Root Coverage with Connective Tissue Graft in Patients with Thin Periodontal Biotype: A Case Series with 12-month Follow-up

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Abstract

Preoperative gingival thickness is an important factor in the success of complete root coverage. Here, two cases are reported in which a biotype probe was used to assess the periodontal biotype before performance of a root coverage procedure. Clinical examinations were performed at baseline and at 3, 6, and 12 months postoperatively. The following clinical parameters were evaluated: probing depth, recession height, clinical attachment level, bleeding on probing, and width of keratinized gingiva. At baseline and at 12 months postoperatively, periodontal biotype was estimated using the biotype probe. The root coverage esthetic score was assessed to determine esthetic outcome at baseline and at 3, 6, and 12 months postoperatively. The periodontal biotypes in the mandibular central and lateral incisors were judged to be thin. These teeth presented with Miller Class II gingival recession after orthodontic therapy. Gingival recession was treated with a coronally advanced flap and autogenous connective tissue graft. In both cases, improvements in all clinical parameters and root coverage esthetic scores were evaluated at 3, 6, and 12 months postoperatively. The treated recession showed 100% root coverage. The periodontal biotype changed from one that was thin to one that was thick at the surgical sites. In both the present cases, objective preoperative assessment of the periodontal biotype allowed the appropriate surgical procedure to be selected.

Key words: Root coverage — Connective tissue graft — Thin periodontal biotype — Biotype probe — Coronally advanced flap

Introduction

Gingival recession is defined as an apical shift of the marginal gingiva from its normal position on the crown of the tooth to levels on the root surface beyond that of the cemento-enamel junction. Gingival recession and root surface exposure to the oral environment can result in impaired esthetics, dentin hypersensitivity, and caries or non-curious cervical lesions. Coronally advanced flaps (CAF) are probably one of the most investi-
gated procedures used in the treatment of gingival recession\textsuperscript{7)}. They are widely used, either alone or in combination with a connective tissue graft (CTG), collagen matrix, enamel matrix derivative, or platelet-rich plasma\textsuperscript{5}. Gingival thickness is a determinant factor for additional use of a CTG when a CAF is used\textsuperscript{7}. Therefore, preoperative evaluation of gingival thickness is important if successful root coverage is to be achieved. One study found that visual assessment of gingival thickness was accurate in only approximately half of the cases investigated, regardless of the clinician’s level of experience\textsuperscript{10}. A variety of instrumental methods (direct measurement, probe transparency, ultrasonic devices, and cone beam computed tomography) for the measurement of gingival thickness have been investigated\textsuperscript{13,16,21}.

A biotype probe system was developed as a new way to objectively assess periodontal biotypes\textsuperscript{23}. Here, two cases are reported in which a biotype probe was used to assess the periodontal biotype before performance of a root coverage procedure.

Case Presentation

Written informed consent was obtained from the patients for inclusion in this report.

Case 1 was a 26-year-old woman who was referred to our hospital by her dentist for the treatment of generalized gingival recession. Her medical history showed nothing that would cause problems with such treatment. Orthodontic treatment had been completed when the patient was aged 22 years.

Case 2 was a 24-year-old woman who visited our hospital with the chief complaint of gingival recession and dentin hyperesthesia. The patient was systemically healthy. Orthodontic treatment had been completed when she was in her teens.

1. Clinical examination

Probing depth (PD), recession height (RH), clinical attachment level (CAL), bleeding on probing (BOP), and width of keratinized gingiva (WKG) were recorded in each patient at baseline and at 3, 6, and 12 months postoperatively. The predictability of root coverage was evaluated in accordance with the Miller classification of gingival recession defects\textsuperscript{20}. The following root coverage esthetic scores (RES)\textsuperscript{6} were evaluated at 3, 6, and 12 months postoperatively: the gingival margin (scored as 6 in cases of complete root coverage); the marginal tissue contour (scored as 1 if a proper scalloped contour following the cemento-enamel junction [CEJ] was observed); soft tissue texture (scored as 1 if there was no visible scar or keloid formation); alignment of the mucogingival junction (AMGJ, scored as 1 in cases of alignment); and gingival color (scored as 1 if the color was normal and there was integration with the tissue at the adjacent teeth). Postoperative estimation of soft tissue biotype was evaluated at baseline and at 12 months postoperatively using a Colorvue\textsuperscript{®} Biotype Probe (Hu-Friedy Chicago, IL, USA) (Fig. 1). Gingival thickness in both patients was evaluated based on the visibility of the colored tip of the probe through the gingival tissue (Fig. 2).

Each patient’s oral health-related quality of life (OHRQL) was also used as a measure of patient-reported outcome\textsuperscript{25}.

2. Diagnosis

1) Case 1

The mean PD was 2.3 mm. BOP was observed at 27.7% of sites. The mandibular right central incisor showed significant gingival recession (4 mm). At this site, PD was 2 mm, CAL was 6 mm, and WKG was 0 mm. No BOP was observed at the site requiring surgical intervention. Gingival recession extended to the MGJ and showed no association with alveolar bone loss in the interdental area. Therefore, it was classified as Miller Class II. When the periodontal biotype was assessed using the biotype probe, all three colored tips were visible through the gingiva. Therefore, the biotype was classified as thin (Fig. 2A–C).

2) Case 2

The mean PD was 2.2 mm, and BOP was
observed at 20.8% of sites. Gingival inflammation was observed in the mandibular anterior region. A 4-mm gingival recession was observed in the mandibular right lateral incisor. At the recession site, PD was 2 mm, CAL was 6 mm, and WKG was 0 mm. Gingival recession was classified as Miller Class II, and the periodontal biotype in the mandibular right-side lateral incisors was classified as thin (Fig. 2 G and H).

### Fig. 1 Quantitative assessment of gingival thickness.

| Thin | Medium | Thick | Very thick |
|------|--------|-------|------------|
| Visible | Visible | Visible | – |
| Visible | Visible | – | – |
| Visible | – | – | – |

Thin: white color of probe clearly visible through gingival tissue. Medium: green probe clearly visible through gingival tissue; white probe not visible. Thick: blue probe clearly visible through gingival tissue, but neither white nor green probe visible. Very thick: all colors of probe not visible through gingival tissue. Visible: colored tip visible through gingival tissue. —: Colored tip not visible through gingival tissue.

### Fig. 2 Representative evaluation of gingival thickness according to biotype probe.

Periodontal biotype evaluation using biotype probe at baseline at mandibular right-side central incisor in Case 1 (A-C) and at mandibular right-side lateral incisors in Case 2 (G, H); and at postoperative 1 year in Case 1 (D-F) and in Case 2 (I-K). Close-up images of tip of periodontal biotype are shown in upper right of each figure. At baseline, all three colored tips were visible through gingival margin in both cases (A-C, G, and H). Periodontal biotypes were classified as thin. At postoperative 1 year, white and green tips were visible through gingiva in both cases (D, E, I, and J). Periodontal biotypes were classified as thick. Insert images show enlargement of tip of phenotype probe inserted into marginal tissue.
Clinical Procedures and Outcomes

1) Case 1

Based on the diagnosis of a thin periodontal biotype, combination therapy with CAF and CTG was selected instead of CAF alone. The treatment plan was presented to the patient and her consent obtained.

After initial periodontal therapy, the bilaminar technique was used to treat multiple recession defects at in the mandibular left and right central incisors (Fig. 3). The surgical procedure was carried out under local anesthesia (2% lidocaine xylocaine with 1:80,000 adrenaline). After local anesthesia was administered, scaling and root planing (SRP) were performed on the root. A horizontal incision was made from a point distal to tooth #31 to a point distal to #41 and between the two recession defects at a 3-mm distance from the tip of the papilla (Fig. 3B). Two vertical incisions were made from the outer ends of the horizontal incisions, diverging slightly as they extended as far as the MGJ. The site was prepared using a partial-thickness flap (Fig. 3C, D). The epithelia in the papillar area coronal to the horizontal incisions were removed in order to create a connective tissue bed for anchorage of the corresponding surgical papillae of the CAF (Fig. 3E). A section of palatal gingival was collected from the right palate and de-epithelialized (Fig. 3F, G). The graft was secured with absorbable sutures (Vicryl® 5-0, Ethicon, Somerville, New Jersey, USA) at the base of the de-epithelialized papilla (Fig. 3I). The flap was positioned to cover the graft and fixed 1 mm above the CEJ with 6-0 nylon sutures (Ethilon™; Ethicon, UK) (Fig. 3J). No brushing or flossing at the surgical site was indicated for 2 weeks. Sutures were removed at 2 weeks postoperatively, at which time the patient was instructed to carefully remove plaque from the crown with an ultra-soft toothbrush. Professional cleaning was performed at each follow-up visit.

At 3 months postoperatively, complete root coverage was observed (Fig. 5B). However, the RES was 6 (Table 1). At a 1-year reevaluation, a PD of 2 mm, a 4 mm gain in CAL, and a WKT of 3 mm were recorded. The periodontal biotype improved to thick (Fig. 2D–F). The total OHRQL score was 2, indicating an
improvement in comparison with at first visit (Fig. 6).

2) Case 2

Here, CAF and CTG were selected for treatment of gingival recession as the periodontal biotype was thin in this patient according to assessment with the biotype probe. The treatment plan was presented to the patient and her consent obtained. Preoperatively, SRP was performed on the root surfaces in the mandibular right central and lateral incisors. The surgical procedure was carried out under local anesthesia. A partial-thickness flap was made using a micro surgical blade (No.350; Feather, Osaka, Japan) and a continuous tunnel prepared from a point distal to tooth #43 to a point mesial to #41. The supraperiosteal dissection was extended well into the mucosal tissues to gain sufficient flap mobility. The interdental papillary tissues were carefully detached by a partial-thickness preparation in their buccal aspect (Fig. 4B). Gingival connective tissue was collected from the right palate. The collected palatal gingiva was de-epithelialized with a blade outside the oral cavity (Fig. 4C, D). A slit was made in the apical and coronal connective tissue to extend its medial-distal dimension; it was then inserted into the tunnel (Fig. 4E–G). The connective tissue graft was positioned at the CEJ, and a tension-free partial-thickness flap was coronally advanced to cover the graft; 6-0 nylon sutures (Ethilon™) were used to secure the connective tissue and the covering flap to the

Fig. 4 Surgical procedure in Case 2.

(A) Preoperative clinical view. (B) Confirmation of tunneling.
(C, D) Collected palatal gingiva. (E, F) Trial application of connective tissue. (G, H) Suturing.
teeth (Fig. 4H). Postoperative cleaning and care were performed as described in Case 1.

At 3 months postoperatively, complete root coverage was observed (Fig. 5F). At 3 and 6 months postoperatively, the RES has reached 9 (Table 1). A decrease was observed in RH, from 4 mm at baseline to 0 mm at 12 months, resulting in root coverage of 100%. Periodontal biotype showed an improvement from thin to thick (Fig. 2I–K). The total OHRQL score was 4, indicating an improvement in comparison with at first visit (Fig. 6). Dentin hypersensitivity disappeared quickly postoperatively.

Discussion

Gingival thickness, tooth location, and width of keratinized tissue are all important factors in achieving successful root surface dressing in cases of gingival recession. It has been suggested that CAF in combination with CTG for root coverage should be recommended when the periodontal biotype is thin. In the present study, gingival thickness was estimated to be thin based on preoperative assessment with a biotype probe. Therefore, the combination of CAF and CTG was selected as the surgical procedure to be used to obtain root coverage. We believe that the clinically favorable outcomes in root coverage observed here owe much to this decision.

With regard to the use of the term “periodontal biotype”, it should be noted that it has been introduced recently to describe the combination of the gingival phenotype as three-dimensional gingival volume and alveolar bone thickness. In the field of biology, biotype denotes a genetic group of organs which share the same specific genotype. On the other hand, phenotype denotes the appearance of an organ based on a combination of genetic traits and environmental factors. The probe used in the present report may therefore be thought of as a “phenotype probe”. This type of probe allows objective assessment of the quality of periodontal tissue; moreover, it is easy to use, biologically noninvasive, and costs less than any other device.

Although the etiology of gingival recession is still unclear, microbiologically induced inflammation in periodontal tissue and mechanical trauma (traumatic tooth brushing and bruxism) are considered important factors in its development. The position of the root might lead to bone dehiscence, and consequently the marginal gingiva could migrate apically, leading to root exposure. Additionally, the movement of teeth to positions outside the labial alveolar plate could result in thinning of the alveolar plate or even
dehiscence formation. Therefore, gingival recession is likely to occur during and after orthodontic treatment. In the two cases reported in the present study, inflammation due to dental plaque was an inducing factor, with gingival recession appearing where dehiscence of labial bone had occurred. It is possible that prior orthodontic treatment played a role in the etiology.

It has been reported that patients with a thick periodontal biotype are at lower risk of gingival recession than those with a thin biotype. In both the present cases, the periodontal biotype showed an improvement to thick by root coverage with CTG. It is expected that the periodontal condition in both cases will remain stable for a long time. As a result of the surgical intervention, the gingival margins aligned with the CEJ, creating an environment that facilitates better plaque control. It should be noted, however, that CTG is not required in all cases of root coverage. It has been reported that with a gingival thickness of >0.9 mm, CAF resulted in 100% of root coverage. Therefore, the risk involved in collection of connective tissue must be weighed against the clinical benefit of root coverage. Avoiding soft tissue graft collection from the palatal donor site reduces patient morbidity and the risk of postoperative complications.

The root coverage esthetic score in both cases was 10 at 12 months postoperatively. However, the improvement in esthetic score up to 6 months in Case 1 was moderate compared to that observed in Case 2. Scars were observed at the incision line of the papilla at 3 and 6 months postoperatively. One possible reason for this discrepancy may be the incision made in the interdental papilla in Case 1.

The present report illustrates the importance of qualitative assessment of periodontal biotype. The results demonstrated that the appropriate surgical procedure could be selected by objectively judging the periodontal biotype preoperatively. Even with a thin periodontal biotype, gingival recession and esthetics showed an improvement after treatment with CAF and CTG.

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### Table 1 Change in root coverage aesthetic score (RES) over time

|        | Case 1 | Case 2 |
|--------|--------|--------|
| RES    | 6      | 9      |
| GM     | 6      | 6      |
| MTC    | 0      | 1      |
| STT    | 0      | 0      |
| AMGJ   | 0      | 0      |
| GC     | 0      | 0      |
| RES    | 7      | 9      |
| GM     | 6      | 6      |
| MTC    | 1      | 1      |
| STT    | 1      | 0      |
| AMGJ   | 1      | 0      |
| GC     | 1      | 1      |
| RES    | 10     | 10     |
| GM     | 6      | 6      |
| MTC    | 1      | 1      |
| STT    | 1      | 1      |
| AMGJ   | 1      | 1      |
| GC     | 1      | 1      |

GM, gingival margin; MTC, marginal tissue contour; STT, soft tissue texture; AMGJ, alignment of the mucogingival junction; GC, gingival color; RES, root coverage esthetic score

Fig. 6 Change in total OHRQL score during treatment.

OHRQL comprised 6 primary domains: Health/Preclinical Disease, Biological/Clinical Disease, Symptom Status, Functional Status, Health Perceptions, and General Quality of Life. Graph shows change in total OHRQL score at baseline, and at postoperative 3, 6, and 12 months.
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