical approach to the treatment of peri-implant horizontal and vertical soft tissue defects in an esthetically demanding patient. One month before surgery, the implant crown restoration was removed, the preexisting implant abutment was reduced, and a short provisional crown, at the level of the homologous contralateral incisor, was applied. A bilaminar technique, consisting of an envelope coronally advanced flap covering two connective tissue grafts, was used to treat the soft tissue defects around the implant site. Four months after surgery, a new implant abutment and provisional crown were applied for soft tissue conditioning before the final impression. Nine months after surgery, the peri-implant soft tissue margin was 4 mm more coronal compared with baseline and at the same soft tissue margin level of the right central incisor. A 2.2-mm increase in buccal soft tissue thickness measured 1.5 mm apical to the soft tissue margin was accomplished. The emergence profile of the replaced tooth faithfully reproduced that of the healthy homologous contralateral central incisor. Two years after surgery, the soft tissue margin was stable and the esthetic appearance of the implant site was well maintained. This report demonstrates the possibility of fully correcting severe vertical and horizontal peri-implant soft tissue defects and achieving high patient satisfaction through a combined mucogingival and prosthetic treatment. (Int J Periodontics Restorative Dent 2013;33:327–335. doi: 10.11607/prd.1632)

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Implant restoration is a common practice for tooth loss rehabilitation in esthetic areas. The main goals are functionality and esthetics for patient satisfaction. The clinician chooses from a variety of surgical approaches such as immediate, early, or delayed implant placement.[1,2] After tooth extraction, the hard and soft tissues undergo substantial changes as a result of healing.[3] Many factors influence the soft tissue level around dental implants but only a handful have been studied: peri-implant biotype, height and width of the facial bone, and orofacial position of the implant head.[4,5] A major concern from an esthetic point of view is soft tissue defects around implant restorations, which often result in extra long prosthetic crowns with disharmony of the marginal soft tissue scallop in respect to the adjacent teeth. The increased esthetic demands require the peri-implant soft tissue color and contour to be in harmony with the neighboring teeth for patient satisfaction; thus, surgical reduction of the peri-implant soft tissue defect may be indicated. Results after surgical root coverage are well reported in

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Plaque-induced peri-implantitis in the presence or absence of keratinized mucosa

An experimental study in monkeys

Warrer K, Buser D, Lang NP, Karring T. Plaque-induced peri-implantitis in the presence or absence of keratinized mucosa. An experimental study in monkeys.
Clin Oral Impl Res 1995: 6: 131–138. © Munksgaard, 1995

In 5 monkeys a total of 30 transmucosal endosseous dental implants were inserted in edentulous areas of the mandible with presence or absence of keratinized mucosa. After a healing period of 3 months with optimal plaque control, all implants were exposed to plaque accumulation for periods up to 9 months. To secure abundant plaque accumulation on half the number of the implants, cotton wool ligatures were placed around the implants at the entrance to the peri-implant sulcus. Attachment loss was measured clinically and histometrically, and tissue recession was measured clinically. Ligated implants without keratinized mucosa demonstrated significantly more recession and slightly more attachment loss than the other implants. The results of this study suggest that the absence of keratinized mucosa around dental endosseous implants increases the susceptibility of the peri-implant region to plaque-induced tissue destruction.

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Key words: keratinized mucosa – oral implants – gingival health – periimplantitis

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Masticatory mucosa includes gingival and palatal mucosa and is covered by a keratinizing stratified squamous epithelium interdigitating with a dense fibrous connective tissue (lamina propria). In the gingiva the lamina propria is attached directly to the alveolar bone by the periosteum and to the supracrestal portion of the roots (Listgarten et al. 1991). The adjacent lining mucosa is covered by a nonkeratinizing stratified squamous epithelium interfacing an underlying loose connective tissue containing numerous elastic fibers (Listgarten et al. 1991; Lindhe & Karring 1989). Based on clinical experience, the necessity of an adequate width of keratinizing mucosa adjacent to the teeth has been postulated for the maintenance of gingival health (Ochsenbein & Maynard 1974; Hall 1981). Several clinical and experimental studies, however, have failed to support this view. Lang & Löe (1972), for instance, demonstrated that minimal widths of keratinized gingiva were compatible with gingival health, and Miyasato et al. (1977) showed that gingivitis did not develop more rapidly in sites with minimal width of keratinized gingiva than in sites with an appreciable width of gingiva. Experimental studies in dogs have also failed to demonstrate differences in the rate or extent of progression of gingival lesions in areas with minimal width of keratinized gingiva (Wennström 1987). Similarly, longitudinal clinical trials in which minimal zones of keratinized gingiva were augmented by the placement of free gingival grafts were unable to document a protective role of such treatment regarding the maintenance of periodontal attachment levels (Dorfman et al. 1982; Wennström 1983; Kennedy et al. 1985). With adequate plaque control, attachment levels were also maintained over many years in control sites with minimal width of keratinized gingiva (Dorfman et al. 1982; Kennedy et al. 1985).

In recent years the discussion has focused on the necessity of the presence of keratinized mucosa around endosseous dental implants. It has repeatedly been postulated that the establishment of a circumferential sealing effect by a dense connective tissue collar at the site of implant penetration into the contaminated environment of the oral cavity

Evaluating the clinical and esthetic outcome of apically positioned flap technique in augmentation of keratinized gingiva around dental implants

Vineela Katam Reddy, Harinath Parthasarathy[1], Priya Lochana[1]

Abstract

Purpose: Dental implants though a successful treatment modality there exists controversies regarding the relationship between the adequacy of the keratinized gingiva (KG) and peri-implant health. The presence of an adequate amount of peri-implant KG reduces gingival inflammation and hence soft-tissue augmentation should be frequently considered. Among the various periodontal plastic surgical procedures, the apically displaced flap increases the width of keratinized tissue with reduced patient morbidity. The current study aims at evaluating the esthetic improvement in KG around dental implants applying apically positioned flap (APF) technique. **Materials and Methods:** A total of 10 endosseous dental implants were placed in eight systemically healthy patients. APF surgery was performed at the implant site on the buccal aspect either at the time of implant placement (one stage surgical protocol) or during the implant recovery stage (two stage surgical protocols) for increasing the width of KG and reviewed until 12 weeks post-operatively. The width of KG was evaluated at baseline and at the end of 12 weeks after surgery. Paired *t*-test was performed to evaluate the changes in the width of KG at baseline and at 12 weeks post-operatively. In addition, soft-tissue esthetic outcome was assessed by using visual analog scale (VAS). **Results:** The mean width of KG at baseline was 1.47 mm and 12 weeks post-operatively was 5.42 mm. The gain in KG from baseline was 3.95 mm with the *P* value of 0.000, which was highly statistically significant. The assessment of esthetic outcome using VAS gave an average score of 7.1 indicating good esthetics. **Conclusion:** The technique of APF yielded a significant improvement in keratinized tissue, which is both functionally and esthetically acceptable.

Keywords: Dental esthetics, dental implants, flap, gingiva

Introduction

Dental implant has been a successful treatment modality in the management of edentulous patients. Success of osseointegrated implants is predominantly based upon patient selection, conservation of hard and soft-tissues along with following proper surgical techniques and prosthetic protocols. The presence of healthy peri-implant soft-tissue to provide an optimal seal between the oral environment and the implant with its associated super structure plays a crucial role in long-term success of dental implants.[1] The protective barriers for an osseointegrated implant are compromised due to the presence of parallel arrangement of gingival connective tissue fibers resulting in a weak peri-implant mucosal seal.

Controversies exist in the scientific literature regarding the relationship between the adequacy of the keratinized mucosa and the health of peri-implant tissues. Lang and Loe established that a minimum of 2 mm of keratinized gingiva (KG) is required to maintain gingival health regardless of the patient's oral hygiene.[2] However, according to de Trey and Bernimoulin, the width of attached gingiva is not the only determining factor for implant survival.[3] Factors like the patient's age, oral hygiene maintenance, esthetic considerations and patient's expectations, should also be taken into consideration.[4] Several experimental studies (Wennström *et al*., Mericske-Stern *et al*., Adell *et al*., Lekholm *et al*., Schou *et al*.) have suggested that there is no correlation between implant success rate and the presence of peri-implant keratinized soft-tissue as long as plaque control is maintained.[5-9] On the other hand, studies by Buser, Schroeder *et al*., and Kirsch and Ackermann have reported that keratinized mucosa around the abutments is an important requisite for peri-implant health,[10-12] presence of an adequate amount of KG around to the implant reduces gingival inflammation[13] and hyperplasia[14] and minimizes marginal peri-implant gingival tissues retraction.[7,14,15]

Though implant survival rate is not merely dependent on the width of keratinized tissues, in areas of esthetic concern and difficulties in plaque control the presence or

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The Significance of Keratinized Mucosa on Implant Health: A Systematic Review

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Aims: Whether a wide width of keratinized mucosa (KM) is required to maintain peri-implant tissue health has been a topic of interest. This systematic review and meta-analyses aimed to investigate the effect of keratinized mucosa on various peri-implant health related parameters.

Material and Methods: An electronic search of 5 databases (1965-2012 Oct) and a hand search of peer-reviewed journals for relevant articles were performed. Human cross-sectional or longitudinal studies with data on relationship between the amount of KM around dental implants and various peri-implant parameters, with a follow-up period of at least 6 months were included.

Results: Eleven studies, 7 cross-sectional and 4 longitudinal studies, were included. Weighted mean difference (WMD) and confidence interval (CI) were calculated and meta-analyses were performed for each clinical parameter. The results showed statistically significant differences in plaque index and modified plaque index (WMD= -0.27, 95% CI= -0.43 to -0.11), modified gingival index (WMD= -0.48, 95% CI= -0.70 to -0.27), mucosal recession (WMD= -0.60 mm, 95% CI= -0.85 mm to -0.36 mm), and loss of attachment (WMD= -0.35 mm, 95% CI= -0.65 mm to -0.06 mm), all favoring implants with wide KM. However, comparisons of other parameters (bleeding on probing, modified bleeding index, gingival index, probing pocket depth and radiographic bone loss) did not reach statistically significant differences. The result of heterogeneity test showed only one parameter (loss of attachment, p value for the chi-square test= 0.30 and I^2 test= 18%) had a low degree of heterogeneity among analyzed studies; meta-analyses of other parameters presented moderate to high degree of heterogeneity. Limitations of the present review included limited number of selected studies (N=11), few longitudinal prospective studies analyzed, existence of heterogeneity and publication bias, and only English-written articles searched.

Conclusions: Based on current available evidence, a lack of adequate KM around endosseous dental implants is associated with more plaque accumulation, tissue inflammation, mucosal recession as well as loss of attachment.

KEY WORDS:

dental implants, dental implantation, gingival recession, gingiva, peri-implantitis, systematic review

The width of keratinized mucosa (KM) around natural teeth is defined as the distance between the mucogingival junction and the free gingival margin. Whether it is required to maintain periodontal health has been a topic of interest. Clinically, a narrow band of KM is often observed together with gingival recession and inflamed periodontium, giving an impression that a certain amount of KM might be necessary for periodontal stability. Lang and Löe[1] reported that even with supervised oral hygiene, all sites without 2 mm of KM showed clinical signs of inflammation and 80 % of sites with > 2 mm of KM remained healthy; therefore, they concluded that 2 mm of KM is needed to maintain the health of periodontal tissues. However, a cross-sectional study[2] showed a similar degree of plaque accumulation and gingival inflammation, regardless of the width of KM. Subsequent studies[3-

CLINICAL ORAL IMPLANTS RESEARCH

Jan L. Wennström
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Is there a need for keratinized mucosa around implants to maintain health and tissue stability?

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Key words: attached mucosa, dental implants, keratinized mucosa, peri-implant disease, peri-implant soft tissue, soft-tissue recession

Abstract

Aim: The objective of the present review was to analyze the literature with regard to the need for keratinized mucosa around implants to maintain health and tissue stability.

Methods: Human and animal studies were identified through electronic and hand searches. Predetermined outcome measures were (i) implant loss, (ii) peri-implant health, (iii) oral hygiene, (iv) soft-tissue recession, (v) change in marginal bone level, and (vi) patient-centered outcomes. With respect to outcome variables, change in "attachment level", soft-tissue recession and change in peri-implant bone level were only retrieved from longitudinal studies. For remaining parameters, cross-sectional studies were also considered.

Results: Nineteen relevant publications were identified (17 human and 2 animal studies). Due to marked heterogeneity in study design and reported data, no statistical analysis of retrieved data was feasible. Twelve human studies reported plaque scores for sites with "adequate" ($\geq$2 mm) and "inadequate" (<2 mm) width of keratinized mucosa, and in five studies, an "inadequate" width was associated with a significant higher plaque score. Half of the studies showed significantly higher bleeding scores at implants with < 2 mm of keratinized mucosa, while the majority of publications (8 of 10) found no differences for probing depths. Two of three longitudinal studies reporting on recessions described no long-term differences with regard to the amount of keratinized mucosa. Evidence on the effect of keratinized mucosa on bone-level changes or implant loss was scarce, and no conclusions could be drawn. No article reporting patient-centered outcomes could be identified.

Conclusion: Collectively, the findings of this review show that evidence in support of the need for keratinized tissues around implants to maintain health and tissue stability is limited.

The soft-tissue healing following implant placement/abutment connection surgery may result in the establishment of a border tissue composed of either masticatory (keratinized) mucosa or lining (non-keratinized) mucosa. The type of mucosa facing the implant surface is determined by the faciolingual extension of the masticatory mucosa in the area of the alveolar process, which in turn is related to the "genetically defined" position of the mucogingival line and the degree of resorption of the alveolar process. A reduced height of the alveolar process, due to crestal bone resorption, will result in loss of keratinized mucosa due to the reduced distance between the mucogingival line and the bone crest, as indicated by data reported by Mericske-Stern et al. (1994).

The *masticatory mucosa* consists of dense, collagen-rich connective tissue lined by a keratinizing epithelium. No free elastic fibers are found in the connective tissue, and the lamina propria is firmly and directly attached to the periosteum of the bone (Ten Cate 1994). The *lining mucosa*, on the other hand, has a structural composition that allows the soft tissue to adapt to muscle tension. The lamina propria of the lining mucosa is comparatively collagen-poor, but contains a large number of elastic fibers, and is covered by a non-keratinized epithelium. Its submucosa is attached to muscles and to the periosteum of the underlying bone by collagen and elastic fibers (Ten Cate 1994).

Whether or not presence or a certain zone of keratinized mucosa is required around dental implants to maintain peri-implant health has been a controversial issue. It was claimed (e.g. Brånemark 1985; Ten Cate 1985; Berglundh 1993) that the maintenance of stability

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Width of keratinized gingiva and the health status of the supporting tissues around dental implants

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Abstract

Purpose: This cross-sectional study was performed to determine whether an association exists between the width of keratinized mucosa and the health of implant-supporting tissues.

Materials and methods: Data on 200 dental implants were collected. Periodontal parameters measured included Plaque Index, Gingival Index, width of keratinized mucosa, thickness of keratinized mucosa, radiographic bone level, and bleeding on probing. Statistical analysis was accomplished with the t test, Wilcoxon rank sum test, and logistic and linear regression models. Significance was established when P was less than .05.

Results: The mean Gingival Index score, Plaque Index score, and radiographic bone loss were significantly higher for those implants with a narrow zone (< 2 mm) of keratinized mucosa. Implants with a narrow zone of keratinized mucosa also were more likely to bleed upon probing, even after adjusting for Plaque Index, smoking, thickness of the gingiva, and time since implant placement (adjusted odds ratio, 2.37; 95% confidence interval, 1.04 to 5.83). Significant independent association also was found between the width of keratinized mucosa and radiographic bone loss in

Case Report

JPIS Journal of Periodontal & Implant Science

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A simple approach to preserve keratinized mucosa around implants using a pre-fabricated implant-retained stent: a report of two cases

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Purpose: There is no consensus regarding the relationship between the width of keratinized mucosa and the health of peri-implant tissues, but clinicians prefer to provide enough keratinized mucosa around dental implants for long-term implant maintenance. An apically positioned flap during second stage implant surgery is the chosen method of widening the keratinized zone in simple procedures. However, the routine suture techniques used with this method tend to apply tension over the provisional abutments and decrease pre-existing keratinized mucosa. To overcome this shortcoming, a pre-fabricated implant-retained stent was designed to apply vertical pressure on the labial flap and stabilize it in a bucco-apical direction to create a wide keratinized mucous zone.
Methods: During second stage implant surgery, an apically displaced, partial thickness flap with a lingualized incision was retracted. A pre-fabricated stent was clipped over the abutments after connecting to the provisional abutment. Vertical pressure was applied to displace the labial flap. No suture was required and the stent was removed after 10 days.
Results: A clinically relevant amount of keratinized mucosa was achieved around the dental implants. Buccally displaced keratinized mucosa was firmly attached to the underlying periosteum. A slight shrinkage of the keratinized zone was noted after the healing period in one patient, but no discomfort during oral hygiene was reported. Clinically healthy gingiva with enough keratinized mucosa was achieved in both patients.
Conclusions: The proposed technique is a simple and time-effective technique for preserving and providing keratinized tissue around dental implants

Keywords: Dental esthetics, Dental implants, Gingiva.

INTRODUCTION

The significance of keratinized tissue in implant maintenance is a controversial issue, and there is a lack of consensus in the literature regarding the relationship between the width of the keratinized mucosa and the health of peri-implant tissues. Several authors have claimed that there is no correlation between implant success rate and the presence of keratinized tissue in the peri-implant soft tissue [1-3]. On the other hand, some studies have reported that the presence of an adequate band of keratinized tissue adjacent to the implant reduces inflammation [4,5], hyperplasia [5], and retraction of the marginal peri-implant soft tissues [1,5,6]. Despite the fact that a lack of keratinized tissues does not influence the long-

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Fu abutment stabilization technique (FAST): A simple technique for stabilization of apically repositioned flap (ARF) at second stage implant surgery

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Abstract

Peri-implant mucogingival surgery aims at improving esthetic, masticatory function and maintenance care of dental implants. Over the years, various techniques such as Subepithelial Connective Tissue Graft (CTG), Free Gingival Graft (FGG), Rotated Double-pedicle Flap(RDF), Apically Repositioned Flap(ARF) or using Acelluar Dermal Matrix have been introduced.

Mucogingival Graft and Surgery have been employed to increase width and/or thickness of attached gingiva around dental implants; however, these added time and expense for the expecting results and many of them are technically demanding. Some of these techniques require special equipment or materials, complicated procedure and long learning curve. Undesirable complications for unexperienced clinicians might occur. Improvement of this technique is desirable. In order to overcome some of these difficulties, Fu Abutment Stabilization Technique (FAST) is introduced in this article to achieve the predictable results. This method does not need special equipment and materials and can be applied to all implant systems and different stages of implantation. Most importantly, it is simple and minimal-invasive and predictable. This method is expected to be the routine method of increasing attached gingiva at second stage implant surgery in the future.

Introduction

Dental implants have become widely accepted and utilized in dental oral rehabilitations by clinicians worldwide over the past two decades [1-6]. Implant treatments have shown endosseous dental implants to be a viable option for the restoration of missing teeth [7,8]. In contrast, based on the Consensus Report of the Sixth European Workshop in Periodontology, Lindhe & Meyle reported an incidence of mucositis of up to 80% and of peri-implantitis between 28% and 56% [9]. The prevention and management of peri-implant disease has become a more and more important issue in implant dentistry. Nowadays, there is no consensus regarding the relationship between the dimensions of keratinized mucosa (KM) and the health of peri-implant tissues, but some clinicians prefer to provide enough keratinized mucosa for long-term maintenance of soft tissue around dental implant [10-13]. Wennström, *et al.* [14] reported that lacking attached gingiva around implants also resulted in the failure of implants. In the presence of attached gingiva around implants, it can help patients to maintain good oral hygiene, prevent recession of marginal tissue and spread of inflammation by providing tight collar around dental implants. Recent studies showed that mucosal inflammation and plaque accumulation were significantly higher around dental implants with width of KM<2 mm [15]. There was a negative correlation between KM and mucosal recession. An increased width of KM is also associated with lower mean alveolar bone loss [16]. Regarding with thickness of mucosa, Zigdon and Machtei showed that a thick mucosa (≥1 mm) was associated with lesser mucosal recession compared with a thin mucosa (<1 mm) [17]. In the recent treatment of peri-implantitis, if nonsurgical treatment is unsuccessful, surgical approach in reducing the pockets around the affected implants has been advocated in order to enhance self-performed oral hygiene [18]. The presence of adequate attached gingiva and the elimination of peri-implant pockets around dental implants are both important for healthy condition of peri-implant tissues.

Peri-implant mucogingival surgery aims at improving esthetic, masticatory function and self-maintenance care of dental implants. Manipulation of soft tissue around dental implants enables proper peri-implant tissue healing and can result in soft tissue architecture in healthy condition. During the past decade, various techniques such as Subepithelial Connective Tissue Graft (CTG), Free Gingival Graft (FGG), Rotated Double-pedicle Flap (RDF), Apical Repositional Flap (ARF) or the application of Acelluar Dermal Matrix have been introduced, all these methods are categorized as mucogingival surgery by which we are able to manipulate and improve the soft tissue architecture around the implant [19-23].

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Key words: *attached gingiva, dental implant, peri-implant disease, peri-implant surgery, mucogingival surgery, minimal-invasive, second stage implant surgery, apically repositioned flap*

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Case Report

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Clinical evaluation of a collagen matrix to enhance the width of keratinized gingiva around dental implants

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Purpose: The purpose of this study was to evaluate the effect of collagen matrix with apically positioned flap (APF) on the width of keratinized gingiva, comparing to the results of APF only and APF combined with free gingival graft (FGG) at the second implant surgery.

Methods: Nine patients were selected from those who had received treatments at the Department of Periodontics, Chosun University Dental Hospital, Gwangju, Korea. We performed APF, APF combined with FGG, and APF combined with collagen matrix coverage respectively. Clinical evaluation of keratinized gingival was performed by measuring the distance from the gingival crest to the mucogingival junction at the mid-buccal point, using a periodontal probe before and after the surgery.

Results: The ratio of an increase was 0.3, 0.6, and 0.6 for the three subjects in the APF cases, 3, 5, and 7 for the three in the APF combined with FGG case, and 1.5, 0.5, and 3 for the three in the APF combined with collagen matrix coverage case.

Conclusions: This study suggests that the collagen matrix when used as a soft tissue substitute with the aim of increasing the width of keratinized tissue or mucosa, was as effective and predictable as the FGG.

Keywords: Collagen, Dental implantation, Gingiva.

INTRODUCTION

The purposes of soft tissue management around dental implants are successful primary closure, papillary reconstruction, gain of keratinized tissue and preservation of ridge contour. Keratinized tissue is a specialized mucosa covered with keratin or parakeratin which includes the free and attached gingiva and extends from the gingival margin to the mucogingival junction. However, The need and significance of keratinized tissue around dental implants is a controversial issue. Wennstrom et al. [1] reported that there is no clinical difference between teeth with and without adequate keratinized tissue and no association between the width of keratinized tissue and the presence of bleeding on probing. Bengazi et al. [2] reported that the width of keratinized tissue was a poor predictor for occurrence of soft tissue recession. The recession was primarily the result of a remodeling of the soft tissue for establishing appropriate biological dimensions. Albrektsson et al. [3] reported that dental implants may have a high survival rate, irrespective of keratinized conditions. Although the significance of keratinized tissue is still controversial, it is certain that the attached gingiva provides increased resistance of the periodontium to external injury, contributes to the stabilization of the gingival margin position, and aids in the dissipation of physiological forces that are exerted by the muscular fibers of the alveolar mucosa on the gingival tissues [4]. Despite the observation that the lack of keratinized tissue does not influence long term implant

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Apically positioned flap, free gingival graft and apically positioned flap with collagen matrix around dental implants: A randomized controlled trial.

Thesis submitted in partial fulfillment of the requirement for the degree of Master of Science

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Tufts University School of Dental Medicine

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June, 2014

Title: Widening keratinized tissue using modified free gingival graft

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ABSTRACT

Free gingival graft (FGG) is one of the most common and predictable methods for augmenting gingival tissue dimensions. FGG has some limitations because it requires an additional wound in the palatal area and its supply is limited by the amount of donor tissue. In this case report, the graft material was placed most apical way and the periosteum coronal to the graft was left exposed.

The grafted area healed uneventfully and the exposed periosteum was healed with keratinized tissue. There was an average of 44.4% vertical graft shrinkage and horizontal shrinkage was 26.7% at six months after surgery. This method can obtain more keratinized tissue from less donor tissue.

Keywords: dental implants; connective tissue; mouth mucosa; oral health

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Free gingival grafts for implants exhibiting lack of keratinized mucosa: A prospective controlled randomized clinical study

Running Title: Keratinized Mucosa Augmentation

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CASE REPORT

Free Gingival Grafting to Increase the Zone of Keratinized Tissue around Implants

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ABSTRACT

Purpose: The importance of an adequate width of attached gingiva around periodontally affected teeth has been well-documented. However, there is no consensus regarding the relationship between the width of keratinized tissue and the health of peri-implant tissues. Clinicians in general prefer to provide enough keratinized mucosa around dental implants for long-term implant maintenance. There are various methods of increasing the width of keratinized tissue around implants at various stages of treatment. This article aims at presenting a case report where free gingival grafting was done prior to implant placement to predictably increase the width of keratinized tissue and thus enhance the long-term success of the implants.

Methods: Free gingival grafting was done in the edentulous region prior to implant placement to increase the width of keratinized tissue at the future implant sites. Two implants were then placed to replace the missing teeth.

Results: Free gingival grafting resulted in an increase in the keratinized tissue at the implant sites and also favorably increased the vestibule depth. Clinically healthy keratinized tissue was achieved and maintained around both implants. The patient was able to adequately maintain oral hygiene, with no discomfort.

Conclusion: The free gingival graft can be used to increase the width of keratinized tissue and increase the depth of the vestibule around implants, thus favoring their long-term prognosis.

Keywords: Free gingival grafting, Dental implants, Keratinized tissue.

INTRODUCTION

The significance of keratinized tissue in implant maintenance has been a controversial issue, and there is a lack of consensus in the literature regarding the relationship between the width of the keratinized mucosa and the health of peri-implant tissues. Several authors have claimed that there is no correlation between implant success rate and the presence of keratinized tissue in the peri-implant soft tissue.[1-3] On the other hand, there are studies which suggest that the presence of an adequate band of keratinized tissue adjacent to the implant reduces inflammation,[4] hyperplasia[5] and recession of the marginal peri-implant soft tissues.[6]

Despite of the conflicting views that exist on the subject, it is believed that the presence or reconstruction of keratinized tissue around implants may help facilitate restorative procedures, improve esthetics and enable the patient to maintain adequate oral hygiene without irritation or discomfort.[7-9] The lack of keratinized tissue can be more apparent and pose certain difficulties, especially in patients where significant ridge resorption has taken place.[10] Therefore, clinicians usually seek methods to maintain or increase the width of keratinized tissue around implants, whenever possible.

Various methods have been proposed for obtaining adequate amounts of keratinized tissue, depending on the technique and patients need. These can either be performed before implant placement, at the time of implant placement or at the time of second stage implant surgery. Apically positioned flaps, laterally positioned flaps, free gingival grafts or connective tissue grafts are some of the more commonly used methods for increasing the zone of keratinized tissue around implants.[11,12] In shallow vestibules with minimal keratinized tissue, the use of a free gingival graft can help increase both the width of keratinized tissue and the depth of the vestibule.[13]

Presented here is a case report, where the free gingival graft technique was used to increase the width of keratinized tissue prior to implant placement.

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Case Report

Free Gingival Grafting Before Implant Placement In A Geriatric Patient : A Case Report

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Abstract

Geriatric patients generally suffer from edentulism or partial edentulism, and those without a dental prosthesis can experience siginificant health issues, mostly due to inadequate nutrition. There are various techniques for rehabilitation of total or partial edentulism. Implant-supported overdentures have become an effective treatment alternative for edentulous patient. In this case report, a free gingival graft technique was used to increase the width of keratinized tissue before implant placement to improve long-term implant-supported prosthesis prognosis in a geriatric patient.

Keywords: Gingiva; Dental implantation; Dental Implants; Maintenance; Dental Prosthesis; Implant-Supported

Introduction

In years of 2000, there were approximately 600 million geriatrics in the world, and that number is increasing due to advances in medical science [1]. In recent years, geriatrics have become more susceptible to chronic illnesses such as cancer, diabetes mellitus, and oral diseases [2]. Among oral diseases, periodontal disease is the most prevalent among geriatrics [3]. There may be several possible causes of this. First, a decrease in hand flexibility of geriatric patients often causes a decline in oral hygiene , which can contribute to periodontal disease. Second, they often experience a compromised immune system, which can also contribute to periodontal disease [4]. Oral status directly affects general health. Geriatric patients generally have edentulism or partial edentulism, and those without a dental prosthesis can experience siginificant health issues, mostly due to inadequate nutrition [5].

There are various techniques for rehabilitation of total or partial edentulism. Implant-supported overdentures have become an effective treatment alternative for edentulous patient [6]. The success and maintenance of implant rehabilitation depends on many factors. The amount of keratinized tissue (KT) around implants may be important for peri-implant tissue health. A recent systematic review concluded that lack of adequate KT around dental implants is associated with more plaque accumulation, tissue inflammation, mucosal recession, and attachment loss [7]. A complete absence of KT, especially with non-optimal oral hygiene status, may negatively influence the long-term maintenance of restored teeth and/or dental implants.

Various methods have been described for increasing KT width around the implants [8-11]. In the presence of both shallow vestibules and inadequate KT, free gingival graft (FGG) can be performed successfully [12]. This procedure can be done either before, after, or at the time of implant placement [13].

In this case report, a FGG technique was used to increase the width of KT before implant placement to improve long-term prognosis of the implant-supported overdenture in a geriatric patient.

Case Presentation

A 73-year-old female patient who was edentulous for approximately 20 years received a total prosthesis at Erciyes University, Faculty of Dentistry, Department of Prosthodontics. She did not have any medical problems and was not taking any medication. Two implants with ball attachments supporting the overdenture were planned, and the patient was referred to the Department of Periodontology. After a clinical examination, a lack of KT, a shallow vestibular sulcus, and alveolar bone loss on the mandibular anterior region were determined (Figure 1 and 2). A preoperative cone-beam computed tomography (CBCT) scan was conducted to examine the bone before deciding on periodontal plastic surgery. The CBCT images revealed that bone length and size were suitable for implants. A bilaterally FGG was

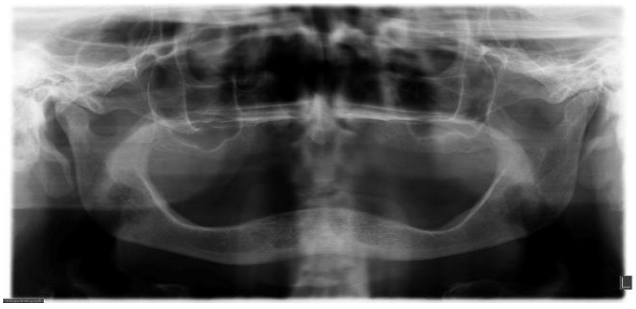

Figure 1: Panoramic radiograph before treatment.

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Modified Roll Palatal Flap Technique in Aesthetic Zone. Stability of Results After 4 years

M. Guglielmi: Case western University, MetroHealth, M. R. Zetz, F. A. Quereshy

A case of oligodontia with several congenitally missing teeth is presented. Implant therapy using modification of Abrams's roll technique was used to correct the localized alveolar ridge deficiency on #7 and #10 areas. A crown was used to immediately provisionalize the implants after flap elevation.

Abrams was the first to describe the ''roll'' technique in 1980. According to this method, a deepithelialized palatal flap was dissected and a pedicle was displaced toward the buccal aspect of the implant site. The connective tissue pedicle was then rolled below the buccal flap in the area of the deformity, in order to correct buccolingual ridge defects.

CLINICAL RESEARCH – PERI-IMPLANT BIOLOGY

The palatal roll technique – A case series

Filipe Cortesao

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Background: The importance of soft tissue thickness and keratinized mucosa width around implant supported rehabilitations is well documented. In the areas which lack these conditions, connective tissue grafts have proven to be the gold standard. The palatal roll is a classical technique that has the advantage of providing pediculate grafts in the areas to enhance, making it a predictable source for soft tissue increase in the canine, premolar and molar area.

Aim/Hypothesis: This case series is focused on reviewing the palatal roll technique as a predictable source for soft tissue thickness and keratinized mucosa width around implant supported rehabilitations in the posterior region of the maxilla.

Material and Methods: Ten patients (seven women, three men) in need of soft tissue volume increase in the areas between the canine, premolar or molar sites were selected. Digital reverse planning with CT scan analysis was performed prior to surgery in all cases, to assure that the correct rehabilitation could be performed without the need for bone augmentation procedures. Sixteen dental implants (Biotech Dental ©, Salon de Provence, France) were placed and rehabilitated as follows- twelve single implant crowns and two implant supported bridges. A palatal roll technique was performed as described by Abrams in 1980 either at implant placement or at second stage surgery. Assessment of tissue volume and keratinized mucosa width changes was performed through the comparison of patronized pictures taken before surgery and after rehabilitation phases.

Results: A significant increase in the total width of soft tissue was observed in all cases. Enough keratinized mucosa width was found around all the rehabilitations in the buccal side. None of the cases required additional surgical procedures to supply peri-implant soft tissue health. These results remained stable in follow-ups performed in a period ranging between 3 and 36 months after rehabilitation

Conclusion and Clinical Implications: As previously stated by other authors and within the limitations of this case series, it can be suggested that the usage of a palatal roll technique in the maxillary canine, premolar and molar area is a predictable source for soft tissue thickness and keratinized mucosa. Furthermore, these results seem to remain stable overtime, providing conditions for successful implant related treatments.

CLINICAL ORAL IMPLANTS RESEARCH

Mario Roccuzzo
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Surgical treatment of buccal soft tissue recessions around single implants: 1-year results from a prospective pilot study

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Key words: dehiscence, dental implants, keratinized mucosa, maintenance, mucogingival surgery, peri-implant mucosa, peri-implant tissues, recession, surgical coverage

Abstract

Aim: The aim of this study was to evaluate the outcome of a soft tissue dehiscence coverage technique, at single non-submerged implant sites, presenting shallow isolated buccal mucosal recession.

Material and Methods: Sixteen patients were included in this prospective study. A connective tissue graft (CTG) was harvested from the maxillary tuberosity. The donor soft tissue was de-epithelialized and trimmed with a mucotome for an optimal adaptation to the collar of the implant.

Results: Surgery and healing proceeded with no complications and minimal post-operative discomfort. One-year follow-up demonstrated clinical and esthetic improvements. Treatment resulted in 89.6 $\pm$ 13.1% mean coverage, and complete implant soft tissue coverage was achieved in nine of 16 cases, corresponding to a 56.3%. The VAS esthetic analysis showed a significant improvement from 3.6 $\pm$ 0.2 to 8.5 $\pm$ 0.3.

Conclusions: These positive preliminary results suggest that, by means of the surgical technique presented, buccal soft tissue dehiscences around single implants can be successfully treated. Additional Randomized controlled trials (RCTs) should be encouraged to assess the most effective variation to the technique in the various clinical situations and around implants of different designs.

Over the years, implant therapy has become a common practice to replace lost or irreversibly damaged teeth and will probably gain in popularity during the near future. At the same time, esthetic demands have tremendously increased, especially if anterior teeth have to be replaced in patients with a high lip line.

From an esthetic point of view, the gray color of titanium may create a major problem, even after successful osseointegration, when becoming visible due to peri-implant soft tissue recession (Marinello et al. 1997; Glauser et al. 2004; Kohal et al. 2008). Even though soft tissue dehiscences around implants have been observed in the last years, the prevalence of this condition is not known (Bengazi et al. 1996).

Oates et al. (2002) reported the long-term changes in the position of the facial soft tissue margins following restoration of 106 one-stage ITI implants in 39 patients, in both maxillary and mandibular anterior regions. After 2 years, a $\geq$1 mm mid-facial soft tissue recession was present in 61% of the cases. Of the 39 patients assessed, 24 showed a loss of 1 mm or more of the soft tissue levels around the implants. The authors suggested that the potential for significant changes in soft tissue levels, after completion of restorative therapy, should be considered in esthetic areas. It must be noted that the risk of soft tissue recession may be higher for implants placed in fresh extraction sockets with both a submerged and non-submerged approach as found by Cordaro et al. (2009).

Unlike teeth where a minimal recession of 1–2 mm does not always produce esthetic discomfort, even a minimal amount of titanium exposure can jeopardize the overall treatment, as it may be unacceptable by the patient. Ideally, clinicians should select the technique for treating these situations, on

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Resubmergence technique for the management of soft tissue recession around an implant: case report

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Affiliations + expand

PMID: 20209203

Abstract

Implant restoration in the anterior maxilla is a true challenge for clinicians. Facial tissue recession around the implant prosthesis is one of most difficult situations to correct. This report details the treatment of a female patient who presented with a root fracture of the maxillary left central incisor and crossbite of the left canines. The treatment protocol included implant placement and subsequent orthodontic treatment to correct the crossbite, with the implant used as adjunctive anchorage. However, labial tissue recession around the implant restoration occurred following orthodontic therapy. A resubmerged implant technique with connective tissue grafting for implant coverage was employed. The implant was uncovered again 2 months after the resubmergence treatment and the definitive prosthesis was delivered later. The resulting esthetic defect was restored and a 3-year postgrafting follow-up examination revealed that there was no further marginal tissue recession of the implant restoration. A harmonious soft tissue margin was achieved in the anterior esthetic region.

Soft Tissue Preservation and Pink Aesthetics around Single Immediate Implant Restorations: A 1-Year Prospective Study

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ABSTRACT

Purpose: (1) To document soft tissue aspects using a specific protocol for immediate implant treatment (IIT) following single-tooth removal; (2) to evaluate whether this protocol allows preservation of pink aesthetics as objectively assessed.

Materials and Methods: Patients with a thick gingival biotype and intact buccal bone wall upon extraction of a single tooth in the aesthetic zone (15–25) were consecutively treated. The protocol included flapless extraction and implant surgery, socket grafting, immediate nonocclusal loading with a screw-retained provisional crown, and replacement by a permanent crown 6 months thereafter. The outcome was assessed after 3, 6, and 12 months. Cases demonstrating major alveolar process remodeling and/or advanced midfacial recession (>1 mm) at 3 months were additionally treated with a connective tissue graft (CTG). The emergence profile of the provisional crown was replicated for all permanent crowns.

Results: Twenty-two patients (12 men, 10 women; mean age 50) were treated after tooth extraction for nonperiodontal reasons using a novel bone condensing implant with variable-thread design, conical connection, and platform switch (NobelActive®, Nobel Biocare, Göteborg, Sweden). One implant failed and mean marginal bone loss was 0.1 mm ($p = .059$). Temporary mesial papilla reduction occurred, whereas distal papilla reduction was permanent (mean 0.5 mm; $p = .001$). At 3 months, five cases demonstrated major alveolar process remodeling and two advanced midfacial recession. Hence, slight initial decline in the pink esthetic score (PES) ($p = .053$) was observed. CTG resulted in a steady improvement of the PES after 3 months ($p \leq .037$). At 12 months, pink aesthetics (mean PES 12.15) was comparable to the preoperative status (mean PES 11.86; $p = .293$). Distal papillae had significantly deteriorated ($p = .020$) in this time span, whereas midfacial contour had significantly improved ($p = .005$).

Conclusions: Preservation of pink aesthetics is possible following IIT. However, to achieve that, CTG may be necessary in about one-third of the patients. Major alveolar process remodeling is the main reason for additional treatment.

KEY WORDS: dental implant, immediate, maxilla, pink esthetic score, single tooth, white esthetic score

INTRODUCTION

Immediate implant treatment (IIT) has become an alluring concept in contemporary practice for obvious reasons of instant reestablishment of function and aesthetics. However, proper risk assessment addressing diagnostic, surgical, and restorative aspects seems mandatory to avoid advanced midfacial recession. Crucial inclusion criteria for a predictable outcome comprise an intact buccal bone wall[1] and a thick gingival biotype.[2,3] Equally important may be a correct three-dimensional implant positioning, which may be hampered by the alveolar socket. Therefore, IIT requires highly

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