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Tunnel technique approach in a one-stage treatment of a deep intrabony defect combined with a class IV gingival recession: a case report

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This article focuses on a one-stage surgical treatment of a deep intrabony defect associated with a Miller's Class IV recession. The flap design follows the principles of a periodontal plastic surgery procedure, the tunnel technique, with the alliance of a regeneration procedure using a xenograft. The comparison between initial and one-year post-surgical periodontal parameters shows clinical attachment gain, periodontal pocket depth reduction and partial root coverage.

■ Introduction

Gingival recession following flap treatment of deep periodontal pockets is frequently associated with a collapse of the interdental papilla. In spite of a successful result, these black spaces between teeth may be a source of concern for patients with aesthetic expectations, and clinicians are aware that the outcome may also depend on tooth crowding, thin gingival tissue, and gingival recession. Recent advances in periodontal plastic surgery have enhanced the periodontist's ability to address these concerns.

One of the most investigated methods of achieving the regeneration of periodontal tissue in an intraosseous defect is to combine an access surgical flap with the placement of a bone graft into the debrided bony lesion. A systematic review of the literature on the correction of intrabony defects found consistent results among various biomaterials[1]; however, slow/non-resorbing bone graft, like xenograft, may have the clinical advantage of supporting soft tissue. Moreover, results from human histological material have demonstrated the formation of root cementum, periodontal ligament and alveolar bone following treatment of deep intrabony defect with bovine derived xenograft[2].

Pre-existing anatomical conditions may negatively influence the outcome of a regenerative procedure. For instance, deep defects are correlated with increased probing depth reduction, bone level gain and attachment gain when compared to shallow or wide defects[3]. The number of residual walls is another significant factor influencing treatment outcome. Kim et al[4] have shown a positive correlation between the number of defect walls and regeneration obtained in a canine model.

Fig 1 Pre-operative view. Note the multiple papilla amputations and the deep interproximal recession on the mesial aspect of tooth 43.

Fig 2 Pre-operative view. The thick biotype is associated with a buccal recession and a severe papilla amputation on tooth 43.

Regardless of the type of surgical access and incision design, bone resorption of varying degrees occurs in the crestal area of the alveolar bone during the initial phase of healing after mucoperiosteal surgery[5]. Additionally, flap design, soft tissue management and the complete primary closure are the predominant factors influencing healing patterns[6,7]. Similarly, Hurzeler and Weng[8] asserted that the success of regenerative procedures is closely linked to the ability of soft tissue to restore barrier continuity. Cortellini and Tonetti[9] have also insisted on the protection of membranes and of regenerative tissue after guided tissue regeneration.

Soft tissue handling is a major concern when dealing with root coverage procedures. Allen[10] presented a technique for the treatment of multiple recessions with a connective tissue graft. An evolution of this technique, the tunnel approach for simultaneous root coverage and papilla reconstruction, has been proposed and involves the coronal repositioning of the gingiva covering both the exposed root and the connective tissue graft, without any incision of the papilla tip[11].

The treatment of the combination of a localised class IV recession[12], with a deep intrabony defect, has been recently proposed with a complete release of papilla from the underlying bone and suspended sutures around the contact points[13]. This new surgical technique has the potential to resolve clinical situations with high aesthetic expectations or wound healing risk factors such as smoking. This conservative procedure optimises wound-healing protection, and the following case will illustrate limited post-surgical sequellae, minimal recession and a satisfactory result.

Clinical case presentation

A 65-year-old male was referred for evaluation by his hygienist after a routine maintenance session. The patient's complaint focused on tooth 43, which was slightly sensitive to cold. The patient was a non-smoker with an unremarkable medical history and a fair level of oral hygiene. Due to his history of chronic periodontitis, multiple areas of interproximal recession were evident, as shown in the anterior view (Fig 1).

A full mouth examination and periodontal evaluation was carried out and an 8 mm probing depth on the mesial aspect of tooth 43 and 4 mm on the buccal aspect was observed (Figs 2 and 3). The mesial site was characterised by a thick periodontal biotype[14], with no attached gingiva at the mesio-buccal aspect. Additionally, the mesial papilla was completely lacking, with a Miller's class IV recession defect (Fig 4).

The periapical radiograph (Fig 5) revealed a deep intrabony defect, with probably 1- to 2-wall.

Treatment began with the reinforcement of oral hygiene and full mouth scaling and root planing. Two months later, a re-evaluation was carried out and a regeneration procedure was proposed to the patient, to which he consented. The pre-existing unfavourable local anatomy as well as the anterior position of the lesion led us to attempt a conservative technique in order to preserve the blood supply as much as possible.

Fig 3 and 4 Pocket depth is 8 mm on the mesial and 4 mm on the buccal aspect.

Fig 5 Pre-operative periapical radiograph, showing a 1- to 2-wall defect with a 5 mm intrabony component.

Fig 6 Bone-sounding after local anaesthesia.

Fig 7 and 8 The tunnel is highlighted by the probe. The papilla tip remains attached to the lingual marginal gingiva.

Surgical technique

Step 1

Under local anaesthesia, bone sounding/mapping (Fig 6) was performed to visualise the shape of the lesion, which was a deep, narrow 2-wall, and a 1-wall mesial defect close to the crest. An intrasulcular incision was carried out around the neck of the root, parallel to the main axis of teeth 42, 43, and 44 with a 15c blade. A sharp Gracey curette (5/6 or 11/12) was then inserted on the buccal aspect of the teeth to dissect a full-thickness flap. A mucosal tunnel was slowly raised laterally (mesial to tooth 42 and distal to tooth 44).

The envelope was extended apically beyond the mucogingival junction (Figs 7 and 8) and this allowed

Fig 9 Tissue mobility of the marginal tissues demonstrated with the probe.

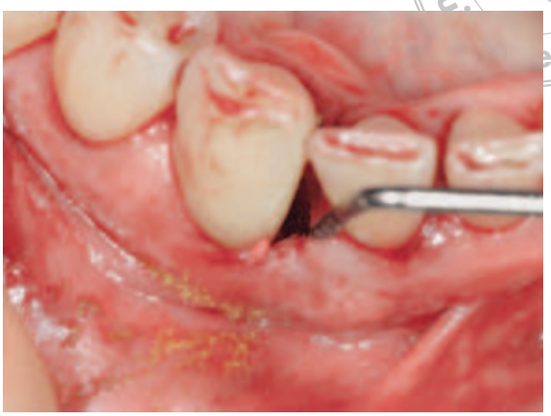

Fig 10 Intrabony defect access.

Fig 11 and 12 Xenograft placement.

the mucosa to be mobilised and displaced occlusally (Fig 9). To facilitate this displacement and increase tissue mobility, the tip of the curette was used to separate the periosteum from the underlying bone.

Step 2

The granulation tissue was thoroughly removed from the defect by using either a Younger-Good curette or sharp mini 5/mini CK6 scalers. The root surface was then carefully scaled and root planed. Sulcular access to the defect is critical and sufficient release of soft tissue had to be obtained in the previous step (Fig 10).

Step 3

The root surface could then be conditioned with a local application of tetracycline HCl. Xenograft (Bioss, Geistlich Pharma, Switzerland) was packed under pressure with a small plugger (Figs 11 and 12).

Step 4

A connective tissue graft was harvested from the palate (Fig 13) and placed into the tunnel using a 6.0 monofilament suture. The graft was stabilised in position to cover both the bone graft and the exposed root.

Step 5

Composite resin stops were placed at the contact points, to support sling sutures that hold in place the coronally advanced mucogingival tissue, with a full coverage of the connective tissue graft (Fig 14). The radiopaque nature of the xenograft was

Fig 13 A thick connective tissue graft lying over the teeth is inserted to cover the intrabony defect.

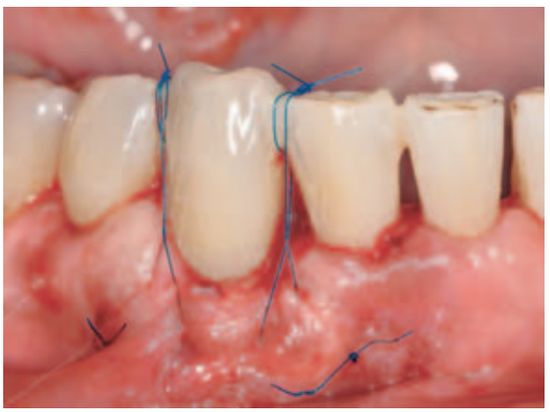

Fig 14 Sling suture over the contact point to maintain soft tissue coronally.

Fig 15 Post-surgical periapical radiograph. The radiopaque nature of the xenograft is evident.

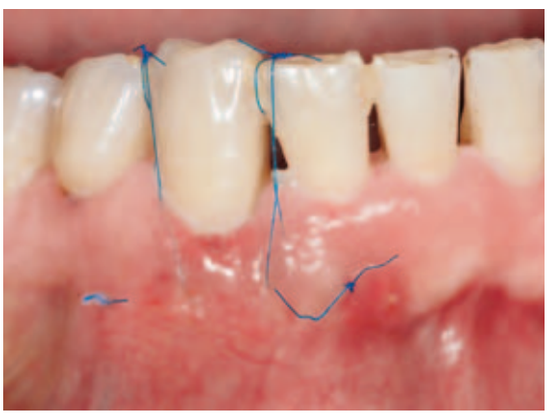

Fig 16 One week post surgery with the sling suture in position.

evident on a post-surgical periapical radiograph (Fig 15).

Post-surgical care

Immediately following surgery, the intermittent use of ice packs was recommended for 3 hours. The patient was instructed to discontinue tooth brushing, and to avoid any motion of the lip or any trauma around the surgical site. A 0.12 % chlorexhidine digluconate (Peridex, Omnipharma, 3M, St. Paul MN, USA) rinse was prescribed daily for the first 10 days. The sutures were removed after 1 week.

Maintenance care

The patient was enrolled in a supportive care programme, and received full-mouth professional prophylaxis and calculus removal every 4 months.

Results

After one week, the early healing results were excellent. There were minor post-surgical sequelae (Figs 16 and 17), which is common in periodontal surgery, and a slight increase in gingival recession was observed between the one-week and two-months post-operative visits (Fig 18).

Healing was complete at one year, with a reduced pocket depth (3 mm compared with an initial 8 mm), partial root coverage on the buccal and mesio-buccal

Fig 17 After one week, the early healing results are excellent, with minor post-surgical sequelae.

Fig 18 Early soft tissue maturation at two months.

Fig 19 Healing is complete at one year, with a reduced pocket depth (3 mm), partial root coverage on the buccal and mesio-buccal aspects and a limited papilla gain in the interproximal space.

Fig 20 The attachment gain is 5 mm.

Fig 21 Bone tissue maturation can be seen on the periapical radiograph. The xenograft appears to be well integrated.

aspects, and a limited papilla gain in the interproximal space (Fig 19). Attachment gain was 5 mm (Fig 20). Radiographically, the xenograft appeared to be well integrated (Fig 21).

■ Discussion

This technique attempts to address the dilemma that faces the clinician for the treatment of an intrabony defect in the aesthetic zone or in lateral segments associated with an advanced gingival recession. While the objective was not a reconstruction of the interdental papilla, there was a limited improvement in the soft tissue interdental volume as well as interproximal hard tissue gain.

The presented approach is a blind, technique-sensitive and time-consuming procedure. The pre-operative clinical assessment is critical for proper case selection. A closed bone mapping of the intrabony defect is required to visualise the shape of the defect and to anticipate the number of residual bony walls, upon which rests the potential for defect repair[4]. The surgical site needs to present a large embrasure for good surgical access for instruments. An average-to-thick soft tissue morphotype is necessary in order to facilitate the soft tissue management, particularly during the debridement of the lesion (step 2).

During initial therapy, scaling and root planing in pockets deeper than 7 mm is a blind procedure resulting in inefficient complete debridement[15]. In the presented case, tooth 43 exhibited an 8 mm mesial probing depth. The tunnel technique and the tissue elasticity provided enough space to offer improved visibility when compared to scaling and root planing, particularly with improved visual acuity device (loupes). However, there is no question that mucogingoval flap elevation through the use of intrasulcular or remote interproximal incisions, eventually with releasing incisions, offers more direct vision for intrabony defect debridement.

After full-thickness flap elevation and bone exposure, bone resorption occurs in the crestal area[5,16]. With the current surgical approach, exposure to the oral environment is limited, and blood supply alteration of the flap is probably transient due to the absence of releasing and crestal incisions. There is preservation of the supraperiosteal vessel continuity and only the anastomoses with the alveolar bone and periodontal ligament blood vessel are severed.

The connective tissue graft serves two purposes. Firstly, gingival thickening and root coverage, and secondly, it may act as a biological barrier to prevent epithelial migration, allowing cells with regenerative capacity to repopulate the defect area in a similar fashion to a collagen-based membrane.

With the tunnel approach, the blood clot is covered and protected from the oral environment as soon as the surgery is completed and primary intention wound healing is optimised. The connective tissue graft prevents the flap margin displacement by wound stabilisation[17], covers the area of recession and limits the risk of post-operative complications by increasing the soft-tissue thickness above the bone substitute.

On the mucogingival component, partial root coverage of the class IV recession was obtained. While the papilla was also partially restored, at the present time papilla reconstruction is unpredictable, and generally an unattainable goal.

An autogenous bone graft has been used in a similar procedure[13] and studies are needed to appreciate if wound healing in these specific combined intrabony–recession defects are similar to results with intrabony lesions only[1].

With wide interproximal spaces and papilla collapse, non-resorbable membranes can be used with an interproximally connected flap (ICF) to regenerate interdental intrabony defects in the anterior area[18]. However, this technique requires the presence of well-represented isthmus of interdental tissue (a minimum of 3 mm of keratinised tissue) and diastema in order to facilitate the surgical manoeuvres. The method allows direct access and a vertical interproximal bone gain, even in the absence of an intrabony defect, but the wound is large and the non-resorbable membrane needs to be removed.

Some studies have demonstrated the negative effect of smoking on periodontal regeneration. For example, Scabbia et al[19] indicated that smokers exhibit a less favourable result in deep pockets following flap debridement surgery. The proposed method may be an option when presented with a patient with general risk factors, such as diabetes or smoking, which have the potential to negatively influence the healing capacity of the tissues[20].

■ Conclusions

Treatment of a deep intrabony lesion and adjacent gingival recession were completed in one stage, resulting in a significantly improved probing attachment level associated with radiographic bone maturation.

The presented approach seems to be a viable option for these particular cases presenting with confounding variables in the aesthetic zone. It is a delicate procedure that requires a wide adjacent embrasure and a thick gingival morphotype. Additionally, the shape of the lesion and patient selection are essential for the success of the procedure. It must be stated that in order to determine the real viability of

the proposed technique, clinical trials are necessary. However, the results of this single case are encouraging.

■ References

1. Trombelli L. Which reconstructive procedures are effective for treating the periodontal intraosseous defect? Periodontol 2000 2005;37:88–105.
2. Sculean A, Jepsen S. Biomaterials for the reconstructive treatment of periondontal intrabony defects. Part 1. Bone Graft and bone substitutes. PERIO 2004;1:5–15.
3. Trombelli L, Kim CK, Zimmerman GJ, Wikesjo UM. Retrospective analysis of factors related to clinical outcome of guided tissue regeneration procedures in intrabony defects. J Clin Periodontol 1997;24:366–371.
4. Kim CS, Choi SH, Chai JK, Cho KS, Moon IS, Wikesjo UM, Kim CK. Periodontal repair in surgically created intrabony defects in dogs: influence of the number of bone walls on healing response. J Periodontol 2004;75:229–235.
5. Ramfjord SP, Costich ER. Healing after partial denudation of the alveolar process. J Periodontol 1968;39:127–134.
6. Cortellini P, Bowers GM. Periodontal regeneration of intrabony defects: an evidence-based treatment approach. Int J Periodontics Restorative Dent 1995;15:128–145.
7. Kornman KS, Robertson PB. Fundamental principles affecting the outcomes of therapy for osseous lesions. Periodontol 2000 2000;22:22–43.
8. Hurzeler MB, Weng D. Functional and esthetic outcome enhancement of periodontal surgery by application of plastic surgery principles. Int J Periodontics Restorative Dent 1999;19:36–43.
9. Cortellini P, Tonetti MS. Focus on intrabony defects: guided tissue regeneration. Periodontol 2000 2000;22:104–132.
10. Allen AL. Use of the supraperiosteal envelope in soft tissue grafting for root coverage. I. Rationale and technique. Int J Periodontics Restorative Dent 1994;14:216–227.
11. Azzi R, Etienne D. Recouvrement radiculaire et reconstruction papillaire par greffon conjonctif enfoui sous un lambeau vestibulaire tunnellisé et tracté coronairement. J Paro Impl Oral 1998;17:71–77.
12. Miller PD Jr. A classification of marginal tissue recession. Int J Periodontics Restorative Dent 1985;5:8–13.
13. Azzi R, Etienne D, Takei H. Bone regeneration using pouch and tunnel appproach. Int J Periodontics Restorative Dent 2007, in press.
14. Olsson M, Lindhe J. Periodontal characteristics in individuals with varying form of the upper central incisors. J Clin Periodontol 1991;18:78–82.
15. Caffesse RG, Sweeney PL, Smith BA. Scaling and root planing with and without periodontal flap surgery. J Clin Periodontol 1986;13:205–210.
16. Wood Dl. Hoag PM. Donnenfeld OW. Rosenfeld LD. Alveolar crest reduction following full partial thickness flaps. J Periodontol 1972;42:141–144.
17. Wikesjo UM, Nilveus R. Periodontal repair in dogs: effect of wound stabilization on healing. J Periodontol 1990;61: 719–724.
18. Tinti C. The interproximally connected flap to treat intrabony defects: case reports. Int J Periodontics Restorative Dent 2007;27:17-25.
19. Scabbia A, Cho KS, Sigurdsson TJ, Kim CK, Trombelli L. Cigarette smoking negatively affects healing response following flap debridement surgery. Periodontol 2001;72:43–49.
20. Needleman IG, Worthington HV, Giedrys-Leeper E, Tucker RJ. Guided tissue regeneration for periodontal infra-bony defects. Cochrane Database Syst Rev 2006;19(2):CD001724. Update of: Cochrane Database Syst Rev 2001;(2):CD001724.