

REMODELING OF THE MAXILLARY CANINE TO THE SHAPE OF THE LATERAL INCISOR AS A METHOD OF HYPODONTIA TREATMENT – 10-YEAR CLINICAL OBSERVATIONS

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ABSTRACT

INTRODUCTION: Hypodontia of the maxillary lateral incisors is an esthetically relevant developmental anomaly. One of the treatment methods is canine mesialization. However, it should be noted that mesialization alone may not prove sufficient and that the treatment will need to include reshaping of the canine and the first premolar.

OBJECTIVES: The aim of the study is to present the results of 10-year clinical observations of the effects of canine reshaping.

MATERIAL AND METHODS: In 2008, 37 patients with uni- and bilateral hypodontia of maxillary lateral incisors underwent canine mesialization and crown reshaping. The reshaping of the canine teeth was submitted to periodic monitoring: every 3 months in the first year and every 6 to 12 months in the following years. Shape, color, structure and marginal adaptation, as well as the presence of secondary caries, were assessed. Analysis of the findings included a percentage of the acceptable clinical outcome in the consecutive years.

RESULTS: An acceptable clinical result was achieved in 100% of patients in years 1-3, 83.93% of patients in years 4-7, 78.57% of patients in year 8, 73.21% of patients in year 9 and 62.5% in year 10.

CONCLUSIONS: The clinical studies have shown that space closure results in acceptable group function occlusion, does not affect the function of temporomandibular joints, and preserves the healthy periodontium. However, it should be noted that the reshaping of the canine using the direct method and resin composite may require routine maintenance or composite reapplication.

KEY WORDS: hypodontia, canine mesialization, reshaping of the canine, composites, clinical assessment.

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INTRODUCTION

Hypodontia of the maxillary lateral incisors is an esthetically relevant developmental anomaly. Lack of anterior dental arch continuity results in significant aesthetic, functional, phonetic and psychological complications. It also poses a therapeutic dilemma for dentists practicing

in different areas of specialization. Making an appropriate decision in the orthodontic treatment planning phase, i.e. whether to close the space or rebuild it, is problematic. Canine substitution, recreating space for the missing maxillary lateral incisor and its implant-prosthetic restoration can be burdened with various complications [8, 9, 14, 16, 18, 20].

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The results of the long-term clinical trials demonstrate that the canine mesialization in the treatment of hypodontia is a method of providing long-term clinical success [20, 24]. The patient qualified for the treatment has to fulfill certain criteria [24]. According to Kokich, there are two types of malocclusion that allow for the canine mesialization: class I, with mandibular crowding and recommended tooth extraction, and class II with no signs of mandibular crowding [8] and proper shape of the canine tooth. After the detailed analysis of the patient's medical records, i.e. patient interview, extra- and intraoral examination, analysis of X-ray, photography and orthodontic models records as well as Bolton index [2, 3], the treatment plan is prepared and presented to the patient. It is imperative that the patient understands that mesialization alone may not prove sufficient and that the treatment may also involve the reshaping of the canine crown and of the first premolar, as well as teeth whitening [22].

OBJECTIVES

The aim of the study is to present the results of the 10-year clinical observations of the effects of canine remodeling in adults after canine mesialization using resin composite and the direct method.

MATERIAL AND METHODS

In 2008, 37 patients with uni- and bilateral hypodontia of maxillary lateral incisors underwent canine mesialization and crown reshaping. Canine remodeling to the shape of the lateral incisor was performed in a total of 56 cases (unilateral reshaping in 18 patients, and bilateral in 19 patients). Detailed analysis of each patient's facial profile, features and proportions were made. Intraoral examination focused not only on the line of symmetry but also on such details as tooth anatomy, emergence profile, gingival margin, dimensions, shape and individual features of the anterior dental arch [1, 5, 17, 19]. Angle's class I malocclusion was found in 19 patients, Angle's class II in 11 patients and deep bite in 7 patients.

In the first phase of the treatment, all patients were treated with fixed appliances. Given the fact that the zenith point of the maxillary lateral incisor is to be 0.5 to 1 mm lower than that of the central incisor, brackets have been applied accordingly. The treatment involved adjustment of the incisal edge of the canine, i.e. cuspid and incisal edge grinding to form a shape similar to that of the maxillary lateral incisor [1, 5, 7, 17, 19]. After the optimal position of the canine was achieved, grinding of its labial surface was performed to give it a shape similar to that of the lateral incisor, and to remove its two planes. The shape of the palatal surface was also changed in order to achieve proper occlusion [5]. In the process of maxillary lateral incisor res-

toration, we followed Chu's proportion, which indicates that the width of the maxillary canine is 1 mm greater than that of the lateral incisor [4]. In order to achieve the desired width, both mesial and distal surfaces were ground, 0.5 mm each.

The first premolar teeth were remodeled as canine by intruding and reshaping, in order to restore canine guidance.

Grinding was performed with particular caution to prevent dentin exposure and damage to the adjacent teeth using new diamond-coated burs with a rich water-cooling system. Each surface was afterward polished with the aid of Sof-lex polishing discs and rubber cups, and covered with Fluor Protector varnish (Vivadent).

In the second phase of the treatment the maxillary canine was remodeled to the shape of the lateral incisor using the resin composite Amelogen (Ultradent U.S.). Initially, each patient had been given professional teeth cleaning treatment. The color of the material was subsequently selected with the aid of the Vita shade guide and additional use of a ShadeStar colorimeter by DeguDent GmbH (Germany).

Once the rubber dam had been applied, the restored tooth was brush cleaned with Opalescence toothpaste (Ultradent U.S.), rinsed with water, dried with compressed air, and treated with 37% phosphoric acid etch for 30 seconds. It was then rinsed with water for a minimum of 30 seconds, dried with compressed air, covered with PQ 1 bonding agent (Ultradent U.S.), and cured with an Optilux polymerization unit (Demetron, Kerr) for 20 seconds. The Amelogen composite resin (Ultradent U.S.) was applied in consecutive layers [11, 13, 21]. Each layer was polymerized by the Optilux unit. Once the resin composite excess had been removed and the final shape created, the polymerized surface was finished with Sof-lex polishing discs (3M ESPE) and rubber cups (Kenda Liechtenstein).

In some cases, it was necessary to implement tooth whitening, as the maxillary canine appeared to be 1-2 shades darker than the central incisor. Opalescence Boost (Ultradent U.S.) was chosen as the whitening agent. Tooth reshaping was performed 2 weeks after a similar shade of maxillary canine to the central incisor was achieved.

The reshaping of the canine teeth was submitted to periodic monitoring, every 3 months in the first year, and every 6 to 12 months in the following years. Shape, color, structure and marginal tightness, as well as the presence of secondary caries, and periodontal and temporomandibular joints status were assessed.

Analysis of the findings included a percentage of the acceptable clinical result in consecutive years. The analysis was carried out using the Microsoft Excel program. The treatment was considered unsuccessful if the procedure had to be repeated, the resin composite became loose or the method of treatment was changed. Corrective measures or adjustments within the oral cavity have been qualified as a positive effect in subsequent years of assessment.

TABLE 1. Results for the clinical examinations

Year/Years	State clinically acceptable	Composite restorations requiring correction or adjustment	Retreatment	Composite restorations loss or method of treatment change
1-3	56	0	0	0
4	35	12	8	1
5-7	47	0	0	0
8	44	0	3	0
9	41	0	0	0
10	35	0	0	6

The University's Bioethical Commission acknowledged the range of the retrospective study (Commission statement AKBE/83/2018).

RESULTS

The clinical assessment results are presented in Table 1.

An acceptable clinical result was achieved in 100% of patients in years 1-3, 83.93% of patients in years 4-7, 78.57% of patients in year 8, 73.21% of patients in year 9 and 62.5% in year 10. Figure 1 shows a selected case immediately after the remodeling and Figure 2 shows another selected case 10 years after remodeling. Figure 2 shows the necessity to improve the aesthetics of composite superstructure.

The radiological assessment showed no temporomandibular joint dysfunction.

All the assessed clinical parameters of periodontal status were within the norm.

DISCUSSION

Hypodontia treatment goals include occlusion, aesthetic and functional norms as well as the patient's satisfaction. The treatment of adult patients with hypodontia of maxillary lateral incisors requires an interdisciplinary approach. Deciding on canine mesialization is not an easy choice and requires careful consideration, which includes malocclusion, patient's age, teeth and periodontium status, alveolar process status and a detailed analysis of smile and occlusion in accordance with the procedures [1, 5, 17, 19, 22]. Decision making in the process of treatment planning involves the identification of alternative methods of treatment, risk assessment, benefits and long-term effects of the treatment as well as the patient's consent, financial status, and expectations [22].

The goal of the orthodontic treatment is to reconstruct the maxillary canine to its most aesthetic and functional position in order to restore the missing lateral incisor with the aid of methods used in aesthetic dentistry [11, 13, 21, 23]. It is important to keep in mind that the treatment is not devoid of drawbacks; it is possible for the space to reopen, malocclusion and



FIGURE 1. Selected case immediately after remodeling



FIGURE 2. Selected case 10 years after remodeling

esthetic dysfunction to reoccur, retention of the composite resin to be lost, and dental plaque adhesion to increase. The maxillary canine root also requires palatal positioning in order to reduce its dental bulge. In order to achieve this, extrusion of the canine is performed. In the case of the prominent maxillary canine, its emergence profile, cervical margin or color may differ significantly from that of the central incisor. It is also usually necessary to reduce the lingual cusp of the first premolar by grinding in order to restore canine guidance.

62.50% of patients in the treatment group showed an acceptable clinical outcome after 10 years of observation. The first setbacks reported as tooth discoloration and loss of adhesion of composite resin occurred four years after the treatment. This outcome may have been

caused by excessive consumption of Coca-Cola and energy drinks by patients. Tooth discoloration was removed in 12 cases using Sof-lex discs and rubber cups. Patients having undergone rebonding accepted the clinical result despite an insignificant composite mass loss. Retention loss in the composite resin was reported in 8 cases, which resulted in the necessity of repeating the treatment. Substantial discoloration of the reshaped maxillary canine was reported in 3 patients after 8 years. This resulted in the need for retreatment; the procedure involved the use of resin composite CeramX Duo (Dentsply). In one case hypodontia in the left dental arch resulted in independent rotation of the maxillary canine. The patient decided to have fixed appliances reapplied. After 10 years in 6 cases, significant loss of composite was observed, which caused the need to change the method of treatment. According to the patients' wishes, ceramic veneers were made.

Canine remodeling to the shape of the lateral incisor using resin composite and the direct method may not require tooth preparation and provides acceptable functional stability for 4-5 years [23]. In a case where a patient makes remarks on aesthetic improvements but does not agree to the prosthetic replacement, it is possible to decide on canine reshaping. The main adverse effects of the treatment include increased dental plaque adhesion and the necessity of reapplication. Therefore, the treatment is recommended as a temporary solution and should be replaced with ceramic veneer in 5 years [23].

In 2010 Wolff *et al.* assessed the quality, longevity, and aesthetics of 327 composite restorations; the 5-year survival estimate was 79.2% [23]. In the current study, during the same period of observation, it was 83.93%, considering repairs performed in the oral cavity.

Other authors recommend a more favorable solution, i.e. application of ceramic veneers which do not irritate the periodontium, are more aesthetic and durable, and require minimal tooth preparation [6, 10, 12]. A proper cementation procedure will secure long-term marginal tightness [15]. Lowe *et al.* propose the application of ceramic veneers in the anterior dental arch without preparation as the most favorable solution [10].

CONCLUSIONS

The 10-year clinical observations have shown that space closure results in acceptable group function occlusion, does not affect the function of temporomandibular joints, and preserves the healthy periodontium. However, it should be noted that the reshaping of the canine using the direct method and resin composite may require routine maintenance or composite reapplication.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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