

# COMPREHENSIVE ORTHODONTIC TREATMENT IN GROWING PATIENT WITH EXTRACTED UPPER CENTRAL INCISOR

## СОВРЕМЕН ОРТОДОНТСКИ ТРЕТМАН КАЈ ПАЦИЕНТИ ВО РАСТ СО ЕКСТРАХИРАН ГОРЕН ЦЕНТРАЛЕН ИНЦИЗИВ

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### Abstract

In everyday orthodontic practice, patients with missing central upper incisor or the ones whose central upper incisor needs to be extracted are occasional. Having in mind that most of the orthodontic patients are children who are growing and by influencing the smile esthetics, the orthodontist is influencing general quality of life itself. Therefore, it is clear that these cases are as challenging as can be. Few treatment options are possible, but single osteointegration implant and orthodontic space closure with bringing the lateral incisor in the extracted area are the most popular. The aim of this case report is to present space closure in the upper front area as an evidence-based treatment option that should be considered as first alternative in growing patients as it reduces the invasiveness of the subsequent restorative treatment, offering long-term periodontal health and optimal aesthetic and functional results.

### Апстракт

Во секојдневната ортодонтска пракса, чести се пациентите со хиподонцијана горен централен инцизив или ониекаде постои индикација за екстракција. Имајќи во предвид дека најголем дел од ортодонтските пациенти се деца во фаза на активен раст, со делувањето на естетиката на насмевката, ортодонтот влијае и на општиот квалитет на животот, па јасно е дека овие клинички случаи се најпредизвикувачки. Во вакви случаи постојат повеќе опции за третман меѓу кои како најпопуларни се поставување на остеоинтегрирачки имплант и ортодонтско затворање на просторот со доведување на латералниот инцизив во екстакциониот простор. Целта на овој приказ на случај е да се презентира затворањето на простор во горниот anterioren сегмент како опција за третман базирана на докази која треба да се смета како прва алтернатива кај пациенти во раст бидејќи ја намалува инвазивноста на последователниот реставративен третман, нуди долгорочно пародонтално здравје и оптимални естетски и функционални резултати.

### Introduction

Years ago, the goal of orthodontic treatment was to achieve "ideal" occlusal relationship. According to E. Angle and his followers, maintaining an intact dentition and ideal occlusion was the only way to achieve best aesthetic. Nowadays, the goals of orthodontic treatment have changed. Today, the focus is on facial proportion and the impact of dentition on facial appearance<sup>1</sup>.

People with more attractive face are perceived to have higher athletic, social and leadership skills<sup>2</sup> and it has been found that the eyes and the mouth where the

most important factors in a hierarchy of characteristics for determining facial beauty<sup>3</sup>. On the other hand, there are several studies who have demonstrated that maxillary central incisors can be the most important factor influencing the perception of smile aesthetic<sup>4</sup>. Consequently, when orthodontist is treating a patient whose maxillary central incisor is/ or needs to be extracted, he is facing one of the biggest challenges.

Cases where maxillary central incisor is missing or needs to be extracted are occasional in orthodontic practice. When they are malformed, dilacerated, irreparably fractured or associated with local pathology, extraction

may be the logical and unavoidable step of the treatment<sup>5</sup>. Different factors, like number of missing teeth, existing occlusion, space conditions, soft tissue profile of the face, age of the patient, tooth morphology, growth pattern, the need of orthodontic treatment in general etc., can influence the decision on the treatment module to be chosen<sup>6</sup>. The treatment options for patients with missing or extracted central incisor are few, such as removable partial dentures, transplantation of developing premolars, maintenance of extraction space and placing a resin bonded bridge or single osseointegrated implant, or orthodontic space closure by substituting lateral incisor for central incisor<sup>7</sup>. Among all these treatment modalities, the last two are the most popular among clinicians. The question is: can lateral substitution be solution as good as single implant, or is it even better, especially if the patient is an individual still experiencing growth?

The **aim** of this article is to show the rationale for orthodontic space closure in cases when one central maxillary incisor was extracted due to poor prognosis and the results (dental and facial aesthetic and satisfactory occlusion) were obtained with lateral incisor substitution, which, from our professional and from the patients' perspective, was acceptable and satisfactory.

## Case Report

A female patient, 16 years old, presented to our clinic with a main complaint of misaligned upper teeth, non-aesthetic "dark" upper central incisor, claiming that she felt that her upper right canine "sticks out". The patient had good general and oral health and presented history of trauma to her maxillary left central incisor when she was 13 years old. The tooth was fractured and endodontically

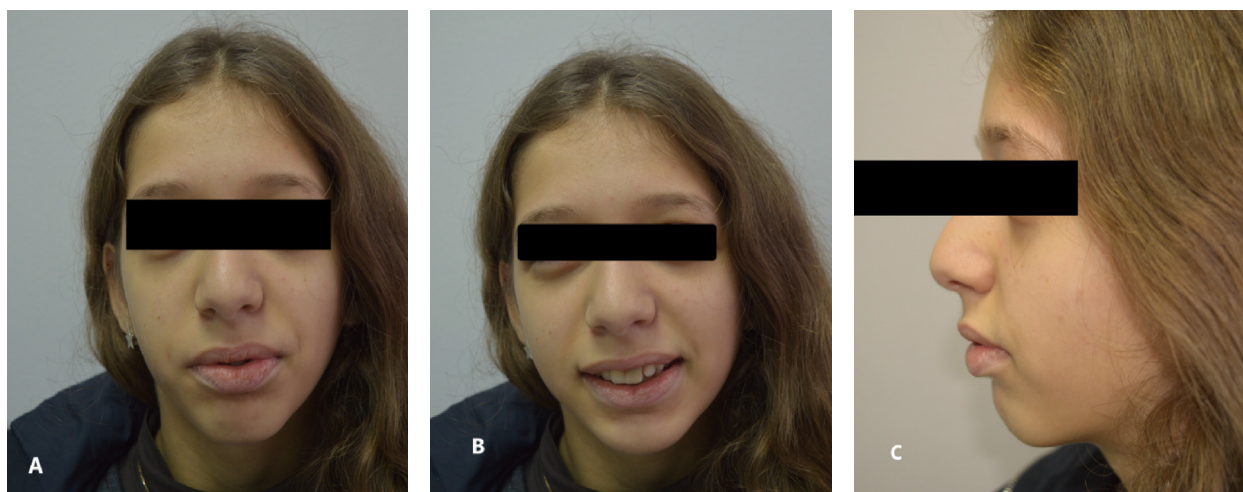
treated by her general dentist at the time, with severe recession and unaesthetic look and bad (short-term) prognosis.

Extraoral clinical examination (Figure 1) showed that she had leptoprosopic and apparently symmetrical face. Convex profile and increased lower facial third height were present. The lips were protrusive and incompetent. There was inconsonant smile.

Intraoral examination (Figure 2) showed that she presented Angel's Class II molar relationship bilaterally, 1/2 Class II canine relationship bilaterally, right maxillary canine with vestibular ectopic infraposition and non-aesthetic appealing, changed color, left maxillary central incisor with mobile coronal fragment. Protrusion of the maxillary frontal teeth and moderate crowding in the mandibular anterior region was also present. Increased overjet of 1 mm and overbite of 4 mm were present. Radiographic examination (Figure 3) revealed periapical translucency, failed root canal treatment and metal intrapulpal post on the tooth 21. There was subgingival, in the gingival third of the root, fracture line on the tooth 21. All the permanent teeth were erupted and the germs of three wisdom teeth were present.

### *The treatment plan included:*

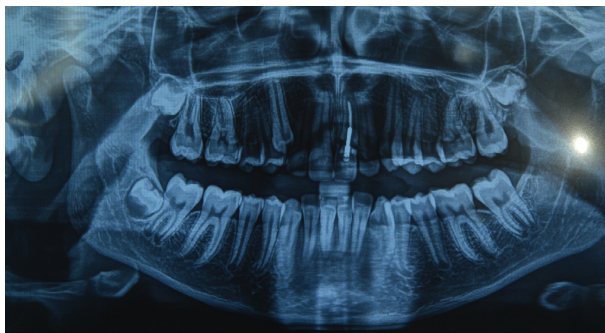
- Extraction of 14 and 21;
- Fixed orthodontic appliance in upper and lower jaws;
- Use of trans palatal arch as reinforcement of upper posterior anchorage;
- Composite aesthetic buildup of 22 and aesthetic reshaping of 23.



**Figure 1.** Pretreatment facial photography: **A)** Front; **B)** Smiling; **C)** Profile



**Figure 2.** Pretreatment intraoral photography: **A)** Front; **B)** Right side; **C)** Left side



**Figure 3.** Pretreatment panoramic radiograph

**The treatment objective included:**

- Positioning of 22 on the place of 21, 23 on the place of 22, etc...
- Correction of crowding;
- Correction of distocclusion and protrusion of upper frontal teeth;
- Correction of the lip incompetence and providing better profile;
- Establishing a stable occlusion with normal overbite and overjet, and aesthetic smile;
- Achieving a pleasing aesthetic facial profile.

After assessment of all possible treatment alternatives, decision was made for extraction of the left maxillary central incisor, followed by mesialisation and aesthetic reshaping of the maxillary lateral incisor, mesialisation and anatomization of the maxillary canine and premolars into lateral incisor and canine space, respectively. Extraction of right maxillary first premolar was planned to create space for alignment of maxillary right canine and resolve the proclination of the upper frontal teeth.

The case was treated with convectional braces (using Roth 0.022" slot prescription) which were bonded on the upper and lower dental arches. Upper left lateral incisor was bonded with bracket for the upper left central incisor in order to maintain better mesiodistal angulation and normal inclination i.e. in order for the lateral left incisor to get three dimensional position of the central left incisor, while the upper left canine received a bracket for upper left lateral incisor for the same reason. Enameloplasty on the canine was performed before bonding, considering the flatter base of the lateral incisor bracket. The maxillary canine bracket was placed on the first premolar, so that there would be expressed minimum root torque on the first premolar.

Phase I (leveling and alignment phase) started with 0.013 inch round Coper nickel- titanium (Cu Ni-Ti) wire, followed by a round 0.016 Cu Ni-Ti wire. The anchorage was critical during the fixed mechanotherapy because of bilaterally asymmetrical extraction in the upper jaw and the existing increased overjet. Therefore, transpalatal arch was used and was later reinforced by bonding the second molars as well.

After three months into a fixed appliance therapy, the leveling phase was finished. Extraction of tooth 21 was requested (Figure 4). Round 0.016-inch stainless steel wire was installed. We moved onto phase II (working phase) which included mesialization of 22 and 23, and at the same time reducing the increased overjet (Figure 5). After mesialisation movement has finished, 0.014 x 0.025" Cu Ni-Ti archwires were placed for duration of two months followed by 0.016 x 0.025" Cu Ni-Ti arch-





**Figure 4.** Intraoral situation immediately after extraction of 21



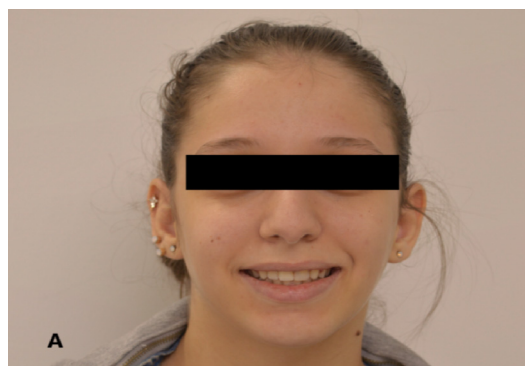
**Figure 5.** Intraoral photography of treatment progress, working wires, mesialised 22 and decreased OJ

wire placed in the upper and lower dental arches for a period of three months. For that time, intermaxillary elastics were placed according to the current situation of force delivery and occlusal situation. The working phase lasted 12 months.

In phase III (finishing phase), rectangular 0,016x0.025 inch SS arch wire was placed in the upper and the lower jaws and the intercuspatation procedure was started. At the end of the occlusal settling procedure and the occlusal adjustment, which lasted for three months, the fixed orthodontic appliance was debonded. Aesthetic composite buildup was made on the tooth 22, and aesthetic reshaping was performed on the left canine (Figure 6). Its length was reduced by flattening the canine's corner. The tip of the palatal cusp of the first premolar was also reduced to be less prominent while speaking and smiling. Fixed retainers in the lower and the upper frontal teeth (canine to canine) were installed, made of 0.0175 inches co-axial wire. (Figure 7)



**Figure 6.** Intraoral photography of tooth 22:  
A) Debonded bracket before composite build-up;  
B) After the composite build-up



**Figure 7.** Posttreatment photography:  
A) Extraoral; B) Intraoral

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After removing the appliance, the patient was instructed to have orthodontic check-up every three months during the first year in retention, two check-ups the second year, and one check-up in the following three years.

## Discussion

Cases when maxillary central incisor is missing or need to be extracted are relatively rare in everyday orthodontic practice. Facing this kind of problem, there are few considerations that need to be taken in mind when deciding between two of the most popular treatment modalities: implant or natural tooth.

Majority of the orthodontic patients are children still experiencing growth. Orthodontic treatment is usually carried out in the early permanent dentition, with duration between 18 and 30 months and conclusion at age 14 or 15<sup>8</sup>. At that age, bone maturity is not at the necessary level for osseointegrated implant to be installed. Placing an osseointegrated implant in individuals with pubertal growth spurt is considered to be contraindication<sup>9</sup>. Meaning, the patient needs to be treated with temporary replacement of the missing tooth if single implant is planned as final restoration.

The anterior maxilla is considered to be the riskiest site for early implantation due to growth unpredictability in the area, especially if natural teeth are present. The vertical growth in this area exceeded the growth in the other dimensions and continues at a later age<sup>10</sup>.

Because of the intimate bone apposition (osseointegration), which resembles ankylosis, single osseointegrated implants do act like ankylosed teeth and do not follow the spontaneous and continuous eruption of natural dentition and facial growth, respectively. Such implants may even disturb a normal development of the jawbones. However, bone growth resembles the other areas next to the implant which often results in infraocclusion in implant patients. Five years after treatment, Jamilian and al. and Rossie and al. found 1mm infraocclusion in all examined implant patients<sup>11,12</sup>. Dental aesthetic is not just the teeth, but maintaining a reasonably even gingival margins in the maxillary incisor area is particularly important as well, especially if patients show the gingiva when they smile. A lot of researchers report that even if the implant is inserted after 19 years of age, the adjacent teeth and surrounding alveolar bone may continue to develop vertically and may continue to erupt, resulting in a discrepancy between the gingival margin of the implant restoration, and the gingival margin of the adjacent natural teeth a few years after treatment of the the implant becomes submerged<sup>13,14</sup>.

Among the implant disadvantages, there were some periodontal problems, such as increased periimplantitis,

gingivitis, increased probing depth, bleeding on probing, and progressive loss of marginal bone support at the buccal aspect of the implant<sup>15,16,17</sup>. It has also been shown that most implant crowns show some lack of interdental papillary fill, particularly, blue coloring of the labial gingiva on the distal papilla has been reported in above more than 50% of single-implant crowns at 4-year follow-ups<sup>18</sup>.

Aesthetic result for single implants in the aesthetic zone can sometimes be suboptimal, even in adults and elderly patients, and especially in patients with unfinished skeletal growth<sup>19</sup>.

Contrary to everything listed above, when orthodontic space closure, using natural tooth, is chosen as a treatment plan, the advantages are as follows:

The treatment is finished as soon as the orthodontic treatment is finished. This is crucial when treating adolescent patient.

To achieve satisfying aesthetic, aesthetic reshaping of the canine and the first premolar often needs to be performed. It is found that it is possible to perform extensive interproximal, facial and cuspal grinding of young teeth without significant discomfort to the patient and with none, or minimal pulp reaction. If proper grinding technique is used, the risk for introducing iatrogenic damage is negligible<sup>20</sup>.

Better periodontal condition is found when orthodontic space closure is performed. When the lateral incisor is mesialised as part of the treatment plan, a new alveolar processes will be established with attached gingiva and intact interdental papillae adjusted to the mesialised tooth. These features will be preserved during the continued growth of the dentofacial complex. Accordingly, the appearance of the soft tissue surrounding the tooth ("red aesthetic") can be maintained, which can be difficult to obtain compared with prosthodontics replacement or implant<sup>21</sup>.

Space closure provides patients with better long-term aesthetic outcome in the transition area, due to lack of bone loss and fewer periodontal problems<sup>22</sup>.

Using composite build-up to alter tooth morphology to resemble the contralateral maxillary central incisor is minimally invasive treatment plan. The need for tooth preparation is minimal and the patient has open options to have further restorative dentistry performed, if desired.

It is a cost-effective treatment option in the short and long run. There are no initial implant/bridge costs for placement and no costs associated with implant/bridge management and future replacement<sup>23</sup>.

Any present malocclusion or malalignment of the teeth can be corrected simultaneously if there is an need for overall orthodontic treatment.

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## Conclusion

Recently, there have been a rising number of adults seeking orthodontic treatment. Around 20 to 25 percent of orthodontic patients are reported to be adults. This trend is likely to rise in the near future because the society is becoming more conscious concerning dental health and aesthetic, which directly affects facial aesthetic<sup>24</sup>. However, most of the orthodontic patients are still children, and it appears that if proper selection of the cases is made, and if the practitioner shows high level of professional skills and attention to detail during all stages of treatment, satisfactory and natural-looking results can be achieved, provided orthodontic space closure is chosen as a method of treatment. Patients treated this way will have their natural teeth in the frontal area and only small aesthetic correction will be necessary for overall attractive smile.

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