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## Current issues in the management of soft tissues of the oral vestibule before orthodontic treatment

Problemas actuales en el manejo de los tejidos blandos del vestíbulo oral antes del tratamiento de ortodoncia

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### RESUMEN:

Las tareas de tratamiento de ortodoncia incluyen requisitos no solo para la alineación adecuada de los dientes y las relaciones óptimas de la mandíbula en los planos sagital y vertical con el máximo de contactos oclusales, sino también para tejidos periodontales sanos al finalizar el tratamiento de ortodoncia. A menudo, ciertas anomalías oclusales afectan los tejidos blandos circundantes. En esta situación, el ortodoncista se da cuenta de que no puede comenzar el tratamiento de ortodoncia hasta que se resuelva el problema periodontal. Las anomalías de los tejidos blandos incluyen cordones epiteliales que hacen que las uniones periósticas sean extremadamente delgadas y pueden prevenir la erupción de los dientes o causar múltiples recesiones gingivales. El vestíbulo oral poco profundo también afecta negativamente la posición de los incisivos, especialmente en la mandíbula inferior. En tales casos, los incisivos no se deben mover utilizando dispositivos de ortodoncia fijos, ya que esto causará adelgazamiento de la encía adherida en los márgenes cervicales de los dientes, o exacerbará las recesiones gingivales existentes, lo que a su vez conducirá a la sensibilidad de la raíz. Si un paciente ya exhibe recesiones gingivales múltiples o únicas severamente expresadas, sugerimos su cierre mediante cirugía como intervención primaria antes del tratamiento de ortodoncia con dispositivos fijos o alineadores, lo que traumatizará continuamente el borde delgado de la encía adherida. En este artículo, abordaremos los procedimientos periodontales necesarios que los ortodoncistas deben considerar antes de iniciar la corrección ortodóncica para evitar la degradación irreversible de los tejidos blandos de la cavidad oral, los tejidos periodontales.

**PALABRAS CLAVE:** periodonto, vestíbulo oral, ortodoncia, alineadores.

**ABSTRACT:**

Orthodontic treatment tasks include requirements not only for proper teeth alignment and optimal jaw relationships in the sagittal and vertical planes with the maximum of occlusal contacts but also for healthy periodontal tissues upon completion of orthodontic treatment. Often, certain occlusal anomalies affect the surrounding soft tissues. In this situation, the orthodontist realizes that not until the periodontal problem is resolved can the orthodontic treatment begin. Soft tissue anomalies include epithelial cords that make the periosteal attachments extremely thin, may prevent tooth eruption, or cause multiple gingival recessions. The shallow oral vestibule also adversely affects the position of the incisors, especially in the lower jaw. In such cases, incisors should not be moved using fixed orthodontic appliances, since this will cause thinning of the attached gingiva in the cervical margins of the teeth, or exacerbate the existing gingival recessions, which in turn will lead to root sensitivity. If a patient already exhibits multiple or severely expressed single gingival recessions, we suggest their closure by surgery as a primary intervention before orthodontic treatment with fixed appliances or aligners, which will continuously traumatize the thin edge of attached gingiva. In this article, we will address the necessary periodontal procedures that orthodontists should consider before initiating orthodontic correction to avoid irreversible degradation of the soft tissues of the oral cavity, periodontal tissues.

**KEYWORDS:** periodontium, oral vestibule, orthodontics, aligners.

**INTRODUCTION**

The Preamble of the Constitution of the World Health Organization (WHO) defines health as ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.’<sup>1</sup> This wording suggests that upon completion of treatment, the patient’s physical and emotional well-being should be restored, while physical defects should be undoubtedly eliminated. The etiology and pathogenesis of dental malocclusion enable the assumption that dental structures have been previously affected by certain predisposing factors triggering at some stage the development of anomalies of jaw relationships, dental arches, free-standing teeth, and periodontal tissues. Quite often, during orthodontic treatment, patients begin noticing periodontal problems – either newly arisen or exacerbated over the short period of treatment that led to the exposure of cervical margins and teeth sensitivity. These problems arise regardless of whether the patient has been fitted with removable aligners, which continuously traumatize gingival tissue adjacent to teeth, or non-removable appliances – braces that reposition teeth vestibularly, expanding dental arches, thus increasing tension in soft tissues adjacent to orthodontic hardware. Also, it is not infrequent that following the elimination of occlusal anomalies defects appear in the form of exposed teeth roots. This may be obvious immediately after the removal of orthodontic appliances or these problems may occur after some time. In all these cases, the principal rule of orthodontic treatment – ‘first, not harm’ – is violated. Indeed, there must have been warning signs, which have been ignored due to either inadequate knowledge of the developing soft tissue problems, or the assumption that there will be an opportunity to eliminate the issue by referring the patient to a periodontist after orthodontic treatment. Unfortunately, this strategy does not always work. Only a consultation with the periodontist before initiating orthodontic intervention will enable to establish an individual treatment plan, which in many cases identifies periodontal treatment as the first phase. Indeed, clinicians identify and eliminate many causative factors of the gingival recession. However, they tend to do so after exposing the tooth roots and they do not always pay due attention to the depth of the oral vestibule and the amount of the attached gingiva when planning the upcoming treatment.

The condition of the vestibular soft tissues, not only affects the health of the periodontium, but it is seen as the main causative factor of localized periodontal defects, most commonly roots exposure, or persistent inflammation<sup>2</sup>. There is a direct linear relationship between the width of the attached gingiva and the frequency of occurrence of periodontal pathology – the wider the attached gingiva, the lower the risk of developing periodontal disease<sup>2</sup>. The minimum width of the attached gingiva should be 5 mm<sup>2,3</sup>. Another contributing factor in developing gingival recessions is the ratio of a free gingival zone to the attached gingival zone. The optimal ratio is considered to be 1:5<sup>2</sup>.

In patients with occlusal anomalies and a shallow oral vestibule, orthodontic treatment may trigger tissue resorption. Patients with occlusal anomalies combined with a shallow vestibule and periodontitis in remission are classified as high-risk patients due to the frequent exacerbations of periodontitis and the development of gingival recessions. The dense and wideband of attached gingiva serves as a “tissue barrier”<sup>4</sup> that prevents the recurrence of periodontitis and gingival recession<sup>5</sup>.

When orthodontic treatment is recommended, there arises a need for increasing the amount of attached gingiva<sup>6,7</sup>. To prevent severe destructive periodontal disease, it is crucial to timely identify and eliminate functional trauma of periodontal tissues by surgical correction of the oral vestibule – vestibuloplasty<sup>3</sup>

We consider it highly relevant to propose our method for developing a treatment algorithm in close cooperation between the orthodontist and periodontist while planning correction of occlusal anomalies in patients with a shallow vestibule and an approach for preparing vestibular soft tissues for orthodontic treatment. Thus, in this work we propose to develop a periodontal treatment algorithm for patients with occlusal anomalies and a shallow oral vestibule before orthodontic treatment.

## MATERIAL AND METHODS

Subjects in our study were patients with Angle Class I and II occlusal anomalies, ICD-10K07, with a shallow oral vestibule, which we evaluated in the area of the lower incisors and canines. The patients were divided into the following groups:

Group 1 – patients without periodontal disorders. In this group, we included patients without a gingival recession; vestibular depth – less than 5 mm; the width of the attached gingiva– 1-3 mm; the ratio of free to attached gingival zone – 1:1-1:3.

Group 2 – patients with generalized moderate periodontitis in remission. This group was divided into two subgroups. Group 2a – patients without a gingival recession; the periodontal probing pocket depth – 1 mm; vestibular depth – less than 5 mm; the width of the attached gingiva– 1-3 mm; the ratio of the free gingival zone to attached gingival zone – 1:1-1:3.

Group 2b – patients without a gingival recession, the periodontal probing pocket depth – 2 mm; vestibular depth – less than 5 mm; the width of the attached gingiva – 1-3 mm; the ratio of free to attached gingival zone – 1:0.5 -1:1.5.

Group 3 – patients with severe generalized rapidly progressive periodontitis in remission. In this group, we included patients with gingival recession (Miller class IV) periodontal probing pocket depth – 1 mm; recession depth – 1-3 mm; vestibular depth – less than 5 mm; the width of the attached gingiva – 1-3 mm; the ratio of free to attached gingival zone – 1:1-1:3.

The patients in Groups 2 and 3 received periodontal debridement. Etiotropic treatment included professional cleaning, medication, and surgical periodontal therapy. Tissue resection and regeneration techniques were used. The treatment resulted in periodontal disease remission. Clinical manifestations of inflammation – edema, hyperemia, bleeding gingiva, and tooth mobility – were not observed. Probing revealed pocket depth not more than 1-2 mm in the regions of mandibular incisors and canines and not more than 3 mm around the rest of the teeth on the upper and lower jaws.

The need for corrective intervention before orthodontic treatment was determined by taking into account vestibular depth, the width of the attached gingiva and the ratio of free to the attached gingival zone.

Vestibular depth, defined as the distance from the free gingival margin to the mucogingival junction, was measured with a periodontal probe positioned vertically. Using the classification system of H.Y. Pakalns, vestibular depth was defined as shallow– less than 5 mm; medium– 5-10 mm; and deep – more than 10 mm.

The width of free gingiva is the distance from the gingival margin to the epithelium of the gingival sulcus. The width of the attached gingiva was calculated by subtracting the width of free gingiva from the vestibular depth.

On Group 1 patients, corrective surgery was performed using a 4 mm wide free gingival graft.

On Group 2a patients, corrective surgery was performed using a 4 mm wide free gingival graft.

On Group 2b patients, corrective surgery was performed using a 6 mm wide free gingival graft.

On Group 3 patients, corrective surgery was performed using a free 4 mm wide free gingival graft.

Corrective surgical procedures create a favourable anatomical conditions for maintaining periodontal health. Vestibuloplasty is one of such procedures. At present, vestibuloplasty with a free gingival graft (FGG) is considered the gold standard<sup>11-13</sup> in mucogingival plastic surgery. Not only does it increase the vestibular depth and the width of the attached gingiva, but it also halts the progression of the gingival recession. The use of autogenous connective tissue grafts increases the vestibular depth and the zone of keratinized gingival was first described by Bjorn<sup>8</sup> and later examined in detail in a series of papers<sup>9,10</sup>.

To create the recipient bed, an incision was made along a line passing through the mucogingival junction, then the movable mucous membrane and muscle fibers were displaced apically. Thus, the recipient bed for a free gingival graft was prepared. *The width and depth of the recipient bed exceeded the dimensions of the free gingival graft by 1-2 mm.*

The selection of the donor site for graft harvesting is of paramount importance since it is donor connective tissue that promotes keratinization of the auto graft<sup>14-16</sup>. The most preferable donor site for a connective tissue graft is the hard palate.

For increasing vestibule depth and the width of keratinized tissue, thin or medium-thickness autografts are optimal – 0.5-0.75 mm<sup>17</sup>. This was our reference point when harvesting the graft. A graft composed of epithelium and connective tissue was removed from the hard palate; the graft thickness –less than 1 mm. After removal from the donor site, the free gingival graft is devoid of nutrient supply. Therefore, it is recommended that the graft is placed on the recipient site without delay. For the first three days after positioning and suturing in place, cellular nutrition of the graft is maintained by a vascular plasmatic circulation<sup>18-21</sup>. From day 3 to day 11, a network of blood vessels begins to form within the graft; anastomoses are established between vessels in the recipient bed and those in the graft, the blood supply to the displaced tissues is being restored<sup>22</sup>. Between day 10 and day 14 the sutures are removed, the surgical protocol is completed. However, the patient remains under the periodontist's care for the entire period of orthodontic treatment.

From day 14 to day 42, the following occurs sequentially: local tissue resorption, reparative osteogenesis, and bone mineralization – the bone tissue response to surgical trauma. While these physiological processes will always take place, they are reversible, often leaving no change in bone architecture<sup>22</sup>. Nonetheless, we believe orthodontic treatment should not be started or fixed orthodontic appliance should not be activated until 30-40 days after vestibuloplasty, especially in thin biotype patients with periodontitis in remission. Active orthodontic intervention during this period may be perceived as excessive tissue damage leading to periodontal tissue destruction with an unpredictable outcome.

## RESULTS

The periodontal treatment achieved changes in the following parameters: vestibular depth, the width of the attached gingiva and the ratio of free to the attached gingival zone.

Group 1 –after vestibuloplasty with a 4 mm wide free gingival graft, the vestibular depth was 6-8 mm, the width of the attached gingiva–5-7 mm, and the ratio of free to attached gingival zone– 1:5-1:7.

Group 2a – after vestibuloplasty with a 4 mm wide free gingival graft, the vestibular depth was 6-8 mm, the width of the attached gingiva– 5-7 mm, and the ratio of free to attached gingival zone – 1:5-1:7.

Group 2b – after vestibuloplasty with a 6 mm wide free gingival graft, the vestibular depth was 9-11 mm, the width of the attached gingiva– 7–9 mm, and the ratio of free to attached gingival zone – 1:3.5–1:4.5.

Group 3 –after vestibuloplasty with a 4 mm wide free gingival graft, the vestibular depth was 6-8 mm, the width of the attached gingiva– 5-7 mm, and the ratio of free to attached gingival zone – 1:5-1:7.

## CONCLUSION

1. Correction of the oral vestibule in patients with dentoalveolar anomalies should be carried out before orthodontic treatment to prevent gingival recession, if these patients have a shallow vestibule – less than 5 mm, the width of attached gingiva– 1-3 mm, and the ratio of free to attached gingival zone – 1:1-1:3.

2. Correction of the oral vestibule in patients with dento-alveolar anomalies and chronic periodontitis in remission should be carried out before orthodontic treatment to prevent exacerbation of the disease, gingival recession, and alveolar bone loss resorption.

3. When choosing the width of the free gingival graft for increasing the keratinized gingiva, the ratio of free to the attached gingival zone should be used as a reference point. The optimal ratio is considered to be 1:5.

4. It is recommended that orthodontic treatment in such patients should start 30-40 days after increasing the width of the attached gingiva using a free gingival graft.

It is recommended that neither removable aligners nor individually removable retainers be used in orthodontic treatment of such patients to avoid injuring the marginal periodontal tissues.

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