

PERIODONTAL/PROSTHETIC REHABILITATION OF DENTAL CARIES AND MUCOGINGIVAL DEFORMITIES USING AN OILY CALCIUM HYDROXID SUSPENSION

Daniel Engler-Hamm, DDS, MSc*
Hiroshi Hirayama, DDS†
Paul A. Levi, Jr., DMD‡



The following case presentation demonstrates the successful use of a newly developed oily calcium hydroxide suspension (OCHS) for root coverage. The patient presented with dental caries and severe generalized recession, and was treated with a combined periodontal/prosthetic treatment approach, using a laboratory-fabricated provisional crown and an OCHS in conjunction with a subepithelial connective tissue graft (SECTG). Six months following treatment, the final crown was delivered, and all teeth but the molar (ie, tooth #3), which carried the provisional crown, showed 100% root coverage and optimal healing.

Learning Objectives:

This article describes the use of an OCHS/SECTG approach to treat severe gingival recession. Upon completing this article, the reader should:

- Better understand the etiology of gingival recession and a new method for root coverage.
- Be aware of the clinical procedure used to deliver the OCHS/SECTG material.

Key Words: gingival recession, calcium hydroxide suspension, OCHS, SECTG, connective tissue graft

*Diplomate, American Board of Periodontology; Assistant Professor, Department of Periodontology, Witten/Herdecke University, Witten, Germany.

†Diplomate, American Board of Prosthodontics; Director of Postgraduate Prosthodontics, Division of Prosthodontics and Operative Dentistry, Tufts University School of Dental Medicine, Boston, MA.

‡Diplomate, American Board of Periodontology; Department of Periodontology, Tufts University School of Dental Medicine, Boston, MA.

Daniel Engler-Hamm, DDS, MSc, Witten/Herdecke University, Alfred-Herrhausenstrasse 50, Witten, Germany 58448
Tel: +49 172 494 111 2 • E-mail: Engler@fachpraxis.de

Periodontal and prosthodontic residents often need experience to determine the ideal treatment approach for complex cases. The purpose of this article is to: 1) present a mucogingival deformity (ie, recession), which was treated periodontally and prosthodontically in a way that allowed for a predictable aesthetic result and 2) demonstrate that an oily calcium hydroxid suspension (OCHS) may be used predictably for root coverage procedures in conjunction with a subepithelial connective tissue graft (SECTG).

Patients present with numerous dental problems such as caries, parafunctional habits, periodontitis, and mucogingival deformities.^{1,2} Certainly, there are many different approaches that may lead to an ideal aesthetic treatment result. This case will highlight several simple steps that may predictably lead to an aesthetic outcome in comprehensive dental rehabilitation.

The etiology of gingival recession is generally believed to be either trauma and/or inflammation.^{3,4} Noncarious cervical lesions in teeth, which are seen in conjunction with gingival recession, may be associated with occlusal discrepancies (eg, abfraction) or trauma (eg, toothbrushing abrasion). It remains difficult to ascertain the degree of inflammation or trauma that will lead to recession. Clinically, this may be observed whenever the clinical impression, with regards to these etiologic factors, does not justify the extent of recession. In these cases, the recession might be associated with additional risk factors such as a thin periodontal biotype/phenotype, which may predispose a tooth to develop attachment loss. The significance of these predisposing factors may vary and may be cumulative, although there are no studies that prove the authors' opinion.

Predisposing factors for the developing recession may be prominent teeth, a thin-scalloped periodontal phenotype, bony dehiscences, high frenum attachments, and a history of past or current orthodontic treatment with buccal positioning of the teeth.^{5,8} In addition, a restorative margin and its microgap, which recently was researched around two-piece implants, may also be a risk factor when it is placed adjacent to thin mucosal tissues, as subsequent plaque accumulation leads to localized inflammation.^{9,10}

The ideal treatment of these cases should not only emphasize changing the patient's brushing habits and controlling his or her inflammation, but should also consider these additional risk factors in order to prevent future attachment loss. It is evident that patients who practice proper oral hygiene techniques do not need to have an adequate band of keratinized mucosa in order to maintain their buccal attachment level.¹¹ Nevertheless, patients who perform good plaque control often are seen with significant recession, possibly due to overzeal-



Figure 1. Preoperative view of the maxillary right quadrant exhibits severe generalized recession and a lost inlay with tooth decay on tooth #3(16).



Figure 2. View of the laboratory-fabricated provisional restoration prior to seating.

ous and frequent toothbrushing.¹² There are no controlled studies that prospectively focus on an accumulation of certain risk factors, such as the presence of a subgingival restoration in a patient with a thin periodontal phenotype, and observe the likelihood of continued attachment loss in comparison to a patient having received the treatment approach shown in the present case.

The SECTG is the standard treatment for patients with gingival recession.¹³ In order to decrease trauma, have predictable aesthetics, and provide an adequate blood supply to the graft, the tunneling technique has proven to be a successful means of achieving the desired result.^{14,15} Tunneling, however, is time consuming, cost intensive, and technique sensitive. In addition, it appears to be more difficult to coronally position flaps more than 3 mm with a tunneling technique compared to the envelope technique. The present case was treated with a combined tunneling/envelope technique in order to maximize time efficiency and also enhance the aesthetics simultaneously.

Different adjuncts have been described for root coverage. Enamel matrix protein (ie, amelogenin) has been shown to increase the amount of root coverage



Figure 3. The provisional restoration was cemented following the removal of tooth decay, placement of a foundation restoration, and tooth preparation.



Figure 4. A split-full-split envelope flap was used at the sites of teeth #2(17) through #5(14); teeth #5 through #7(12) received full tunneling flaps.

and keratinized tissue using the coronally positioned flap techniques with or without its use.¹⁶ Using an OCHS (ie, Osteoinductal [formerly Osteora], MetaCura, Munich, Germany) for root coverage has not been described in the literature to date. Based on limited in vitro and in vivo studies, this material is reported to be bacteriostatic and

increase the proliferation of mesenchymal cells, collagen, and bone.^{17,21} To the best of the authors' knowledge, the use of this new approach for root coverage has not been described.

Case Description and Results

A 48-year-old male patient presented for replacement of an inlay that he had just lost in tooth #3(16). The patient's medical history was normal and his oral hygiene was good. Periodontal and radiographic evaluation showed the presence of Miller Class I recession in the area of teeth #4(15) through #7(12) and Miller Class III in the area of tooth #3 (Table). After specific questioning, the patient explained that he had a previous history of severe brushing trauma, although his brushing regimen at the time of the initial visit appeared correct.

Tooth #3 also presented with occlusal caries (Figure 1). The decay was removed and a foundation restoration was made. Periodontal Phase I treatment (ie, periodontal debridement) was performed and tooth #3 was prepared for a full-coverage restoration. The preparation margin was placed intrasulcularly on the mesial, lingual, and distal surfaces. On the facial aspect, the preparation margin was placed right at the cemento-enamel junction. Impressions were made, and a laboratory-fabricated long-term provisional crown was delivered (Figures 2 and 3).

SECTG With an OCHS

Informed patient consent for treatment with an SECTG in conjunction with an OCHS was obtained. In the posterior region for teeth #2(17) through #5(14), a split-full-split envelope flap was performed using straight and angled microblades in conjunction with a papillary and mucoperiosteal elevators (PPSCHLEE and PPAEL, Hu-Friedy, Inc, Chicago, IL). In the anterior aesthetic

Table

Miller Classification (1985)	
Miller Class I:	Marginal soft tissue recession does not extend to the mucogingival junction in the absence of interdental bone or soft tissue loss. Complete root coverage can be anticipated.
Miller Class II:	Marginal soft tissue recession extends to or beyond the mucogingival junction in the absence of interdental bone or soft tissue loss. Complete root coverage can be anticipated.
Miller Class III:	Marginal soft tissue recession extends to or beyond the mucogingival junction with interdental bone or soft tissue loss apical to the cemento-enamel junction but coronal to the level of soft tissue recession. Partial root coverage is possible.
Miller Class IV:	Marginal soft tissue recession extends to or beyond the mucogingival junction with loss of interdental bone or soft tissue apical to the level of the recession defect. Root coverage is not possible.

region on the facial gingiva of teeth #5 through #8(11), a full-split tunneling flap was prepared. The roots of these teeth were scaled and root planned with curets and an ultrasonic diamond tip (Figures 4 and 5). Thereafter, the OCHS was dispensed on the debrided root surfaces.

Donor Site and Graft Positioning

Subepithelial connective tissue grafts were harvested bilaterally from the palate area of teeth #2 through #6(13) and #9(21) through #15(27) using the single-incision technique. One of the two grafts was placed underneath the papillae of teeth #5 through #7 and anchored mesially of tooth #7 with Vicryl 5-0 sutures. The two grafts were sutured together using Vicryl rapide 5-0, and the distal part of the second graft extended approximately 3 mm distal to the distal line angle of tooth #3, allowing for an adequate blood supply from the distal papilla. The distal part of the second graft was also anchored with a Vicryl 5-0 suture. The posterior envelope flap was coronally positioned with vertical mattress 5-0 sutures. The anterior tunneled area was coronally positioned using a combination of vertical mattress and criss-cross circumferential sutures. The patient received chlorhexidine mouthrise 0.06% twice daily, ibuprofen 800 mg (tid for 7 days) and amoxicillin (500mg tid for 7 days). The patient was instructed not to brush or floss in the area of the graft for 4 weeks. Meanwhile, the patient presented twice for careful plaque and suture removal. The healing was uneventful (Figures 6 through 8).

Results

After six months of healing, all teeth but #3 showed 100% root coverage. Tooth #3 still maintained approximately 1.5 mm of recession. The facial preparation margin of tooth #3 was prepared into the newly developed crevice. Impressions, face-bow, and bite registration for a final restoration were made. The final porcelain-fused-to-metal crown was made with a buccal ceramic shoulder in order to enhance aesthetics on the facial aspect. After checking for fit and minor occlusal adjustment, the crown was cemented (Figures 9 and 10).

Discussion

It is important that both periodontal and prosthetic residents and clinicians in practice have experience in each other's field and learn to work together for the patient's benefit. Furthermore, it can be beneficial for periodontal and prosthetic programs to teach their residents to treat simple cases in each other's discipline to develop an understanding beyond the scope of an individual's specialty.



Figure 5. Placement of the OCHS following root preparation.



Figure 6. Placement of the two SECTGs over the recipient site in anticipation of graft positioning.



Figure 7. Buccal view exhibits coronal positioning of the flap with vertical mattress and criss-cross sutures.

Multidisciplinary treatment approaches may often be the choice of the clinician in order to increase efficiency, aesthetics, and decrease trauma. The current case demonstrates that a combined tunneling envelope flap may be an adequate treatment in order to achieve optimal aesthetics. The envelope flap area did not present with scarring, which may have been because of the use of OCHS or because of the individual's healing



Figure 8. Healing after 10 weeks. Tooth #3 has approximately 1.5 mm of recession remaining following root coverage.



Figure 9. The definitive metal-ceramic full-coverage crown was fabricated with a buccal ceramic shoulder.



Figure 10. Postoperative buccal view after cementation of the definitive restoration.

pattern. The fact that tooth #3 exhibited less root coverage than the other teeth treated could be explained with the more unfavorable tooth surface-to-blood supply ratio.²² Also, severing the blood supply by splitting the papilla may additionally have diminished the blood supply.²³ In addition, tooth #3 had a 5-mm probing depth prior to Phase I therapy and showed radiographic interproximal bone loss, which according to Miller also

leads to decreased root coverage.²⁴ Since a result of 60- to 85-percent root coverage in Miller Class I and II recessions is common, the prosthetic treatment approach should consider that recession may be present after root coverage, especially in Miller Class III or IV cases.²⁵ Exposed roots may develop Class V caries and subsequently decrease the prognosis of the individual tooth.²⁶ In addition, if the aesthetic treatment result is a concern, it may be compromised if the final restoration is not considered at the outset of treatment. Thus, after an adequate healing period of 3 to 6 months, the crown margin may be placed into the newly developed crevice without causing trauma. This treatment approach shows significant advantages in terms of aesthetics and a decreased prevalence of Class V caries. The alternative would have been a Class V restoration, which has been shown to lose its bond with the root and will need to be replaced with possible secondary decay and further loss of tooth structure.^{27,28}

Crown margins should only be placed into the sulcus and not violate the biologic width.²⁹ In addition, crown margins that are placed in keratinized tissue result in less bleeding of the tissue than crowns that are placed in mucosal, non-keratinized tissue.³⁰ Subepithelial connective tissue grafting results in greater tissue thickness and a greater zone of keratinized tissue, which may help to decrease gingival inflammation when restorative margins are placed into the sulcus.³¹ Depending on the marginal fit of a crown,³² plaque can accumulate and the resulting inflammation in a patient with thin periodontal tissues may lead to recession.

One primary goal of mucogingival treatment is to increase the periodontal phenotype of the patient.³³ Although thinner graft thickness may sometimes provide a more aesthetic treatment result, thicker grafts result in greater periodontal biotype soft tissue thickness and subsequently may improve the marginal stability of the attachment apparatus. The present case described two thick bilaterally harvested SECTGs that were used to increase the periodontal phenotype thickness and keratinized tissue in order to cover the patient's exposed roots. Whenever patients have numerous risk factors such as a dehiscence seen in tooth #3, a thin periodontal biotype in conjunction with an anticipated restoration, and an etiologic factor such as severe brushing trauma, harvesting a thick rather than a thin graft may be the choice in order to decrease the presence of these risk factors and allow for long-term stability of the treatment. Although there certainly is a greater morbidity in terms of marginal flap necrosis, postoperative bleeding, and discomfort associated with the donor site when thick grafts are harvested bilaterally, the advantages of a good result overcome the negatives of the donor site.

To the best of the authors' knowledge, the use of a newly developed OCHS for root coverage has not been described to date. The successful use of OCHS was demonstrated for the treatment of intrabony defects, and was able to show significantly greater attachment-level gain compared to open-flap debridement.³⁴ Also, one study indicated that OCHS may improve wound healing.³⁵ The present case showed good wound healing and excellent root coverage. It remains unclear if the result was influenced by OCHS, and further randomized controlled trials are recommended to adequately judge the benefits of its use for root coverage procedures.

Conclusion

Training in periodontics and prosthodontics helps to adequately learn how to treatment plan cases with multidisciplinary problems. An OCHS may be used for root coverage procedures. Further studies should be conducted with OCHS to confirm the added benefit of this approach versus the use of SECTG alone.

Acknowledgment

The authors mention their gratitude to Oral Design Laboratory, Munich, Germany for the fabrication of the restorations depicted and declare no financial interest in any product cited herein.

References

- Papapanou PN, Lindhe J. Epidemiology of periodontal disease. Lindhe J, Karring T, Lang NP, eds. *Clinical Periodontology and Implant Dentistry*. 4th ed. Copenhagen: Blackwell Munksgaard; 2003: 50-80.
- Marthaler TM. Changes in dental caries 1953-2003. *Caries Res* 2004;38(3):173-81.
- Matthews DC. No good evidence to link toothbrushing trauma to gingival recession. *Evid Based Dent* 2008;9(2):49.
- Wennström JL. Mucogingival therapy. *Ann Periodontol* 1996;1(1): 671-701.
- Ochsenbein C, Ross S. A reevaluation of osseous surgery. *Dent Clin North Am* 1969;13(1):87-102.
- Mello-Moura AC, Cadioli IC, Corrêa MS, et al. Early diagnosis and surgical treatment of the lower labial frenum in infancy: A case report. *J Clin Pediatr Dent* 2008;32(3):181-183.
- Wennström JL. Mucogingival considerations in orthodontic treatment. *Semin Orthod* 1996;2(1):46-54.
- Müller HP, Eger T. Masticatory mucosa and periodontal phenotype: A review. *Int J Periodont Rest Dent* 2002;22(2):173-183.
- Stetler KJ, Bissada NF. Significance of the width of keratinized gingiva on the periodontal status of teeth with submarginal restorations. *J Periodontol* 1987;58(10):696-700.
- Broggini N, McManus LM, Hermann JS, et al. Persistent acute inflammation at the implant-abutment interface. *J Dent Res* 2003;82(3): 232-237.
- Wennström JL. Lack of association between width of attached gingiva and development of soft tissue recession. A five-year longitudinal study. *J Clin Periodontol* 1987;14(3):181-184.
- Serino G, Wennström JL, Lindhe J, Eneroth L. The prevalence and distribution of gingival recession in subjects with a high standard of oral hygiene. *J Clin Periodontol* 1994;21(1):57-63.
- Langer B, Langer L. Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 1985;56(12):715-720.
- Blanes RJ, Allen EP. The bilateral pedicle flap-tunnel technique: A new approach to cover connective tissue grafts. *Int J Periodont Rest Dent* 1999;19(5):471-479.
- Tözüm TF, Keçeli HG, Güncü GN, et al. Treatment of gingival recession: Comparison of two techniques of subepithelial connective tissue graft. *J Periodontol* 2005;76(11):1842-1848.
- Cueva MA, Boltchi FE, Hallmon VVV, et al. A comparative study of coronally advanced flaps with and without the addition of enamel matrix derivative in the treatment of marginal tissue recession. *J Periodontol* 2004;75(7):949-956.
- Schwarz F, Stratul SI, Herten M, et al. Effect of an oily calcium hydroxide suspension (Osteoinductal) on healing of intrabony periodontal defects. A pilot study in dogs. *Clin Oral Investig* 2006;10(1): 29-34.
- Stratul SI, Schwarz F, Becker J, et al. Healing of intrabony defects following treatment with an oily calcium hydroxide suspension (Osteoinductal). A controlled clinical study. *Clin Oral Investig* 2006;10(1):55-60.
- Kasaj A, Willershausen B, Berakdar M, et al. Effect of an oily calcium hydroxide suspension on early wound healing after nonsurgical periodontal therapy. *Clin Oral Investig* 2006;10(1):72-76.
- Kasaj A, Willershausen B, Jewczyk N, Schmidt M. Effect of an oily calcium hydroxide suspension (Osteoinductal) on human periodontal fibroblasts. An in vitro study. *Eur J Med Res* 2007;12(6):268-272.
- Stavropoulos A, Geenen C, Nyengaard JR, et al. Oily calcium hydroxide suspension (Osteoinductal) used as an adjunct to guided bone regeneration: An experimental study in rats. *Clin Oral Impl Res* 2007;18(6):761-767.
- Mlinek A, Smukler H, Buchner A. The use of free gingival grafts for the coverage of denuded roots. *J Periodontol* 1973;44(4):248-254.
- Tözüm TF, Keçeli HG, Güncü GN, et al. Treatment of gingival recession: Comparison of two techniques of subepithelial connective tissue graft. *J Periodontol* 2005;76(11):1842-1848.
- Miller PD Jr. Root coverage with the free gingival graft. Factors associated with incomplete coverage. *J Periodontol* 1987;58(10): 674-681.
- Pini-Prato G, Baldi C, Pagliaro U, et al. Coronally advanced flap procedure for root coverage. Treatment of root surface: Root planing versus polishing. *J Periodontol* 1999;70(9):1064-1076.
- Berg R, Berkey DB, Tang JM, et al. Oral health status of older adults in Arizona: Results from the Arizona Elder Study. *Spec Care Dentist* 2000;20(6):226-233.
- Lo EC, Luo Y, Tan HP, et al. ART and conventional root restorations in elders after 12 months. *J Dent Res* 2006;85(10):929-932.
- Hara AT, Queiroz CS, Freitas PM, et al. Fluoride release and secondary caries inhibition by adhesive systems on root dentine. *Eur J Oral Sci* 2005;113(3):245-250.
- Nevins M, Skurow HM. The intracrevicular restorative margin, the biologic width, and the maintenance of the gingival margin. *Int J Periodont Rest Dent* 1984;4(3):30-49.
- Stetler KJ, Bissada NF. Significance of the width of keratinized gingiva on the periodontal status of teeth with submarginal restorations. *J Periodontol* 1987;58(10):696-700.
- Maynard JG Jr, Wilson RD. Physiologic dimensions of the periodontium significant to the restorative dentist. *J Periodontol* 1979;50(4): 170-174.
- Quante K, Ludwig K, Kern M. Marginal and internal fit of metal-ceramic crowns fabricated with a new laser melting technology. *Dent Mater* 2008;24(10):1311-1315.
- 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 Periodont Rest Dent* 2002;22(1):71-77.
- Stratul SI, Schwarz F, Becker J, et al. Healing of intrabony defects following treatment with an oily calcium hydroxide suspension (Osteoinductal): A controlled clinical study. *Clin Oral Investig* 2006;10(1):55-60.
- Kasaj A, Willershausen B, Berakdar M, et al. Effect of an oily calcium hydroxide suspension on early wound healing after nonsurgical periodontal therapy. *Clin Oral Investig* 2006;10(1):72-76.

CONTINUING EDUCATION (CE) EXERCISE No. 3



To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education exercise are based on the article "Periodontal/Prosthetic rehabilitation of dental caries and mucogingival deformities using an oily calcium hydroxid suspension" by Daniel Engler-Hamm, DDS, MSc, Hiroshi Hirayama, DDS, and Paul A. Levi, Jr., DMD. This article is on pages E1-E6.

- 1. What are the etiologic factors mentioned that may lead to recession:**
 - a. Trauma and abfraction.
 - b. Trauma and Inflammation
 - c. Trauma, inflammation, and thin periodontal biotype.
 - d. Thin periodontal biotype.
- 2. Amelogenin and oily calcium hydroxide suspension (OCHS) may be used for:**
 - a. Sinus elevation.
 - b. Root coverage.
 - c. Hard-tissue augmentation.
 - d. Ridge preservation.
- 3. According to this article, comprehensive oral rehabilitation means:**
 - a. Do whatever you need to maximize your practices cash-flow.
 - b. Talk to your patient and treat him based on his demands only.
 - c. Consider other dental specialties in your treatment approach to maximize the aesthetic and functional treatment outcome.
 - d. None of the above.
- 4. Enamel matrix derivative is:**
 - a. Emdogain, an amelogenin.
 - b. An amelogenin but not emdogain.
 - c. An OCHS.
 - d. A root conditioner.
- 5. Tunneling may be best described as:**
 - a. Atraumatically harvesting a palatal donor site graft.
 - b. Inserting a soft tissue graft over a dehiscence type defect.
 - c. Undermining the patient's soft tissue to maximize blood supply and enhance aesthetics.
 - d. None of the above.
- 6. Factors that may predispose a periodontium to develop recession are:**
 - a. Thin periodontal biotype and dehiscences.
 - b. Thin periodontal biotype, dehiscences, absence of attached keratinized tissue, and occlusal trauma.
 - c. Thin periodontal biotype, dehiscences, and absence of attached keratinized tissue.
 - d. Thin periodontal biotype and occlusal Trauma.
- 7. After connective tissue grafting, the clinician should wait how long before placing the preparation margin into the sulcus?**
 - a. 1 month.
 - b. 2 months.
 - c. 3-6 months.
 - d. 12 months.
- 8. Porcelain-fused-to-metal crowns in the aesthetic zone may be aesthetically designed by?**
 - a. Reducing minimal dentin.
 - b. A buccal chamfer.
 - c. A buccal ceramic shoulder.
 - d. None of the above.
- 9. Harvesting thick grafts from the palate may lead to:**
 - a. Improved healing.
 - b. Greater morbidity.
 - c. Greater periodontal soft tissue thickness at the recipient site.
 - d. Both b and c are correct.
- 10. Miller Class III recession may be best explained as:**
 - a. Recession beyond the interproximal bone.
 - b. Recession without bone loss.
 - c. Recession in the presence of bone loss.
 - d. None of the above.