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Indication and Timing of Mucogingival Soft Tissue Augmentation Associated with Orthodontic Treatment

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ABSTRACT

Gingiva recession is defined as an apical shift of the gingival margin caused by different conditions/pathologies. It is associated with clinical attachment loss. Several studies showed prevalence of gingiva recession in orthodontic patients. Some predisposing factors should be taken carefully considering the effect of the treatment modality. No consensus agreement was identified about the timing of the soft tissue augmentation intervention for orthodontic patients with the risk of gingival recession. However, several critical factors can guide the decision making to obtain the most preferred treatment option.

This article reviews the factors regarding the correlation of gingival margin alteration and orthodontic treatment, and to assess the appropriate timing of soft tissue augmentation intervention according to the different factors. *Taiwanese Journal of Orthodontics* 2021;33(3):111–115

Keywords: Gingival recession; Indication; Mucogingival augmentation; Orthodontic treatment

INTRODUCTION

Gingival recession is defined as an apical shift of the gingival margin caused by different conditions/pathologies. It is associated with clinical attachment loss.¹ This may lead to hypersensitivity, unaesthetic appearance, higher susceptibility to root caries. Thus, soft tissue augmentation for gingival margin correction may be indicated. The etiologic factors of gingival recession may be gingival biotype, periodontal disease, trauma from occlusion, frenum attachments, bone dehiscences, etc.^{2–5} In orthodontic patients specifically, trauma caused by tooth brushing and plaque induced gingival inflammation are considered the dominating factors.¹ Previous research showed the prevalence of gingival recession in the dentition was mostly in

the labial surface of the mandibular central incisors within the esthetic zone.⁶

There is a controversy whether orthodontic treatment may cause gingival recession in certain orthodontic movements. The reported prevalence of gingiva recession is 5%–12% at the end of orthodontic treatment.⁷ During and after orthodontic treatment, the formation of alveolar bone dehiscences and the presence of gingivitis may be the factor of gingival recession according to Renkema et al.⁸

There is no consistency in literatures about the timing of soft tissue augmentation intervention for orthodontic patients with potential risk of gingival recession.⁹ The benefits of soft tissue augmentation to transform a thin to thick periodontal phenotype during orthodontic treatment remain unclear due to the limited studies available.¹⁰ The clarification of different factors, however, can be a guide to the decision making of the treatment plan. The purpose

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of this article is to review the factors regarding the correlation of gingival margin alteration and orthodontic treatment, and to specifically assess the appropriate timing of soft tissue augmentation intervention according to the different factors.

Correlation between gingival recession and orthodontic treatment

Change in the inclination of the incisors

There has been a controversy whether the inclination of the incisors can cause the development of gingival recessions. Some studies show correlation between incisor inclination and gingival recessions.^{11–13} In Sawan's study, it showed that labial movement of incisors demonstrated by the change in arch depth increases a higher chance of gingival recession significantly.¹⁴ The amount of recession was found to be comparable with the incisor inclination, gingival recession increased by approximately 0.2 mm per 1 degree labial inclination of the tooth.¹⁵ On the other hand, Vasconcelos' study showed that retroclination of the incisors with mesial basal relations increases the risk of gingival recession. The probability of developing gingival recession increased four times when the values of ANB is less than 1.45 degree and the inclination of the mandibular incisor is less than 92.6 degree.¹⁶ However, other studies result in contrast which showed no such correlation.^{17–19} In a recent retrospective long-term study, gingival recessions present five years after orthodontic treatment were 8.8%, 4.5%, and 16.3% from mandibular incisor retroclination, stable inclination and proclination groups respectively. The difference between the groups is not statistically significant.⁸

There seems to be no consistency in relation to gingiva recession and orthodontic teeth inclination according to studies. Other factors must also be considered collectively in regard to patient's initial teeth alignment. Ngan et al., 1991, found that for teeth with initial gingival recession, whether grafted or ungrafted prior orthodontic treatment, both groups present less gingival recession after being retroclined.²⁰ Therefore, other factors such as whether the teeth are moved within the alveolar bone housing may be the reason for gingiva recession rather than the inclination of the teeth.

Bone housing

The influence of tooth position in the alveolar process is important when evaluating the mucogingival condition in the dentition.⁷ Thin gingiva and labial bone plate is often associated with buccal position of teeth.^{21,22} Labial movement of lower

incisors in animal studies showed the development of bone dehiscences and periodontal attachment loss.^{23,24} In a research by Sawan et al., they found that there was 0.47 times lower odds of gingival recession for each 1 mm increase in pre-treatment mandibular symphysis width, and 0.39 times lower odds of gingival recession for each 1 mm increase in post-treatment mandibular symphysis width.¹⁴ Therefore, the author concluded that patients with wider symphysis are more resistant to bone dehiscences and gingival recession during orthodontic treatment.

In a review, Wennström concluded that as long as a tooth is moved solely in the alveolar bone process, there will be no development of gingival recession.² Studies have shown that in areas with labial dehiscences, bone formation occurs once the tooth is retracted within the alveolar process to its proper position.^{25,26} Therefore, in cases of labial prominent tooth with gingival recession, the correction of gingival margin occurs after the tooth is placed in a proper position in the alveolar bone and may also likely to have accompany with the formation of bone. It was acknowledged that although buccal movement of the tooth results in thinning of the gingival dimension, as long as the tooth is within the alveolar process, gingival recession will not occur.

Yet if the tooth movement is unavoidably to develop a bone dehiscence, the thickness of the labial gingiva would be an important factor to whether a gingiva recession may occur. Soft tissue augmentation to gain gingiva thickness in thin phenotype cases for this type of orthodontic movement might be indicated prior, as well as after, orthodontic treatment. Wennström suggested if soft tissue augmentation is still indicated after the proper position of the tooth placed, it will have a higher predictability of success than if it was performed before orthodontic treatment.² Zucchelli also points out the malposition of the root may lower the success rate of the surgery procedure.²⁷ When a tooth is placed in a proper position it will allow the complete coverage of the exposing root.

Recent studies have shown that it is beneficial to perform bone augmentation when orthodontic movement will compromise the bone housing. Such procedures include periodontally accelerated osteogenic orthodontics, surgically facilitated orthodontic therapy or corticotomy-assisted orthodontic therapy. There will be situations in which soft tissue augmentation may be needed prior or conjunction with bone grafting. The timing when soft tissue augmentation is needed prior to bone augmentation still needs more future studies to be determined.²⁸

Mucogingival condition

When assessing the gingiva status prior to orthodontic treatment, the presence of gingival recession may be a factor to consider. The study of Vasconcelos et al. showed the prevalence of gingival recession before orthodontic treatment in the group with gingival recession after treatment was 51%. In which, 47% of the patients with Miller Class I gingival recession after orthodontic treatment has recession before treatment, and 70% of the patients with Miller Class II gingival recession after orthodontic treatment had recession before treatment. The presence of gingival recession increases the risk of more severe gingival recession.¹⁶

The current consensus is that to maintain periodontal health, about 2 mm of keratinized gingiva (KG) and 1 mm of attached gingiva is desirable.⁷ However, a minimal amount of KG is not needed to prevent gingiva recession if optimal oral hygiene is maintained.²⁹ In previous longitudinal study, it has been proven that a certain amount of KG may not be the necessity for periodontal health maintenance and gingival recession prevention. Incidence of gingival recession without KG is not higher than areas with wide amount of KG.³⁰ However, when involved with orthodontic treatment, the amount of KG is predominantly considered related to gingiva recession. Mathews and Kokich suggested teeth with less than 2 mm of attached gingiva may require soft tissue augmentation, but other factors such as the combination of dehiscences, should also be considered before making the decision.³¹

It is suggested by the American Academy of Periodontology consensus review that augmentation before any labial tooth movement, especially in the presence of a thin phenotype or when there is <2 mm KG, should be planned accordingly on a case-by-case basis.¹⁰ In Sawan's study, it is reported that for each 1 mm increase in pre-treatment KG height, there was 0.77 times lower odds of gingival recession, and for each 1 mm increase in post-treatment KG height, there was 0.51 times lower odds of gingival recession.¹⁴ Yared et al. also indicated that teeth with KG height ≥ 2 mm are less susceptible to gingival recession.¹³ However, Wennström indicated that the important factors to consider are the direction of the tooth movement and the bucco-lingual thickness of the gingiva, rather than the quality of the KG.^{2,30} Furthermore, Coatoam et al. suggested that gingiva can be maintained during orthodontic therapy as well as in areas that have only a minimal zone of KG.³²

A recent experimental study presented that the initial labial gingiva thickness was not associated with gingival recession after orthodontic

treatment.¹⁵ However, Wennström revealed in clinical and histological evaluation that lingual tooth movement will increase the height of the free gingiva, by increasing the bucco-lingual thickness of the facial gingiva. In Wennström's animal experiments, it is found that after extensive labial bodily movement of incisors, most teeth showed minimal apical displacement of the gingival margin, but only the reduced height of the free gingival had no loss of connective tissue attachment.³³ In conclusion, Wennström suggested if the thin gingiva is the result of a prominent position of the tooth, the lingual movement of orthodontic treatment will increase the gingival thickness and the coronal migrate of the free gingiva, thus no need for pre-orthodontic soft tissue augmentation.² This could also be implied to the cases with gingival recession caused by prominent tooth position before orthodontic treatment. If the tooth is unavoidably to be moved buccally or to cause a dehiscence, then the thickness of the gingiva tissue must be considered for the development of gingiva recession. It is favorable to proceed soft tissue augmentation before orthodontic treatment for the prevention of gingival recession in patients with a thin type of gingiva.⁹ Patients with thin gingiva less than 1 mm, measured from within the coronal one-third of the periodontal soft tissue, are more prone to have future gingival recession.²⁸ Gingiva recession is not directly caused by orthodontic movement, however, thinner marginal gingiva may be more susceptible to gingival inflammation caused by plaque or traumatic brushing.³⁰

Other factors

Different types of orthodontic teeth movement can have different result in gingival margin alteration. It is reported that non-extraction orthodontic treated patients can have 1.31 times higher odds of gingival recession than patients receiving extraction.¹⁴ In a previous study, it is also proven that rotational movement of teeth has no significant association with gingival recession.³¹ It is important for orthodontists to carefully consider their treatment modalities. Over expansion of the arch should be avoided, and maintaining the teeth within the bone housing by considering dental extractions or interproximal enamel reduction should be considered in the presence of a bone dehiscence.³⁴

Maintenance of patient's oral hygiene is another critical factor for the development of gingiva recession, regardless of orthodontic treatment. A recession defect can be caused by a localized plaque induced inflammation.³⁴ In one study, it is presented that patients with Miller Class II recessions

had significantly more pretreatment gingiva inflammation than those with Miller Class I recessions.¹⁶ In the presence of plaque induced gingivitis, a thin type of gingiva is more susceptible to recession than a thick marginal soft tissue. Furthermore, extensive tipping and intrusive movement may displace supra gingival plaque into subgingival area, thus cause the loss of soft tissue attachment.²

Another critical factor affecting the level of the gingival margin is the age of the patients.³⁵ One study presented that the age of the patients with post orthodontic Miller Class II recession was significantly higher than patients with Miller Class I recession. Moreover, older adolescents and adults might be more susceptible to gingival recession after orthodontic treatment.¹⁶ The prevalence of gingiva recession increases with age due to the faster cell turnover in younger patients.^{5,36} It is also reported that patients younger than 16 years had lower chance to develop gingiva recession.¹⁷ Since the prevalence of gingival recession gradually increases with age, gingival recession tends to occur slowly after orthodontic treatment rather than during.³⁷ Thus the factors correlated to gingiva recession should be taken into consideration during orthodontic treatment as well as after orthodontic treatment.

CONCLUSION

Regardless of the inclination of the teeth, as long as the teeth is moved within the alveolar bone housing, bone dehiscences and gingival recession will not occur. For cases require dental proclination, if the teeth can be maintained within the bone housing, gingival recession would not result. In prominent tooth cases, whether with initial gingival recession or not, if the tooth can be corrected into its proper position within the alveolar process, then bone formation and gingival growth will occur. However, if the tooth is inevitably to be moved outside the bone process, then the thickness of the gingiva will be a key factor whether gingiva recession will occur. Soft tissue augmentation to gain thickness of the gingiva prior to orthodontic treatment in this case can be considered. Some researchers also suggest that <2 mm KG should be considered as an indication for augmentation procedures to maintain the periodontium. The patient's oral hygiene should also be maintained at all times, during orthodontic treatment as well as after orthodontic treatment, to avoid further gingiva recession.

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ETHICAL APPROVAL

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PATIENT CONSENT

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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