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

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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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Methodology of the Literature Review

The abovementioned keywords were searched for in the following databases: Pubmed, Timbó, Scielo and the Virtual Health Library.

Introduction

Esthetics is one of the most frequent reasons why patients seek consultation in the areas of implant dentistry and periodontics (2-6). Clinicians have become concerned about the management of peri-implant and periodontal hard and soft tissue (7). The esthetic zone is defined as the area delimited by the lip perimeter (7). Restorative and esthetic dentistry requires a comprehensive approach: the first step of any treatment plan must be basic therapy (8, 9).

Periodontal plastic surgery is defined as the plastic surgical procedures designed to correct defects in morphology, position, and/or amount of gingiva surrounding the teeth (2). This definition also applies to peri-implant tissue management. Some indications: esthetic concerns, cases where dental plaque is difficult to control in the recession area, prior to orthodontic treatment in cases where movement can entail risk of recession, and prior to rehabilitation in areas without attached gingiva (4). We now have the concept of evidence-based periodontal plastic surgery, which is defined as the "systematic evaluation of clinically significant scientific evidence intended to investigate the esthetic and functional effects of treatment of defects of the gingiva, alveolar mucosa, and bone, based on clinician's knowledge and patient's centered outcomes, such as perception of esthetic conditions, functional limitations, pain/discomfort, root sensitivity, level of sociability post-surgery, and preferences" (10). Many times there are differences between the esthetic perceptions of dentists and patients (11).

Definition, etiology, gingival and peri-implant recession classification

Gingival recession is the exposure of root surfaces due to apical migration of the gingival tissue margins; the gingival margin migrates apical to the cementoenamel junction (CEJ) (12). It can appear in its localized or generalized form (13).

It is even frequent in developed countries with very effective dental plaque control (14). There is no epidemiological data regarding peri-implant recession. Regarding its etiology, its causes can be divided into predisposing factors and precipitating factors (15).

Predisposing factors: Narrow band of attached gingiva (narrow band of attached mucosa), high frenum attachment, tooth malposition (implant malposition), dentoskeletal disharmony, bone dehiscences and fenestrations, periodontal biotype.

Thin periodontal biotypes are a predisposing factor for gingival or peri-implant recession (16, 17) and condition the results of any plastic surgery, be it periodontal or periimplant (8, 16).

An implant placed in these patients may develop recession and color changes (18).

Periodontal biotype and the integrity of bone structures are crucial when placing an implant in esthetic areas (19, 20), especially if it is placed immediately. The combination of connective tissue grafts and immediate placement has had excellent results, even on sites where the extracted tooth showed signs of recession and lack of attached gingiva (19-23).

Precipitating factors: Traumatic brushing, inflammatory disease of gingival-periodontal or peri-implant tissues (Gum disease because of plaque build-up, Periodontitis, Mucositis, Peri implantitis), orthodontic treatment and iatrogenesis (24).

Predisposing factors affect the position and stability of the gingival or mucosal margin

(in implants), and precipitating factors affect predisposing factors causing periodontal or periimplant recession. It is said that even with lack of attached gingiva/peri-implant mucosa on a patient with good dental plaque control, the gingiva can remain healthy (25, 26).

The most widely accepted classification of gingival recession is the one presented by Miller in 1985 (27). It is based on the most apical margin of the recession regarding the mucogingival junction, and on the amount of tissue loss (gingiva and bone) in interproximal areas adjacent to the recession site.

Dr. Preston Miller estimates the prognosis for each class: complete coverage in class I and class II, partial coverage in class III, and no root coverage in class IV, but he does suggest increasing the band of keratinized gingiva.

The size of papillae, the tooth type and the degree of proximal bone tissue loss can also affect the prognosis (9).

In 2011, Dr. Francesco Cairo put forward a new classification: R1- gingival recession with no loss of interproximal attachment; proximal cementoenamel junction (CEJ) was not detectable; R2- gingival recession associated with loss of interproximal attachment. The amount of proximal loss was less or equal to the vestibular loss, measured from the CEJ (proximal and vestibular) to the depth of the pocket; R3- the amount of proximal loss was higher than the vestibular loss, measured from the CEJ to the depth of the pocket). Level of proximal attachment is the main parameter in this classification. R1 is associated with healthy patients; R2 and R3 are associated with periodontal disease. It does not consider the amount of keratinized tissue (28).

Dr. Henry Salama's classification (1998) stresses the importance of proximal bone and the presence of peri-implant papillae to predict esthetic results (19, 20, 29).

Complete coverage is achieved when the gingival margin is placed at the same level as the cementoenamel junction, the gingival sulcus has a probing depth lower than 2 mm and when there is no bleeding on probing. This coverage can be achieved in a primary or secondary way. The latter is achieved through the coronal migration of the gingival margin in the months after the surgery (30).

Bone height and width are the main factors determining the height of soft tissue. Factors like dental morphology, location of point of contact and quality of soft tissue can affect its appearance (18-20). The greater the gingival recession, the smaller the chance of achieving complete root coverage (10).

Miller's class I recession has a better prognosis than class II recession (10).

Smoking has a crucial role in the potential percentage of root coverage (31).

Regardless of the periodontal plastic surgery technique used, they can all significantly improve the treated sites compared with the initial clinical parameters (10).

Peri-implant soft tissue is similar to periodontal tissue. It is formed by epithelium and a connective attachment parallel to the implant with tissue that is more fibrous and less vascularized than periodontal tissue (32). Peri-implant plastic surgery is indicated for the treatment of peri-implant recession, for increasing clinical attachment level, for increasing the length and width of the attached gingiva, and for gingival reconstruction.

Periodontal plastic surgery techniques can be applied in cases with no loss of interproximal tissue nor exposure of implant threads. This provides stability and esthetic results for the future rehabilitation process, improving tissue contour, increasing keratinized mucosa and the height of soft tissue to avoid food impaction and phonation problems (10, 16, 33, 34).

It is important to respect the 3-mm mesiodistal space between implants and the 1.5-mm space between implant and tooth to facili-

tate the development of papillae. Respecting the 2mm width of the vestibular bone table will prevent the loss of such table and also recession. In the apico-coronal direction, the implant must be placed at 2 mm in the apical direction towards the CEJ of the adjacent tooth (18, 35).
After treatment with connective tissue grafts, the periodontometer can penetrate between 1 and 2 mm into the sulcus. Healing is possible through the formation of a long junctional epithelium both on the tooth and the implant (10, 36).
All peri-implant plastic surgery procedures have a better prognosis if conducted before implant placement (34).

Evolution of mucogingival surgical techniques

As of 1900 there are indications of mucogingival surgical techniques, but more predictable techniques began to appear in the 50s.
The first treatments involved a sliding flap operation (37). According to the displacement direction they can be rotated flaps or coronally advanced flaps. The main limitation of these techniques is the need to have attached gingiva around the area to be treated (38). They are indicated mainly for the treatment of one tooth/implant. Their main advantages are technical ease and the esthetic results achieved.
Free grafts were indicated if there was no keratinized tissue (39). Their main disadvantages are the esthetic results and the management of the palatal area. It is a predictable technique to increase the width of the attached gingiva (40).
In 1974, Karring proved that the characteristics of epithelial tissue are genetically determined by the subjacent connective tissue, which justified the development of connective tissue graft techniques (41).
They were first described by Edel in 1974, popularized by Langer and Langer in 1985, and modified by several authors (42-49).
They were initially indicated to thicken keratinized gingiva, and are currently indicated for the coverage of gingival recession, the thickening of soft tissue in edentulous areas, the thickening of tissue surrounding implants or teeth, papilla reconstruction, scar correction and modification of periodontal or peri-implant biotype (50). Connective tissue grafts are considered the gold standard for root coverage given their predictability, stability over time, increase in thickness and length/width of keratinized gingiva (10, 51).
lIf this technique cannot be applied, a second choice might be coronally advanced flaps combined with allogenic or xenogeneic matrices. The last choice would be coronally advanced flaps or guided tissue regeneration (10, 51, 52).
As there is only limited literature available on plastic periodontal surgery in connection with implants, the results obtained on teeth should be used as a clinical guide for the treatment of peri-implant recession/mucosal defects. Selecting the right type of graft (size and shape) as well as complete root coverage achieved with the coronally advanced flap will enhance the final esthetic results (53).
Connective tissue grafts are an essential tool in periodontal and implant mucogingival surgery, both functionally and esthetically (54).
They are highly esthetic and predictable for root coverage: percentages of complete root coverage reach 89% (53).
There is partial root coverage in 80.94% of cases and complete root coverage in 46.63% of cases (51). The postoperative process is better with connective tissue grafts than with free graft techniques. The double blood sup-

ply to the graft increases its success rate (10, 55, 56).

There is a direct correlation between flap tension and reduced root coverage, and between tissue thickness and the percentage of coverage achieved: flaps more than 0.8 mm thick have a better prognosis (57, 58).

Different techniques have been proposed for the use of grafts: tunnel techniques (Raetzke,1985; Allen, 1994) (44, 45); reposition of the flap partially covering a connective graft with an epithelial border (Langer, B; Langer, L.) (43); coronally advanced flaps with vertical releasing incisions (Nelson, S.; Wennstrom, J.) (46, 47); or without them (Bruno, J.) (48); or lateral sliding papillae flaps (Harris, R.) (49).

In all techniques, graft size is greater than bone dehiscence and the graft is placed and sutured at CEJ level (53).

Connective tissue grafts with epithelial border were used by Langer and Langer (1985), Allen (1994) and Raetzke (1985) (43-45). Connective tissue grafts have an exposed section in the techniques described by Nelson (1987), Bruno (1994), Wennstrom and Zuchelli (1996) (46-48). The exposed root is usually treated with curettes (53).

In the past, mucoperiosteal flaps were used on the recipient site, but nowadays mucosal grafts are preferred as they allow for greater graft mobility and coverage (59).

Donor sites

They are the palate, the inner side of the mucoperiosteal flap and/or an edentulous area (42).

Palate harvesting in the area between the canine and the first molar is the procedure of choice. It is there that the palatal mucosa is thickest, as it decreases towards the molar area. It increases from the gingival margin towards the palatal suture (60). The palatal mucosa is thickest with age and is thinner in women (60).

The thickness of the palatal mucosa and the height of the palatal vault are essential considerations when selecting a graft harvesting technique (60).

The harvesting of an epithelial-connective graft is recommended in the case of thin palates. Once the graft has been harvested, the epithelium is eliminated, the graft is repositioned at the donor site, sutured, and surgical cement is applied. This makes it possible to obtain the graft more superficially, hence avoiding complications in patients with thin biotypes. Replacing the epithelialized graft promotes faster healing (60). The references to consider are the palatal rugae (anterior area), the palatal root of the first molar (posterior area) and the neurovascular bundle coming from the greater palatine foramen (medially).

Regarding the shape of the palate and the position of the palatine artery, Reiser et al. (1996) identified three possible palatal vaults: shallow, average and high. According to this classification, depending on the size of the arch, the neurovascular bundle is located at 7 mm, 12 mm or 17 mm from the adjacent tooth (54). Hemorrhaging can be avoided by respecting this structure.

Several types of incision provide access to the connective tissue.

The initial critical factor is whether we will obtain a graft with or without epithelial border. At first this border was included to provide a better transition with the existing epithelial border when treating gingival recession (43). But later it was noted that if the epithelium was maintained, the esthetic outcome was not better, and that the final result depended mainly on the connective tissue graft. Both the natural appearance, shape and color of the new epithelium will depend on the subjacent connective tissue (41). Harvest-

ing the graft with an epithelial border hinders healing by first intention in the donor site, which leads to pain and potential postoperative bleeding. Acrylic plates and haemostatic drugs have been used to prevent such situations (43).

If the epithelial strip is not harvested with the graft, access can be achieved with one (singleincision technique), two (angular-incision technique) or three (trapdoor technique) incisions. If there are more incisions, the connective tissue can be better visualized, but the flap has lower vascularization which may lead to postoperative necrosis (42, 61, 62). The current trend is to harvest the graft with only one incision (63).

The single-incision technique has the following advantages: optimal vascularization of the cover flap, a small number of sutures, no need for additional haemostatic or compressive measures, a better postoperative process and the possibility of obtaining grafts of variable dimensions (59).

The palatal sliding flap technique is cited as an alternative to the conventional connective tissue graft. It has a better prognosis because the flap remains vascularized and is easier to stabilize. It is specially indicated when used jointly with bone grafts or membranes that make vascularization harder (64).

All these different techniques place have in common a connective tissue graft on the root surface to be covered and above it the flap, which provides partial or total coverage.

This can be achieved with suturing, but the possibility of using cyanoacrylate has been described with promising results (65).

The same technique would be used on implants with recession (59).

Post-treatment healing

By using connective tissue grafts or epithelial-connective grafts we can achieve the formation of a long junctional epithelium with a fibrous attachment (66, 67), although a few studies report variable degrees of regeneration (68-70). Only the areas where the cementum was preserved were able to form new cementum (70).

Periosteum cannot regenerate after it has been detached from the bone surface, therefore its presence does not seem to condition the type of healing the root surface will have (71-74). The mechanical trauma of detaching DE the periosteum from the bone destroys the cell layer called "cambium layer" in the periosteum. This layer has the potential for regeneration, hence the risk run by detaching it (59).

Case report 1

Male patient who attends the School of Dentistry of Udelar to seek treatment for retraction on teeth #23 and #24. It is a case of Miller Class I recession (figure 1).

Figure 1

Treatment plan:
1- Basic therapy adapting his oral hygiene habits to his specific situation (75).
2- Treatment of gingival recession using a connective tissue graft. A tunnel technique was chosen for the procedure. The graft was harvested through a single palatal incision (Figure 2) (33, 63).

Figure 2

Results 12 months post-treatment (Figure 3).

Figure 3

Case report 2

Male patient, 43, who attends a private clinic in Montevideo, Uruguay. He was referred to another professional to have tooth #22 replaced (figure 4).

Figure 4

As the gingival morphology was not the necessary one at that level, a connective tissue graft was placed when the implant was installed (76). Figure 5 shows the results 6 months posttreatment.

Figure 5

Conclusions

To achieve success it is essential to follow a diagnosis protocol strictly (29). Subepithelial connective tissue grafts are the gold standard in periodontal/peri-implant surgery.
Tissue replacement, vascular areas irrigating the tissue and its attachment are basic considerations (77). The need for periodontal/

peri-implant keratinized gingiva has been widely discussed, but this technique is more predictable if the tissue is stable (34, 78).

More literature is needed in the field of peri-implant plastic surgery, which will, in future, become a sub-specialization of implant dentistry (34). The lack of randomized controlled clinical trials on peri-implant plastic surgery is a limitation when it comes to making final conclusions, but the application of indications and results taken from periodontal surgery has proven viable from a clinical viewpoint (10).

Procedures where soft and hard tissue is managed have a better prognosis if conducted before implants are placed. These tissues are prepared both when placing the implant and in the rehabilitation process (7).

Minimally invasive harvesting techniques enable us to harvest grafts of various sizes, causing minimal trauma to the palate.

Science and technology are making progress in the field of cell cultures seeking to replace the connective tissue graft. Additionally, other alternatives have appeared, such as biomaterials, homografts (Alloderm) and heterografts (Mucograft), which show promising results, but such results are still not as interesting as the ones achieved with the use of connective tissue grafts (59, 79).

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References

1. Chambrone L, Chambrone D, Shibli J. Aplicación de Cirugía Plástica Periodontal en Implantología: Cirugía Plástica Peri-implantar. In: Implantología Clínica Basada en Evidencia Científica, ABROSS, 2012, Chapter 8, 227-243.
2. Miller PD. Regenerative and reconstructive periodontal plastic surgery. Mucogingival surgery. Dental Clinic of North America, 1988; 32: 287-306.
3. Blanco J, Villaverde G, Barbosa R. Tratamiento de las recesiones gingivales con injertos de tejido conectivo. Resultados tras cinco años de evolución. Avances en Periodoncia, 2000; 12(1): 35-42.
4. De Carvalho S, Ribeiro L, Coelho M. Solución estética para prótesis sobre implante. Full Dent Sci, 2012; 4(13): 112-115.
5. Magne P, Magne M, Belser U. Natural and restorative oral esthetics. Part I: Rationale and basic strategies for successful esthetic rehabilitations. J. Esthetic Dent. 1993; 5: 161-173.
6. Magne P, Magne M, Belser U. Natural and restorative oral esthetic. Part III: Fixed partial dentures. J. Esthetic Dent. 1994; 6: 15-22.
7. Saadoun, A. Periodontal implications in implant treatment planning for aesthetic results. Pract. Periodont Aesthet Dent, 1998; 10 (5): 655-664.
8. De Jesús Tavarez R, Santos A, Silva, A. Remodelación del contorno gingival como forma de optimizar el resultado estético de prótesis fijas anteriores. Full Dent. Sci, 2012; 4(13): 5-15.
9. Blanco J, Ramos I. Single Implant-Supported Restorations in the Anterior Maxilla. Int. J. Periodontics Restorative Dent, 2005; 25:149-155.
10. Chambrone L, Pannuti CM, Tu YK, Chambrone LA. Evidence-based periodontal plastic surgery. II. An individual data meta-analysis for evaluating factors in achieving complete root coverage. J Periodontol 2012; 83: 477-490.

11. Cooper G, Tredwin C, Cooper, N. The influence of maxillary central incisor height to width ratio on perceived smile aesthetics. Br Dent J, 2012; 12 (23): 589-599.
12. Wennström JL, Zucchelli G. Increased gingival dimensions. A significant factor for successful outcome of root coverage procedures? A 2-year prospective clinical study. J Clin Periodontol 1996; 23: 770-777.
13. Gonzales J, Klimek J, Meyle J. Aesthetic Periodontal Plastic Surgery: a Case Report. Periodontal Practice Today, 2004 (1) 3: 263-276.
14. Loe H, Anerud A, Boysen H. The natural history of periodontal disease in man: prevalence, severity, extent of gingival recession. J Indian Soc Periodontol 1992; 63:489-495.
15. Hall W. Present status of tissue grafting. J. Periodontol, 1977; 48: 587-92.
16. Palacci P, Nowzari H. Soft tissue enhancement around dental implants. Periodontology 2000, 2008; 47: 113-132.
17. Olsson M, Lindhe J. Periodontal characteristics in individuals with varying forms of the upper central incisors. J Clin Periodontol, 1991; 18: 78-82.
18. Palacci P, Nowzari H. Soft tissue enhancement around dental implants. Periodontology 2000, 2008; 47: 113-132.
19. Shibli J, d´Avila S, Marcantonio E. Connective tissue graft to correct peri-implant soft tissue margin: A clinical report. J. Prosthet Dent, 2004; 91: 119-22.
20. Shibli J, d´Avila S. Restoration of the soft tissue margin in single tooth implant in the anterior maxilla. J. Oral Implantology, 2006; 32, 6: 286-290.
21. Wilson T, Buser D. Timing of Anterior Implant Placement Postextraction: Immediate Versus Early Placement. Clinical Advances in Periodontics, May 2011; 1 (1): 61-76.
22. Yong-Moo L, So-Young K, Jim, K. Peri-implant soft tissue level secondary to a connective tissue graft in conjunction with immediate implant placement: a 2 year follow up report of 11 consecutive cases. Int. J Periodontics Restorative Dent, 2012; 32: 213-222.
23. Covani U, Marconcini S, Galassini G. Connective tissue graft used as a biologic barrier to cover an immediate implant. J. Periodontol, 2007; 78: 1644-1649.
24. Leong D, Wang H. Árbol de decisión para injertos de tejidos blandos. Rev. Int. Odont. Rest. Period, 2011; 15: 306-313.
25. Dorfman H, Kennedy J, Bird W. Longitudinal evaluation of free autogenous gingival grafts. A four year report. J. Periodontol, 1982; 53: 349-352.
26. Wennstrom J. Lack of association between width of attached gingiva and development of gingival recession. A 5 year longitudinal study. J. Clinical Period, 14, 181-184
27. Miller PD. A classification of marginal tissue recession. Int J Periodontol Rest Dent, 1985; 5: 9-13.
28. Cairo F, Nieri M, Cincinelli S, Mervelt J, Pagliaro U. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: an explorative and reliability study, 2011, 38: 661-666.
29. Salama H, Salama M, Garber D. The interproximal height of bone: a guidepost to predictable aesthetic strategies and soft tissue contours in anterior tooth replacement. Pract. Periodont Aesthetic Dent, 1998, 10(9): 1131-1141.
30. Harris R. Creeping attachment associated with the connective tissue with partial thickness double pedicle graft. J Periodontol, 1997; 68: 890-899.

31. Chambrone L, Chambrone D, Pustiglioni FE, Chambrone LA, Lima LA. The influence of tobacco smoking on the outcomes achieved by root coverage procedures: a systematic review. J Am Dent Assoc 2009; 140: 294-306.
32. Berglundh T, Lindhe J, Ericsson I, Marinello CP, Liljenberg B, Thomsen P. The soft tissue barrier at implants and teeth. Clin Oral Implants Res 1991; 2: 81-90.
33. Belser U, Buser D, Hess D. Aesthetic implant restorations in partially edentulous patients - A critical appraisal. Periodontology 2000, 1998, 17: 132-150.
34. Kazor C, Al Shammari K, Sarment D. Implant Plastic Surgery: A review and rationale. Journal of Oral Implantology, 30(4) 2004: 240-254.
35. Ghassemian M, Nowzari H, Lajolo C. The Thickness of facial alveolar bone overlying healthy maxillary anterior teeth. J. Periodontol, Jun 2010; 81 (6): 885-890.
36. Chambrone LA, Villa N, Cardoso RL, Lascala NT. Aspectos histopatológicos do tratamento de retrações gengivais localizadas com retalho deslocado e associado ao ácido cítrico. Rev Peridontia 1998; 7: 61-65.
37. Grupe H, Warren R. Repair of gingival defects by a sliding flap operation. J. Periodontol, 1956; 27: 92- 99.
38. Zuchelli G, Amore C, Sforza, N. Bilaminar techniques for the treatment of recession type defects. A comparative clinical study. J. Clin. Periodontol, 2003; 30: 862-870.
39. Sullivan H, Alkins J. Free autogenous gingival grafts III. Utilization of grafts in the treatment of gingival recession. Periodontics, 1968; 6: 152-160.
40. Ferrao J, Kalife A, Parma A. Aumento de faja gingival insertada a través de injerto gingival libre en áreas de recesión originada por el uso de piercing: reporte de caso. Full Dent. Sci.2012, 4(13): 72-77.
41. Karring T, Lang N, Loe H. The role of gingival connective tissue in determining epithelial differentiation. J. Dent Res, 1972; 51: 1303-1304.
42. Edel A. Clinical evaluation of free connective tissue grafts used to increase the width of keratinized gingiva. J. Clin. Periodontol; 1974; 1: 185-196.
43. Langer B, Langer L. Subepithelial connective tissue grafts technique for root coverage. J. Periodontol; 1985; 56: 715-720.
44. Raetzke P. Covering localized areas of root exposure employing the "envelope" technique. J. Periodontol, 1985; 56: 397-401.
45. Allen A. Use of the supraperiosteal envelope in soft tissue grafting for root coverage. II. Clinical results. International J. of Periodontics and Restorative Dentistry, 1994; 14: 303-315.
46. Nelson S. The subpedicle connective tissue graft. A bilaminar reconstructive procedure for the coverage of denuded root surfaces. J. Periodontol, 1987; 58: 95-102
47. Wennström JL, Zucchelli G. Increased gingival dimensions. A significant factor for successful outcome of root coverage procedures? A 2-year prospective clinical study. J. Clin Periodontol, 1996; 23: 770-777.
48. Bruno J. Connective tissue graft technique assuring wide root coverage. International J. Periodontics and Restorative Dentistry, 1994; 14: 127-137.
49. Harris, R. The connective tissue and partial thickness double pedicle graft: a predictable method of obtaining root coverage. J. Periodontol, 1992; 63: 477-486.
50. Azzi R, Etienne D, Takei H, Fenech P. Surgical thickening of the existing gingiva and reconstruction of interdental papillae around implant-supported restorations.

Int J Periodontics Restorative Dent 2002; 22: 71-77.
51. Chambrone L, Faggion CM Jr, Pannuti CM, Chambrone LA. Evidence-based periodontal plastic surgery: an assessment of quality of systematic reviews in the treatment of recession-type defects. J Clin Periodontol 2010; 37: 1110-1118.
52. Roccuzzo M, Bunino M, Needleman I, Sanz M. Periodontal plastic surgery for treatment of localized gingival recessions: a systematic review. J Clin Periodontol 2002; 29: 178-194.
53. Harris R. The connective tissue and partial thickness double pedicle graft: a predictable method of obtaining root coverage. J. Periodontol, 1992; 63: 477-486.
54. Reiser GM, Bruno JF, Mahan PE, Larkin LH. The subepithelial connective tissue graft palatal donor site: Anatomic considerations for surgeons. Int J Periodontics Restorative Dent 1996; 16: 130-137.
55. Chambrone L, Chambrone D, Pustiglioni FE, Chambrone LA, Lima LA. Can subepithelial connective tissue grafts be considered the gold standard procedure in the treatment of Miller Class I and II recession-type defects? J Dent 2008; 36: 659-671.
56. Harris R. Root coverage in molar recession: report of 50 consecutive cases treated with subepithelial connective tissue grafts. J. Periodontol, 2003; 74: 703-708.
57. Pini Prato G, Pagliaro U, Baldi C. Coronally advanced flap procedure for root coverage. Flap with tension versus flap without tension: a randomized controlled clinical study. J. Periodontol, 2000; 71: 188-201.
58. Tsourounakis I, Sweidan C, Palaiologou A. Coverage of Isolated, Severe Gingival Recession. A Modified Technique. Clinical Advances in Periodontics, 2013; (10): 1-13.
59. Bohm S, Weng T, Meyle J. Connective Tissue Grafts in Periodontal Surgery. Perio, 2006, 3 (2): 129-137.
60. Bosco A, Días J. An Alternative Technique to the Harvesting of a Connective Tissue Graft from a Thin Palate: Enhanced Wound Healing. Int. J. Periodontics Restorative Dent, 2007; 27: 133-139.
61. Harris RJ. A comparison of two techniques for obtaining a connective tissue graft from the palate. Int J Periodontics Restorative Dent 1997; 17: 261-271.
62. Harris RJ. The connective tissue with partial thickness double pedicle graft: the results of 100 consecutively treated defects. J Periodontol 1994; 65: 448-461.
63. Hurzeler M, Weng D. A single incision technique to harvest subepithelial connective tissue grafts from the palate. Int. J. Periodontics Restorative Dent, 1999, 19, 279-287.
64. Khoury F, Happe A. The palatal subepithelial connective tissue flap method for soft tissue management to cover maxillary defects: A clinical report. Int. J. Oral Maxillofac Implants, 2000; 15: 415-418.
65. Barbosa F, Soares D, Goncalvez E. Dimensional changes between Free Gingival Grafts Fixed with Ethyl Cyanocrylate and Silk Sutures. J. International Academy of Period, 2009; 11, 2: 170-176.
66. Wilderman MN, Wentz FM. Repair of a dentogingival defect with a pedicle flap. J Periodontol 1965; 36: 218-231.
67. Caffesse RG, Kon S, Castelli WA, Nasjleti CE. Revascularization following the lateral sliding flap procedure. J Periodontol 1984; 55:352-358.
68. Harris RJ. Successful root coverage: a human histologic evaluation of a case. Int J Periodontics Restorative Dent 1999b; 19: 439-447.
69. Goldstein M, Boyan BD, Cochran DL, Schwartz Z. Human histology of new at-

tachment after root coverage using subepithelial connective tissue graft. J Clin Periodontol 2001;28:657-662.
70. Pasquinelli, K. Histología de la nueva inserción al utilizar un injerto autógeno de tejido blando grueso en un área de profunda recesión: Reporte de un caso. Int. J. Period Rest Dent, 1995; 15:248-257.
71. Melcher AH, Accursi GE. Osteogenic capacity of periosteal and osteoperiosteal flaps elevated from the parietal bone of the rat. Arch Oral Biol 1971; 16: 573-580.
72. Melcher AH. Role of the periosteum in repair of wounds of the parietal bone of the rat. Arch Oral Biol 1969; 14: 1101-1109.
73. Melcher AH. Wound healing in monkey (Macaca irus) mandible: effect of elevating periosteum on formation of subperiosteal callus. Arch Oral Biol 1971; 16: 461-464.
74. Weng D, Hürzeler MB, Quinones CR, Ohlms A, Caffesse RG. Contribution of the periosteum to bone formation in guided bone regeneration: a study in monkeys. Clin Oral Implants Res 2000; 11: 546-554.
75. Lindhe J, Karring T. Anatomy of the periodontium. In: Lindhe J, Karring T, Lang NP. Clinical Periodontology and Implant Dentistry. 3 ed. Copenhagen: Munksgaard; 1997. pag: 19-68.
76. Bueno L, Rodriguez D. Tratamiento Interdisciplinario de Periodontitis Agresiva Localizada: Reporte de un caso. Rev Clín Periodon, Implantol Rehab Oral, 2010, 3 (2); 90-93.
77. Lenga Y. Connective Tissue Grafts. Ontario Dentist, 2007, 84(10):22-25.
78. Tinti C, Parma-Benfenatti S. Minimally invasive technique for gingival augmentation around dental implants. Int. J. Periodontics Restorative Dent, 2012; 32: 187-193.
79. Durán J, Alarcón C, Velásquez D. Application of biological based biomaterials, bioactive molecules and tissue engineering in periodontal plastic surgery. A review. Rev. Clin. Periodoncia Implantol. Rehabil. Oral, 2012, Vol. 5 (3); 144-151.

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