Case Report

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The significance of the distance between tooth roots for the formation of the interdental papilla

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Abstract

INTRODUCTION. In contemporary periodontology, the interproximal attachment receives significant attention, as it is a key diagnostic and prognostic factor. Clinicians employ various surgical techniques to reconstruct the papilla and eliminate black triangles. Currently, some criteria that may influence the achievement of interproximal attachment are known. This article highlights the importance of one such criterion – the distance between tooth roots. The aim of this study is to demonstrate the significance of the distance between roots for the formation of interproximal attachment. A clinical case involving two surgical procedures in the region of teeth 42–32 and orthodontic treatment is presented. Four teeth with proximal, mid-vestibular, and mid-lingual recessions were treated. The mean root coverage in the proximal area reached 85% after reducing the interradicular distance to 2.7 mm. This study demonstrates the relevance of interradicular distance as a criterion for interproximal attachment formation.

AIM. The aim of this study is to demonstrate the significance of root proximity in the formation of interproximal attachment. A clinical case involving two surgical procedures in the area of teeth 42–32 combined with orthodontic treatment is presented. Four teeth with proximal, mid-buccal, and mid-lingual recessions were treated. The average root coverage in the proximal region reached 85% after reducing the interradicular distance to 2.7 mm. This study demonstrates that the distance between roots is a critical factor in achieving interproximal attachment formation.

MATERIALS AND METHODS. A clinical case involving two surgical procedures in the region of teeth 42–32 and orthodontic treatment is presented.

RESULTS. Four teeth with proximal, mid-vestibular, and mid-lingual recessions were treated. The mean root coverage in the proximal area reached 85% after reducing the interradicular distance to 2.7 mm.

CONCLUSIONS. This clinical case demonstrates that successful formation of interproximal attachment during recession treatment requires consideration of the distance between tooth roots. It was shown that the initial surgical treatment, although providing temporary improvement, did not yield a stable outcome due to insufficient proximity of the roots (3.6 mm). Subsequent orthodontic correction to reduce the interradicular distance to 2.7 mm resulted in a significant and stable increase in the volume of the interdental papilla and root coverage. Therefore, planning of mucogingival procedures should include assessment of interradicular distance, and when unfavorable, preoperative orthodontic preparation should be considered.

Keywords: periodontology, gingival recession, periodontal attachment loss, gingivoplasty, periodontitis, periodontal tissue regeneration

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Значение расстояния между корнями зубов для формирования межзубного сосочка

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Резюме

ВВЕДЕНИЕ. В современной пародонтологии итерпроксимальному прикреплению уделяют большое внимание, так как оно является ключевым диагностическим и прогностическим фактором. Доктора используют различные хирургические методики, чтобы получить сосочек и устранить черные тре-

угольники. На данный момент мы знаем часть критериев, которые могут влиять на получение интерпроксимального прикрепления. Данная статья демонстрирует важность такого критерия, как расстояние между корнями. Целью данного исследования является показать значимость расстояния между корнями для формирования интерпроксимального прикрепления. Рассмотрен клинический случай с проведением двух операций в области зубов 42–32 и ортодонтического лечения. Было обработано 4 зуба проксимальных, средневестибулярных и среднеязычных рецессий. Среднее покрытие корней в проксимальной области достигло 85% после сближения корней на расстояние 2,7 мм. В рамках данного исследования продемонстрирована значимость критерия для формирования интерпркимального прикрепления – расстояние между корнями.

ЦЕЛЬ ИССЛЕДОВАНИЯ. Целью данного исследования является показать значимость расстояния между корнями для формирования интерпроксимального прикрепления.

МАТЕРИАЛЫ И МЕТОДЫ. Рассмотрен клинический случай с проведением двух операций в области зубов 42–32 и ортодонтического лечения.

РЕЗУЛЬТАТЫ. Было обработано 4 зуба проксимальных, средневестибулярных и среднеязычных рецессий. Среднее покрытие корней в проксимальной области достигло 85% после сближения корней на расстояние 2,7 мм.

ВЫВОДЫ. Настоящий клинический случай демонстрирует, что для успешного формирования интерпроксимального прикрепления при лечении рецессий необходимо учитывать расстояние между корнями. Показано, что первоначальное хирургическое лечение, хотя и привело к временному улучшению, не обеспечило стабильного результата из-за недостаточной близости корней (3,6 мм). Последующая ортодонтическая коррекцию по сближению корней до 2,7 мм позволило достичь значительного и стабильного увеличения объема межзубного сосочка и покрытия корней. Таким образом, планирование мукогингивальных операций должно включать оценку межкорневого расстояния, а при его неблагоприятных значениях – рассматривать возможность предоперационной ортодонтической подготовки.

Ключевые слова: пародонтология, рецессия десны, потеря прикрепления пародонта, гингивопластика, пародонтит, регенерация тканей пародонта

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INTRODUCTION

The interdental papilla is a part of the gingiva that occupies the area between two adjacent teeth. It is composed of dense connective tissue containing blood vessels, nerves, and fibers, and is covered by oral keratinized epithelium externally, oral sulcular epithelium internally, and junctional epithelium [1].

Frequently, the absence of papillary height is a consequence of periodontal disease, as well as a response to periodontal treatment, particularly following surgical interventions [2; 3].

GLoss of soft tissue leads to the formation of an open interdental embrasure, or “black triangle”, which can result not only in an aesthetic defect but also in functional problems, such as food impaction, impaired oral hygiene, and halitosis. Consequently, the risk of caries on proximal surfaces increases. With rising aesthetic demands of patients and the development of cosmetic dentistry, the significance of the smile’s central zone has increased, where the interdental papilla plays a critical role in soft tissue harmony [3].

Despite significant advances in dentistry, the predictability and long-term outcomes of interdental papilla reconstruction remain subjects of active research and clinical discussion. This is due to the complexity of anatomical relationships in the interproximal area, biological characteristics of soft tissue regeneration, and the influence of multiple factors.

In this article, we examine an important parameter: the distance between tooth roots and its influence on the formation of interproximal tissue volume.

AIM

To demonstrate the significance of the interradicular distance for the formation of interproximal attachment.

MATERIALS AND METHODS

A clinical case involving two surgical procedures in the region of teeth 42–32 and orthodontic treatment is presented. A 40-year-old non-smoking woman with an unremarkable medical history presented to a private dental clinic in October 2022 with the main complaints of root exposure and hypersensitivity in the mandibular region (Fig. 1).

Medical history: The patient had not previously received any treatment for gingival recession. At the time of presentation, she was undergoing orthodontic treatment with aligners.

Intraoral examination: Indices: BOP 15%, PI, and individual oral hygiene were satisfactory. The clinical data obtained during probing are presented in Table 1 and Fig. 2, including probing depth (PD), recession depth (RD), and width of attached gingiva (WAG).

Based on clinical and radiographic data, a diagnosis of localized Miller Class IV gingival recessions was established.

Fig. 1. Before surgical treatment

Рис. 1. До хирургического лечения

Treatment plan:

1. Surgical phase: Implementation of a two-layer technique.

2. Continuation of orthodontic phase: Orthodontic treatment performed using a fixed bracket system.

Written informed consent for the mucogingival surgery was obtained from the patient.

Immediately prior to surgery, the patient rinsed her mouth for 30 seconds with 0.12% chlorhexidine gluconate solution. Contact points were splinted with composite to facilitate suture placement. Infiltration anesthesia was administered using 1.7 ml of 4% Articaine with adrenaline 1:200,000.

Table 1. Clinical data obtained during probing

Таблица 1. Полученные клинические данные при зондировании

Distal		Tooth 4.2			Tooth 4.1			Tooth 3.1			Tooth 3.2		
		Distal	Central	Mesial	Distal	Central	Mesial	Distal	Central	Mesial	Distal	Central	Mesial
Buccal recession depth (mm)	Before	0	1	1	2	3	4	3	4	4	1	1	2
	Surgery – 3 months	0	0	0	1	2	2	1	2	1	0	0	0
	Surgery – 6 months	0	1	1	2	4	4	2	3	4	1	1	1
	Orthodontic treatment – 6 months	0	1	0	1	2	2	2	2	1	0	0	1
	Change	0	0	1	1	2	2	1	2	3	1	1	1
Lingual recession depth (mm)	Before	0	2	2	2	3	4	3	3	1	1	1	2
	Surgery – 3 months	1	0	0	1	2	2	1	2	1	0	1	0
	Surgery – 6 months	0	1	1	2	4	4	2	3	1	1	1	0
	Orthodontic treatment – 6 months	0	1	2	1	3	2	2	2	1	0	0	1
	Change	0	1	0	1	0	2	1	1	0	1	1	1
Buccal probing depth (mm)	Before	1	2	1	1	2	1	1	1	1	2	1	1
	Surgery – 3 months	1	2	2	1	1	2	1	1	2	1	2	1
	Surgery – 6 months	2	2	1	1	2	1	2	1	1	2	1	2
	Orthodontic treatment – 6 months	1	1	1	1	2	1	1	1	1	1	1	1
	Change	0	1	0	0	1	0	0	0	0	1	0	0
Lingual probing depth (mm)	Before	1	2	1	2	2	1	1	1	2	1	1	2
	Surgery – 3 months	2	1	2	2	1	1	1	1	1	1	1	2
	Surgery – 6 months	2	1	2	1	2	2	2	1	1	2	2	2
	Orthodontic treatment – 6 months	1	1	1	1	1	1	1	1	1	1	1	2
	Change	0	1	0	1	1	0	0	0	1	0	0	0
Buccal attachment level (mm)	Before	2	3	2	2	2	3	2	3	2	2	2	3
	Surgery – 3 months	4	5	4	4	5	6	4	5	4	4	5	6
	Surgery – 6 months	5	5	4	4	5	6	5	5	4	4	5	6
	Orthodontic treatment – 6 months	5	5	4	4	5	6	5	5	4	4	5	6
	Change	3	2	2	2	3	3	3	2	2	2	3	3
Lingual attachment level (mm)	Before	3	2	2	2	2	3	3	2	2	2	2	3
	Surgery – 3 months	4	4	4	4	4	4	4	4	4	4	4	4
	Surgery – 6 months	4	4	4	4	4	4	4	4	4	4	4	4
	Orthodontic treatment – 6 months	4	3	4	3	3	4	4	3	4	3	3	4
	Change	1	1	2	1	1	1	1	1	2	1	1	1

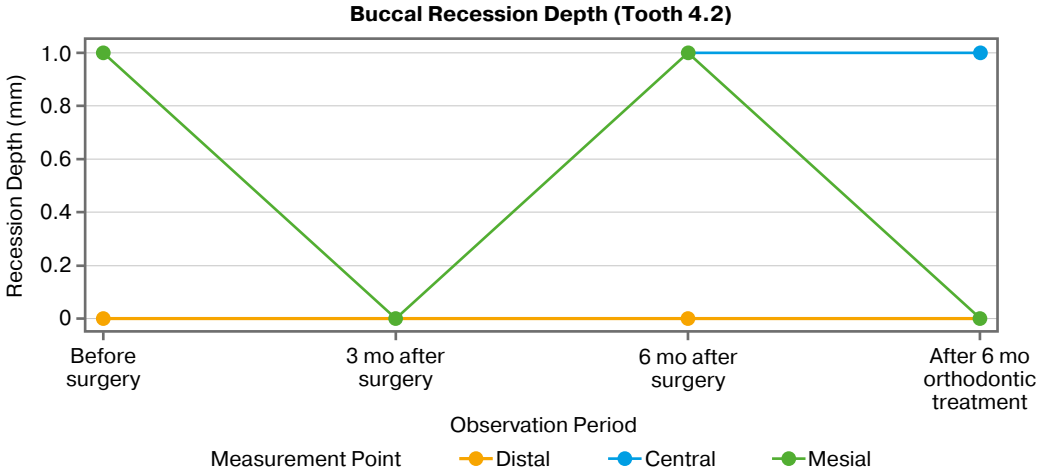

Fig. 2. Clinical data obtained during probing

Рис. 2. Полученные клинические данные при зондировании

Using a flexible microsurgical VIPER blade, intrasulcular incisions were made on the vestibular and lingual aspects in the region of teeth 42–32. Tunnel instruments were used to create split-thickness mucosal tunnels on both vestibular and lingual sides. Muscular and collagen fibers attached apically and laterally to the inner surface of the tunnel were dissected with the VIPER microsurgical blade. Flap mobility was checked using a periodontal probe.

Two free gingival autografts were harvested with a 15c scalpel – one corresponding to the length of the vestibular tunnel and the other to the lingual tunnel. The grafts measured 4 mm in height and 2 mm in thickness. The grafts were carefully de-epithelialized on the surgical table using a 15c scalpel.

The de-epithelialized free grafts were then inserted into the vestibular and lingual tunnels using knot sutures. The tunnel flaps, along with the grafts, were coronally advanced and stabilized with double-crossed sutures according to O. Zuhr (IJED 2009). Suturing was performed using 6-0 and 7-0 Prolene.

RESULTS

Three months after the surgery, an increase in the width of the attached gingiva and no increase in probing depth were observed. The tip of the papilla between teeth 41 and 31 was positioned 3 mm more coronally compared to the baseline. Partial root coverage of 2 mm was achieved on teeth 31 and 41, while complete coverage was obtained on teeth 32 and 42 (Fig. 3).

Six months after the surgery, the width of the attached gingiva remained stable, with no increase in probing depth. The tip of the papilla between teeth 41 and 31 returned to the baseline level. Recession increased by 1 mm and 2 mm on teeth 31 and 41, respectively, while teeth 32 and 42 showed a recession of up to 1 mm (Fig. 4).

The interradicular distance measured 2.7 mm. Six months after orthodontic treatment, the distance between the roots was altered, and changes in recession depth of 1–2 mm on the mesial and distal sides were observed. The tip of the papilla between teeth 41 and 31 was positioned 3 mm more coronally compared to the baseline. Partial root coverage was achieved on teeth 41, 31, and 42, with a residual gingival recession of 1 mm, while complete root coverage was obtained on tooth 32.

The aesthetic outcome was stable, with no increase in gingival recession observed on the vestibular surfaces of the incisors (Fig. 5).

Fig. 3. Result after 3 months

Рис. 3. Результат через 3 месяца

Fig. 4. Result after 6 months

Рис. 4. Результат через 6 месяцев

Fig. 5. Result after orthodontic treatment

Рис. 5. Результат после ортодонтического лечения

DISCUSSION

This article describes a clinical case in which surgical treatment was performed to increase the volume of interproximal tissues. Although a reduction in recession depth on the mesial and distal aspects was observed at three months, by six months the recession depth had returned toward baseline values, with only an increase in gingival thickness. The interradicular distance at this stage was 3.6 mm.

The classic study by Tarnow et al. demonstrated that the most critical prognostic factor is the distance from the apical portion of the contact point to the crest of the interdental bone, with a threshold of 5 mm or less, where the interdental papilla is present in nearly 100% of cases [3; 4]. However, Chow et al. emphasized the importance of interradicular distance, indicating a favorable distance of 2.8 mm [5], which was later refined by Carnio to 2.5 mm [6].

Six months after orthodontic treatment, the interradicular distance was reduced to 2.7 mm, resulting in significant root coverage, clinical improvement of the interdental papilla, and a marked increase in interproximal attachment with reduced probing depth.

This clinical case highlights the importance of considering interradicular distance when planning surgical interventions aimed at achieving interproximal attachment. Furthermore, the observed improvements in probing depth, attachment gain, and papilla height in this case encourage further investigation into the use of this periodontal regeneration technique.

CONCLUSIONS

This clinical case demonstrates that successful formation of interproximal attachment during recession treatment requires careful consideration of the interradicular distance. The initial surgical treatment, although providing temporary improvement, did not achieve a stable outcome due to insufficient root proximity (3.6 mm). Subsequent orthodontic correction, reducing the interradicular distance to 2.7 mm, resulted in a significant and stable increase in both interdental papilla volume and root coverage. Therefore, planning of mucogingival procedures should include assessment of interradicular distance, and when unfavorable, preoperative orthodontic preparation should be considered.

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AUTHOR'S CONTRIBUTION

Zurab S. Khabadze – preparation of the manuscript or its critical revision for important intellectual content, final approval of the version to be published.

Kristina S. Inozemtseva – substantial contribution to the conception and design of the study.

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