



# Impacted Upper Central Incisors – Frequency and Factors Complicating the Treatment Protocol

Greta Yordanova<sup>1</sup>, Gergana Gurgurova<sup>2</sup>

<sup>1</sup> Department of Orthodontics, Faculty of Dental Medicine, Medical University of Sofia, Sofia, Bulgaria

<sup>2</sup> Resident doctor in Department of Orthodontics, Faculty of Dental Medicine, Medical University of Sofia, Bulgaria

**Corresponding author:** Greta Yordanova, Department of Orthodontics, Faculty of Dental Medicine, Medical University of Sofia, 1 Georgi Sofijski St., 1606, Sofia, Bulgaria; E-mail: gretayordanova@gmail.com; Tel.: +359 877 922 665

**Received:** 5 June 2020 ♦ **Accepted:** 10 Nov 2020 ♦ **Published:** 30 June 2021

**Citation:** Yordanova G, Gurgurova G. Impacted upper central incisors – frequency and factors complicating the treatment protocol. *Folia Med (Plovdiv)* 2021;63(3):405-12. doi: 10.3897/folmed.63.e55145.

## Abstract

**Introduction:** Eruption of central incisors occurs at a time when the mixed dentition starts to develop and their impaction is mostly a severe esthetic problem.

**Aim:** Our aim was to assess the frequency of impaction of an upper central incisor and to analyse the factors which affect the successful outcome and the protocols for orthodontic treatment in cases of impacted upper central incisors.

**Materials and methods:** In the present study, we used all medical records of 651 patients treated in our private practice over the last 3 years and also the medical records of 18 patients we diagnosed and treated for this problem over the last 8 years.

**Results:** We found the ratio of impacted upper central incisors to be 1.4% as there were more male than female patients affected. There were 2.8% male patients and 0.7% female patients. The most frequent cause of impaction of the upper central incisor was the presence of mesiodentes and supernumerary teeth (55.5%), followed by presence of follicular cysts (44.4%) and odontoma collections (22.2%) or a combination of these.

Several approaches have been used in treating the different positions of impacted incisors. It is necessary first to rotate the axle of the incisor and assure its root full bone coverage. We used directly TPA for support. In other patients, we waited for the spontaneous eruption after removal of the etiological factor and in another patient, we used conventional fixed techniques.

**Conclusions:** It is important that dental doctors should monitor the formation of the dentition so that they detect the impacted tooth early in its development.

## Keywords

arrested eruption, follicular cysts, mesiodens, treatment protocol, supernumerary teeth

## INTRODUCTION

Eruption of the central incisors occurs in a period which is clearly seen by the patient as the starting period of the development of mixed dentition. Usually, it concurs with the beginning of school education. The eruption of the

first molars is usually underestimated and hidden for the patient, but they are “proud” with their “big” frontal teeth. That is why their absence, or more often their impaction, is disturbing for a patient and their parents and dental help is sought early. Most often, delay of orthodontic treatment happens because of some inappropriate advice that erup-

tion time varies from person to person and therefore it is necessary to wait.

The impaction of the upper central incisors is an orthodontic problem which is mostly a severe esthetic problem. The clinical manifestation of this impaction makes it easier to notice. Most often, the impaction of the central incisors is combined with the persistence of the primary incisors. This can confuse the parents and they do not seek dental help.

From the literature review we made, the frequency of this problem is 0.05% to 3-4% of all orthodontic patients. In our previous study, we found out that the frequency of distribution of impacted upper central incisors is right after the impacted upper canines, upper second premolars, lower second premolars, and lower canines. The frequency of this problem is 4.4% of all patients with impacted teeth we treated. Becker<sup>1</sup> reports that 0.42%–2.1% of orthodontic patients are diagnosed with impacted upper central incisor. The most common cause for this is the presence of mesiodentes. The mesiodens is a supernumerary tooth that has high manifestation. Around 82% to 90% of all supernumerary teeth are located in the maxilla, and half of them are in the frontal area. Kuroi<sup>2</sup> has found that impaction of upper central incisors is observed in 0.2%–1.0% of the general population.

The most common etiological factors are mechanical obstruction along the eruption path or general diseases of the child. The most common causes are supernumerary teeth, mucogingival structures (cysts), tooth decay treatment or primary tooth ankylosis, and tumours.<sup>3</sup> Special attention in the literature is given to the supernumerary teeth, especially mesiodentes. According to the literature, the mesiodentes cause impaction of upper central incisors in 28%–60% of all cases.<sup>4,5</sup> The cleidocranial dysplasia<sup>6</sup> is a syndrome characterized by tooth impaction. In some cases, the abnormal function of parathyroid gland can be a factor inducing tooth impaction.<sup>7</sup> In our previous study, we found a significant correlation between tooth impaction and transposition in the same quadrant.<sup>8</sup> This correlation was found in 5 out of 14 patients with transposition which is 1/3 of the cases. The etiology of transposition is not completely clear. The most common cause for this is either inheritance or a trauma in early age and change of the direction of the germs. When the transposition affects the lateral incisor and canine there is also an impaction of the central incisor.<sup>8-10</sup>

Odontomas in the frontal area of the maxilla are also factors causing tooth impaction. Sanchez et al.<sup>11</sup> discuss the clinical manifestations of the odontomas and make the following conclusions: odontomas are very frequently the cause for tooth impaction (55.4% of patients and most frequently, the upper frontal area is involved), swelling (14%), primary teeth persistence (12.7%, and most often involving the upper frontal sector), tooth agenesis of permanent teeth (7.2%), pain (4%), inflammation (3.3%), tooth malpositioning (1.1%), and other non-specified manifestations (2.3%).

When solving this kind of problem, there are several parameters that are important: appropriate diagnosis and assessment of the etiological factor, age of the patient, surgical intervention, and the choice of orthodontic technique.<sup>12-14</sup>

## AIM

The aims we pursued in the present study were as follows: assess the frequency of impaction of the upper central incisors according to other impactions in the maxilla without the impaction of the third molar, and analyse the factors which affect the successful outcome and the protocols for orthodontic treatment in cases of impacted upper central incisors.

## MATERIALS AND METHODS

To achieve the first aim, we conducted a survey including all medical records of 651 patients treated in our private practice for the last 3 years. The patients we treated gave their written informed consent allowing us to use their personal medical records in the study.

The analysis of treatment protocols concerning the upper central incisor impaction was made on the basis of the documentation of 18 patients we diagnosed and treated for this problem for the last 8 years. They gave their written informed consent agreeing to have their records used in the analysis of their data.

Statistical analysis of the data was performed using SPSS v. 13.0. In the analysis, we used the Mann-Whitney test, the Fisher's exact test, and the Kruskal-Wallis test.

To achieve the aims we set ourselves in the study, we assessed the etiological factors for impaction; the localization of the impacted central incisor according to the axles of the lateral incisors and adjacent bone structures; level of root development and its shape (dilacerations), the age and sex of the patient, type of surgical manipulation, and the orthodontic technique.

Accurate diagnosis was made after careful clinical and para-clinical examinations, most often X-ray imaging. The medical histories and previous medical documentation of the patients were surveyed for any local or systemic diseases. All patients and their parents were asked to provide detailed information about any previous tooth trauma in early childhood. The clinical examination included alveolar ridge palpation. We used cone-beam computed tomography to analyze the exact locations of crowns, the development and localization of the tooth apex, three-dimensional orientation of the tooth axle, the closeness of the impacted incisor to other tooth roots, presence of supernumerary teeth, odontomas, periodontitis, cysts, and root resorption.

With the help of 3D imaging, we identified some previously mentioned factors and eliminated the chance of superimposition of adjacent structures as seen in the 2D

imaging. We obtained full and exact orthodontic and surgical manipulation data during the treatment of the patient.

## RESULTS

The mean age of the study group (651 patients) was 17.43 years. The ratio (Fig. 1) of men to women was 215 (33%) to 436 (67%). According to the dentition, the patient ratio was 44.9% (292 patients) in mixed dentition and 55.1% (359 patients) in primary dentition.

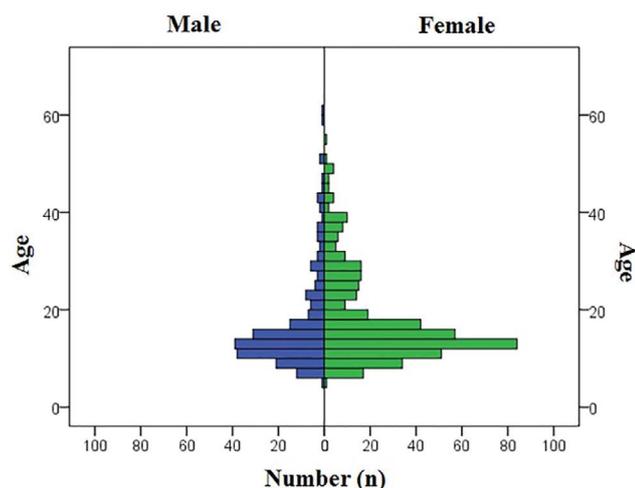


Figure 1. Ratio of men to women and patients' age.

In this group of orthodontically treated patients, 56 patients (8.7%) had impacted upper teeth, excluding the third molars. They were classified as follows: impacted upper canines – 6.5%; impacted upper central incisors – 1.4%, and impacted upper second premolars – 0.8%.

Patients' distribution by sex was as follows: 17 (7.9%) male patients and 25 (5.7%) female patients had impacted canines; only 5 (1.1%) female patients had impacted second premolars; central incisors were impacted in more male patients (6 patients, 2.8%) than female patients (3 patients, 0.7%) (Table 1).

Impacted upper second premolars were diagnosed mainly in the primary dentition. Impacted central incisors were diagnosed mainly in the mixed dentition in all patients (9 cases). Impacted canines were diagnosed mainly in the primary dentition of 28 patients and in 14 cases they were diagnosed in the late mixed dentition. The mean age at which impacted teeth were diagnosed was 15.07 years and the patients' distribution by mean age was as follows: patients with impacted central incisors: 9.11 years, patients with impacted second premolars: 15.4 years, and patients with impacted canines: 16.31 years.

There were 10 impacted central incisors in 9 patients – one male patient had two impacted central incisors.

Analysis of the causes for impaction of upper central incisors in 651 patients showed that mesiodentes and supernumerary teeth were the most frequent causes of upper central incisor impaction (55.5%, 4 cases with a mesiodens and one patient with two supernumerary teeth); less frequently impaction of the upper central incisors was caused by follicular cysts (44.4%, 4 patients), odontomas (22.2%, 2 patients), and there was a combination between a mesiodens and odontomas in one patient.

Bilateral manifestation of the impaction occurs when there are supernumerary teeth. Cysts also resulted in impaction of more than one tooth, but in most cases impaction was unilateral (central and lateral incisors). In 5 patients, the impacted incisor was perpendicular to the axis of the other incisors. This finding is most likely to occur when the etiological factor is a follicular cyst. Using the Fisher's exact test, we found a correlation between the impaction of teeth and other orthodontic problems such as follicular cysts, transposition, tooth agenesis, supernumerary teeth, mesiodentes, and others. For impaction of upper central incisors, significant statistical correlation existed only with the presence of follicular cyst and a mesiodens (Table 2).

Using the data for 18 patients with impacted upper central incisors we treated over the past 8 years, we performed a far more detailed analysis of the factors causing impaction and leading to successful treatment. The mean age of these patients was 10 years. Of these 18 patients 12 were men and 6 women. The impacted central incisors were 22

Table 1. Distribution by sex and type of impacted teeth in the upper jaw

Impacted teeth		Male	Female	Total	<i>p</i>
	N	192	403	595	0.042
	%	89.3%	92.4%	91.3%	
Upper canines	N	17	25	42	
	%	7.9%	5.7%	6.5%	
Second premolars	N	0	5	5	
	%	0.0%	1.1%	0.8%	
Upper central incisors	N	6	3	9	
	%	2.8%	0.7%	1.4%	
Total	N	215	436	651	
	%	100.0%	100.0%	100.0%	

**Table 2.** Correlation between tooth impaction and other pathology

Pathology		Impacted teeth			Total	<i>p</i>
		Upper canine	Second premolar	Upper central incisor		
Transposition	N	4	0	0	4	1.000
	%	9.5%	0.0%	0.0%	7.1%	
Follicular cyst	N	5	0	4	9	0.032
	%	11.9%	0.0%	44.4%	16.1%	
Tooth agenesis	N	6	1	0	7	0.383
	%	14.3%	20.0%	0.0%	12.5%	
Supernumerary teeth	N	0	0	1	1	N/A
	%	0.0%	0.0%	11.1%	1.8%	
Odontoma collection	N	0	0	2	2	N/A
	%	0.0%	0.0%	22.2%	3.6%	
Mesiodens	N	0	0	4	4	0.001
	%	0.0%	0.0%	44.4%	7.1%	
Microdontia	N	1	0	0	1	N/A
	%	2.4%	0.0%	0.0%	1.8%	
Persistent primary teeth	N	3	1	0	4	0.414
	%	7.1%	20.0%	0.0%	7.1%	

(in 4 male patients the problem was bilateral).

The main factor for this turns out to be a bio-mechanical obstruction in the eruption path of the teeth – supernumerary teeth and especially with a specific conically shaped mesiodens. In 39.9% (4 patients with a mesiodens and 3 with supernumerary teeth) this was the etiological factor causing impaction. The patients with bilateral impaction belong to this group because of the bilateral position of two supernumerary teeth. Only one of the patients was with bilateral impaction of central incisors because of two mesiodentes.

The next most frequent cause was a follicular cyst which complicates the process of eruption; it was found in 6 of our patients (33.3%). These patients were most likely to have a severe change in the topography – the position of the impacted tooth. In 83.3% of the cases caused by cysts, the impacted teeth were perpendicular to the other incisors' axes. One of the patients was with reverse position of the crown and the root and extraction had to be done. The follicular cyst can dislocate a large number of teeth from one side, for example lateral incisor and even a canine.

Another commonly observed problem was the odontomas. This can cause an impaction of the central incisors. In our study, the impaction in 4 (22.2%) cases was due to this problem. In one of the cases, the lateral incisor and canine were also impacted. They were in transposition. In these cases, the central incisors were significantly tipped or dislocated in the opposite direction of the odontomas, but they were not horizontally positioned.

Only in one patient, the transposition between lateral and canine was a primary etiological factor for impaction.

Transposition was quite likely to be a secondary rather than a main cause for the impaction because of the inversed position root-crown. This patient reported no previous trauma in the interview.

In 2 (11%) patients, we had to extract the impacted incisors because of their unfavourable position of crown-root. Such location does not allow proper traction and positioning of the tooth. The main goal in these cases was preservation of the alveolar ridge for future prosthetic restoration.

In 3 patients after eliminating the etiological causative factor (a mesiodens or odontoma collection) there was a spontaneous eruption of the impacted incisor and the goal of the orthodontic treatment was mainly alignment.

Ten of the cases were solved with the help of a palatal anchor. We used TPA with extender arm to correct the axle of the impacted tooth and its positioning in the alveolar ridge. Using TPA, we could assure correct direction of the traction which allows the proper shaping of the gingival zenith of the tooth. This provided the needed aesthetic solution and sufficient gingival tissue for normal function.

In three of the cases, we used direct traction using vestibular fixed technique. This was used in cases with a favourable tooth position – when the etiological cause was a mesiodens.

We achieved success in all of the cases of traction of impacted central incisors.

## DISCUSSION

In the two surveys with patients with impacted central in-

cisors, the ratio of male to female patients was 2:1 (6 males to 3 females and the second group 12 male patients to 6 females).

The greatest change in the position of the impacted teeth was noticed when the etiological factor was a follicular cyst. The increase in dimensions of the cyst leads to severe dislocation of the germ and it is more likely to be found horizontal to the palate and perpendicular to the other incisor's axle. This position severely differs from the orthodontic traction, because it is necessary first to rotate the axle of the tooth and assure its root full bone coverage. Then orthodontic traction can be successfully applied to pull it into the dental arch. If the root is dilacerated, traction becomes complicated because of the larger root surface and the process of bone resorption and apposition are slower. The used palatal anchorage via the TPA assures correct rotation of the tooth before the main vertical traction (Fig. 2). Thus we avoid its positioning to the labial cortical bone, which would complicate the future vertical traction. Clinicians must be careful of a possible apical resorption due to the use of heavy forces.

When planning the orthodontic treatment, we have to bear in mind the root development of the impacted central incisors because of the traction process. It is more important to assess the root development of the lateral incisors,

because of the space opening procedure before traction of the impacted central incisor.

If we use heavy forces with underdeveloped lateral incisors roots, we can achieve dilacerations of the roots. Assessment of the root development is important when taking a decision which of the supernumerary teeth should be extracted (Fig. 3). We have to extract the ones with abnormal root development and crown shape. In the contemporary orthodontics, we use CBCT to assess these parameters.

The severity of the problem of impacted central incisors comes from the fact that such a condition is diagnosed most often in mixed dentition and there is a lack of anchorage for the traction. That is why we use a technique which assures the anchorage of the first molars via a TPA with extended arm palatally to the frontal area (Fig. 4).

The extender arm increases the elastic properties of the arch and, at the same time, assures good support. The preposition of the teeth with its most bone surrounding location in the alveolar ridge assures predictable vertical traction when included to the vestibular fixed technique. Using this kind of treatment protocol, we can be sure to achieve good aesthetics, gingival zenith of the teeth and alignment in the upper dental arch.

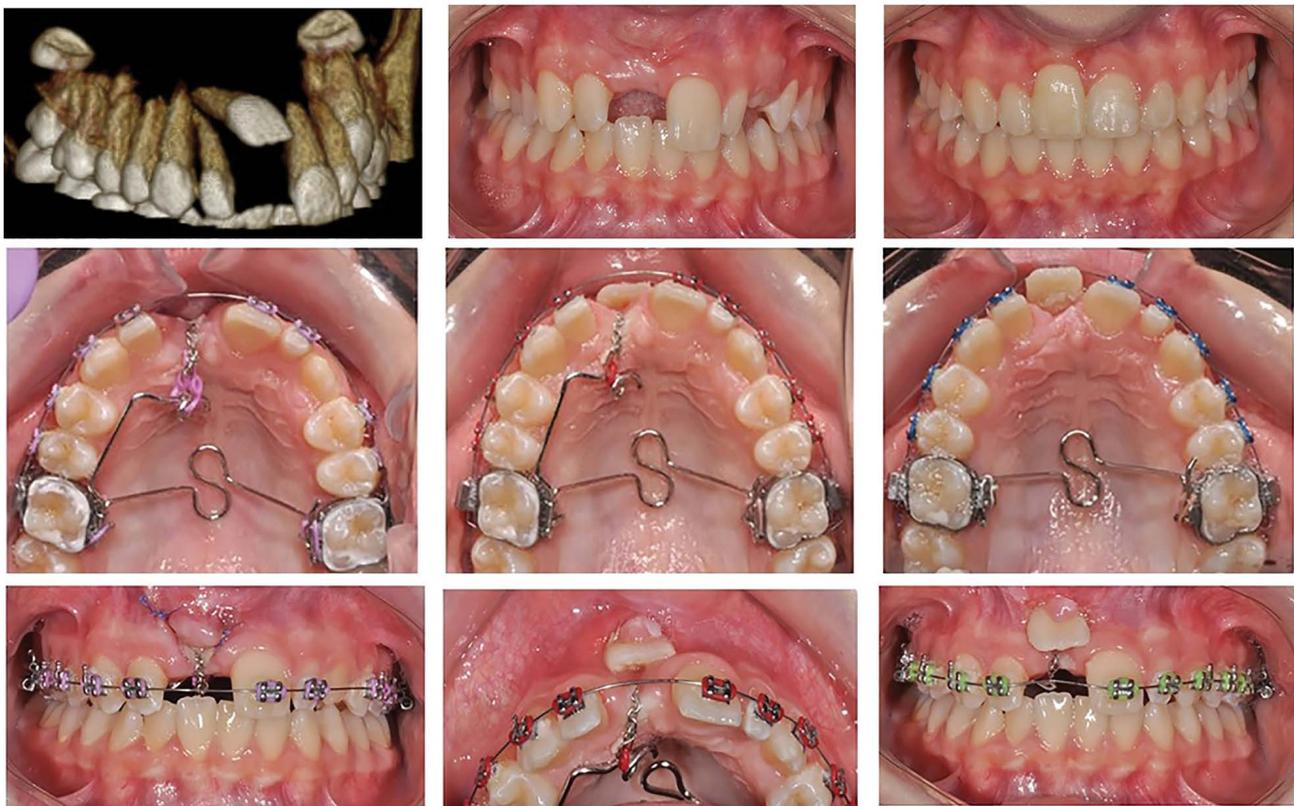
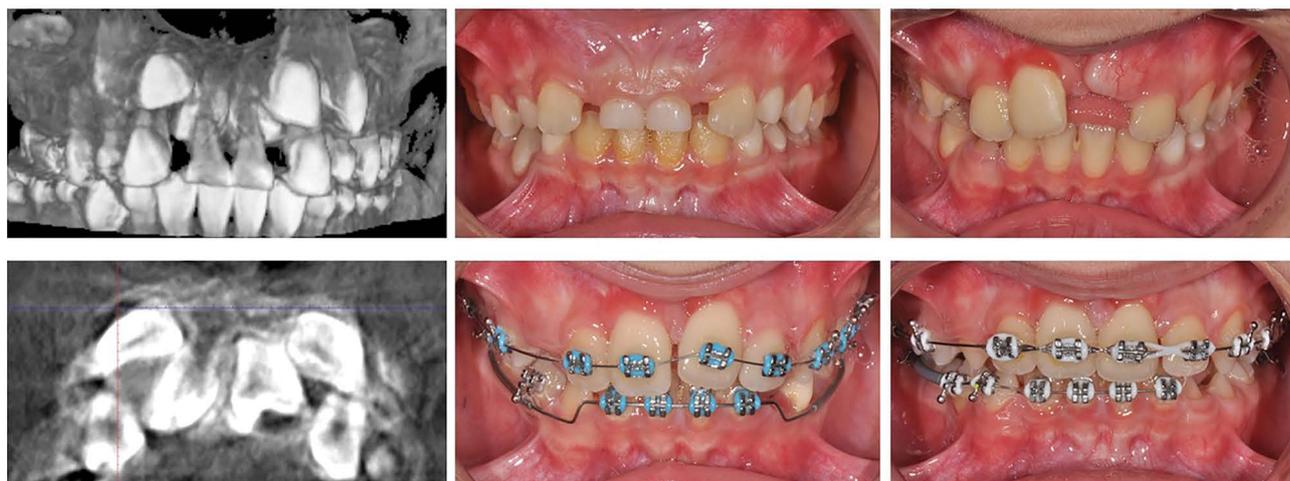
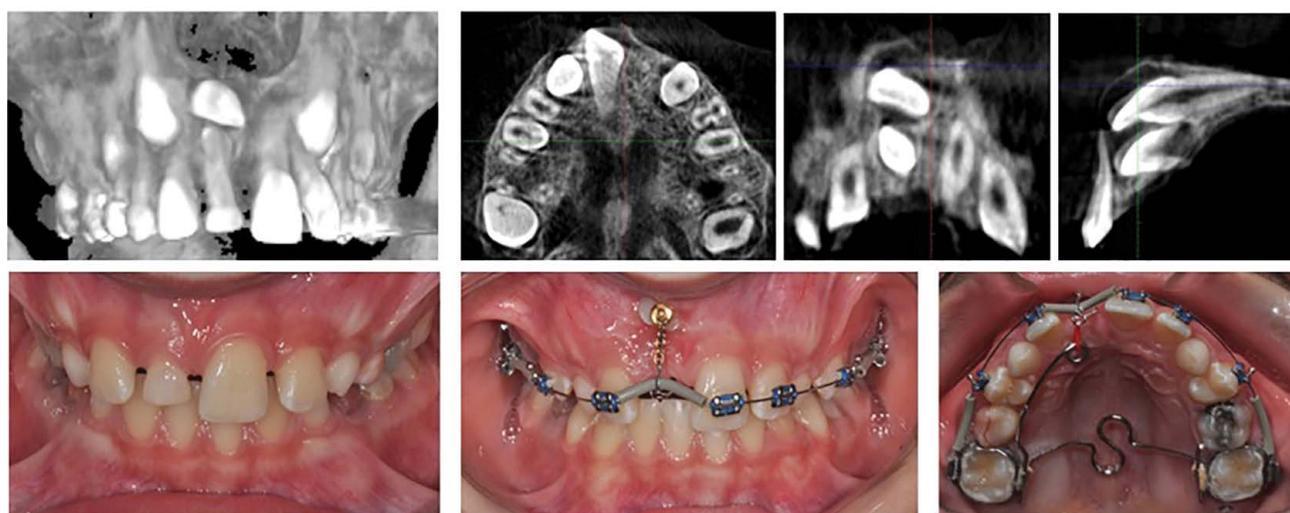


Figure 2. Treatment protocol using the palatal arch.



**Figure 3.** Central incisors, with palatal position, with underdeveloped roots and altered shape of crowns. The right one is pig-shaped, and the left one has a premolar shape. The two well-developed central incisors are located over the lateral incisors. They erupted spontaneously after extraction of supernumerary teeth.



**Figure 4.** A 9-year-old patient with impacted central incisor and a mesiodens. The orthodontic treatment was done using the molars as anchorage with the help of TPA.

## CONCLUSIONS

Treatment of impacted upper central incisors consists of surgical manipulation which removes the bio-mechanical obstructions in the eruption path and orthodontic space gaining and traction to achieve optimal levelling and alignment.

Orthodontic treatment of patients with impacted central incisors starts immediately after the problem is identified. A few phases are needed, especially if in the dental arch there is no space for the impacted incisor to be aligned. In diagnostics, the three dimensional localisation of topography of impacted incisor through CBCT is necessary. This method provides information about inter-axes incisors position and also the real etiological reason

for impaction. This defines the selection of surgical and orthodontic techniques, which will be used in each clinical case. This method gives detailed information about the dimension of the bone and alveolar crest through which the orthodontic traction will be done. Therefore, the following orthodontic treatment is more predictable and the technique we use is better planned. Contrary to the traction of canines with palatal position, the orthodontic traction of upper incisors requires excellent level of attached gingiva to be done.

The upper central incisors are very important for the overall smile aesthetics and their absence or impaction concerns the facial aesthetic, masticatory function, phonetics and the psycho-social appearances of the patient.

## REFERENCES

1. Becker A. Treatment of impacted teeth. Wiley-Blackwell, 2012. p 456
2. Kuro J. Early treatment of tooth eruption disturbances. *Am J Orthod Dentofacial Orthop* 2002; 121:588–91.
3. Chaushu S, Becker T, Becker A. Impacted central incisors: Factors affecting prognosis and treatment duration. *Am J Orthod Dentofacial Orthop* 2015; 147(3):355–62.
4. Yordanova G, Dinkova M. Prevalence and clinical manifestation of a mesiodens. *IJSR* 2014; 3(11):1665–8.
5. Russell KA, Folwarczna MA. Mesiodens – diagnosis and management of a common supernumerary tooth. *J Can Dent Assoc* 2003; 69(6):362–6.
6. Kuroda S, Yanagita T, Kyung HM, et al. Titanium screw anchorage for traction of many impacted teeth in a patient with cleidocranial dysplasia. *Am J Orthod Dentofacial Orthop* 2007; 131:666–9.
7. Frazier-Bowers SA, Simmons D, Wright J, et al. Primary failure of eruption and PTH1R: the importance of a genetic diagnosis for orthodontic treatment planning. *Am J Orthod Dentofacial Orthop* 2010; 137:160.e1–7.
8. Yordanova G, Dinkova M. Study on rate and characteristics of dental transposition, *CR Acad Bul Scien* 2015; 68(1):107–14.
9. Pair J. Transposition of a maxillary canine and a lateral incisor and use of cone-beam computed tomography for treatment planning. *Am J Orthod Dentofacial Orthop* 2011; 139:834–44.
10. Yordanova G, Stanimirov P. Impaction of teeth – frequency and treatment protocol. *Stoma Edu J* 2017; 4(3):53–60.
11. Hidalgo-Sánchez O, Leco-Berrocal M, Martínez-González M. Meta-analysis of the epidemiology and clinical manifestations of odontomas. *Med Oral Patol Oral Cir Bucal* 2008;13(11):E730–4.
12. Pavoni C, Mucedero M, Laganà G, et al. Impacted maxillary incisors: diagnosis and predictive measurements. *Annali di Stomatologia* 2012; 3(3/4):100–5.
13. Pinho T, Neves M, Alves C. Impacted maxillary central incisor: Surgical exposure and orthodontic treatment. *AJODO* 2011; 140:256–65.
14. de Andrade Santos PP, Barroso KM, de Souza LB, et al. Odontomas: Clinicopathologic study of 104 cases and a case report of compound odontoma associated in an unerupted maxillary central incisor in a child. *International dentistry – African edition* 2012; 2(5):32–9.

# Ретинированные верхние центральные резцы – частота и факторы, усложняющие протокол лечения

Грета Йорданова<sup>1</sup>, Гергана Гургурова<sup>2</sup>

<sup>1</sup> Кафедра ортодонтии, Факультет дентальной медицины, Медицинский университет – София, София, Болгария

<sup>2</sup> Стажер отделения ортодонтии стоматологического факультета Софийского медицинского университета, София, Болгария

**Адрес для корреспонденции:** Грета Йорданова, Кафедра ортодонтии, Факультет дентальной медицины, Медицинский университет – София, ул. „Георги Софийски“ №1, София, Болгария; E-mail: gretayordanova@gmail.com; Тел.: +359 877 922 665

---

**Дата получения:** 5 июня 2020 ♦ **Дата приемки:** 10 ноября 2020 ♦ **Дата публикации:** 30 июня 2021

---

**Образец цитирования:** Yordanova G, Gurgurova G. Impacted upper central incisors – frequency and factors complicating the treatment protocol. Folia Med (Plovdiv) 2021;63(3):405-12. doi: 10.3897/folmed.63.e55145.

---

## Резюме

**Введение:** Прорезывание центральных резцов происходит на начальном этапе развития сменного прикуса, а их ретенция обычно представляет собой серьёзную эстетическую проблему.

**Цель:** Нашей целью было оценить частоту ретенции верхних центральных резцов и проанализировать факторы, влияющие на успешный результат, и протоколы ортодонтического лечения в случаях ретенции верхних центральных резцов.

**Материалы и методы:** В настоящем исследовании мы использовали полные медицинские карты 651 пациента, лечившегося в нашей частной практике за последние 3 года, а также медицинские карты 18 пациентов, которым мы диагностировали и лечили за последние 8 лет.

**Результаты:** Мы обнаружили, что частота ретинированных верхних центральных резцов составила 1.4%, при том что пациенты мужского пола были поражены чаще, чем пациенты женского пола. Результаты показали 2.8% пациентов мужского пола и 0.7% пациентов женского пола. Наиболее частой причиной ретенции верхних центральных резцов было наличие mesiodens и сверхкомплектных зубов (55.5%), за которыми следовало наличие фолликулярных кист (44.4%) и одонтомных разрастаний (22.2%) или их комбинации.

При лечении различных положений ретинированных резцов использовалось несколько подходов. Во-первых, необходимо вращение оси резца, чтобы обеспечить полное покрытие корня костью. Мы использовали ТПД (транспалатинальную дугу) для прямой опоры. У других пациентов мы ждали спонтанного появления после удаления этиологического фактора, а у другого пациента мы использовали обычные методы фиксации.

**Заключение:** Стоматологам важно следить за формированием зубного ряда, чтобы идентифицировать ретинированный зуб на ранней стадии его развития.

---

## Ключевые слова

задержка прорезывания, фолликулярные кисты, mesiodens, протокол лечения, сверхкомплектные зубы

---