

Double teeth: evaluation of 10-years of clinical material

Research Article

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Abstract: The aim of the study was to evaluate 10-years of clinical material referring to the rare dental abnormality of double teeth. The study material consisted of case records, operation-books and radiographic or photographic documentation on patients treated in the Department of Oral Surgery, Silesian Medical University, Katowice, from the 1st of June 2000 to the 31st of May 2010. The following features were considered important: age and sex, the reason why the patient reported for treatment, general state of health, the time of recognition and type of double teeth, location of double teeth, complaints and disturbances connected with double teeth, types of radiographs, the radiographic and macroscopic appearance of double teeth and treatment method. Diagnoses were as follows: eight conrescent teeth, two fused teeth, two geminated teeth and one invaginated tooth. The anomaly of a deciduous tooth was referred to in one case only. Double teeth were most often seen in the region of maxillary incisors and molars but rarely in the mandible. The region of incisors was affected chiefly in children and the region of molars in adults. Double incisors are usually recognized prior to treatment whereas double molars as late as during their extraction. In many cases, neither intraoral radiographs nor pantomographs help to confirm double teeth or provide sufficient information to plan the treatment. In such a situation, CT or CBCT should be used in addition to imaging diagnostics. Double teeth among incisors are usually accompanied by occlusal disorders. Therefore the therapeutic management is conducted by a team, including orthodontists.

Keywords: *Dental abnormality • Double teeth • Geminated teeth • Fused teeth • Dens invaginatus*

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1. Introduction

Dental abnormalities can be related to distorted crowns, roots or entire teeth and changes in their internal structure. Such abnormalities include, to a large extent, atypical formations consisting of two or more conjoined teeth. Due to a variety of underlying pathogenetic mechanisms, several different terms are used to describe conjoined teeth. Some authors have introduced the term "double teeth" to describe a large group of dental abnormalities, disregarding their etiology [1-4]. This term applies to such dental anomalies as fusion, gemination, conrescence, dens in dente or dens invaginatus [1-6]. Some authors prefer to use the term "syndontia" for fused teeth [7] and "schizodontia" for geminated teeth [8].

A geminated tooth is usually defined as an abnormal formation originating from the division of one tooth germ [2-6,8,9]. Such division occurs at an early stage of crown development. The resulting abnormal tooth has either two crowns or one partially separated crown and one root or such a number of roots as are adequate for the group of teeth where the original germ belongs. Such teeth unite at dentin and enamel levels to have one crown and one root canal [2-5,8]. Mochizuki et al [10] and Nahmias et al [11] also describe triple teeth, but these seem to be geminated teeth considering their pathogenetic mechanism. Geminated teeth do not lead to a smaller number of teeth in the dental arch unless they cause maleruption or impaction of other teeth or there are other concomitant defects or disorders.

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A fused tooth is made as the result of fusion between two separate tooth germs occurring at an early stage of development when the crowns are not yet mineralized [1-6,8,9]. The union occurs in the region of dentin and enamel [1-6,9]. The crowns of such teeth are excessively large and usually have a groove along the vestibular surface ending up with a crypt on the incisive edge. Conrescent teeth replace two teeth in the dental arch. They have one common chamber with a crypt corresponding to a crown groove, two joined chambers and one broad common root canal, or two separate canals [1,2,4,6,9]. Conrescence occurs to two normal tooth germs, one normal tooth germ or one supernumerary tooth germ [1,4,6]. If a supernumerary tooth becomes united with a normal tooth, the total number of teeth in the dental arch is not reduced. In such a situation it is very difficult clinically to differentiate between conrescence and gemination [1,4].

Conrescence is a union, solely in the root cementum or, sometimes, in the crowns at enamel level. The amount of such unions may vary considerably in extent. The teeth have separate chambers and root canals [12-15,17,19]. Just like in the case of fusion, conrescence may refer to a normal tooth and a supernumerary one [12-14,19]. This abnormality occurs at a late stage of development, after crowns and most parts of the roots, or even entire roots, are complete. If the condition occurs during root formation, it is called true conrescence and is considered a developmental disorder. If the condition occurs after root formation has completed, it is called acquired conrescence, caused by chronic inflammatory factors leading to hypercementosis of the joined teeth [12-14,16]. Conrescent teeth take the place of two teeth in the dental arch.

Double teeth also include an anomaly called dens in dente or dens invaginatus. This is a morphological disorder, caused by the invagination of dental papilla before the germ has mineralized [20,21]. This anomaly usually refers to maxillary lateral incisors or, in rarer cases, to central incisors, canine teeth and supernumerary teeth. They are also sometimes found in the region of mandibular incisors and premolars [20,21]. The crown of dens invaginatus or dens in dente typically demonstrate abnormal forms. The condition is often recognized accidentally during x-ray examination showing impenetrable tissues within the tooth cavity, the saturation thereof being close to enamel [20,21].

Most authors believe that the development of double teeth is strongly related to both general and local factors, including respectively: avitaminosis, hypervitaminosis A, systemic diseases, the RH incompatibility of parents,

endocrinological disorders, atavism, thalidomide embryopathy, mental diseases [2,6,12,22-24], and crowded adjacent tooth germs or injuries, the latter including chronic mechanical injury e.g. pressure that leads to a gradual loss of the bone septum between tooth germs [2,4,12,19,22-24]. It is generally believed that autosomal recessive inheritance or the low penetration dominant gene plays an important role too [2,4]. Such factors lead to disorders within the dental lamina during the germ formation process [2,12].

Double teeth have often been observed to coexist with other odontogenetic disorders like hyperdontia, hypodontia, macrodontia or tooth transposition [5,25,26]. It has also been observed that 50% of patients with double teeth, in deciduous dentition, will develop disorders in permanent dentition including too small or too large a number of teeth, double teeth, retarded root formation or retarded tooth eruption [1,5,19,25,27]. Double teeth are reported to accompany quite a lot of syndromes like Russel-Silver, ear-finger-facial, Ellis-van Creveld, cleidocranial, ectodermal dysplasia, Cornelia de Lange, Gorlin-Goltz [1,28-30]. In addition, double teeth can also coexist with congenital syphilis, syndactyly, squint and nail deformations (19).

Many authors share the opinion that double teeth occur usually in deciduous dentition (0.15%-1.2% compared with 0.1% in permanent dentition) [3,4,12,22,31]. However, Brook and Winter [19] report that double teeth are rarely found in deciduous molars. It is also interesting to note that double teeth are more often observed in patients coming from The West Indies or Japan and in the Mongolian race than in Caucasians [2,32,33].

Double teeth are observed in maxillas and mandibles alike, but more often in upper incisors and canines [2,4,6,26]. On the other hand, conrescent teeth are most often seen in maxillary molars [12-16,31]. Bilateral occurrence of this abnormality is estimated at 0.02% with reference mostly to incisors [2,32,33]. Some authors report that double teeth occur equally, both in girls and boys [4], while others state that it is more often in boys [2,19]. This may be connected with low penetration autosomal recessive inheritance [34].

2. Aim

Double teeth are rare lesions. The literature describes individual cases rather than extensive clinical material. The aim of this paper is to present an analysis of double teeth, as treated in the Department of Oral Surgery, at the Silesian Medical University, Katowice.

3. Material and method

The study material consisted of medical documents (case records, operation-books, x-ray and photographic documents) referring to patients treated in the Department of Oral Surgery from the 1st of June 2000 to the 31st of May 2010. Patients only with double teeth were selected for the study, and the following features were considered important: age and sex, reason or reasons why the patient reported to the Outpatient Clinic of Oral Surgery, general health state, time of recognition and type of double teeth, location of double teeth, complaints connected with double teeth, types of radiography, macroscopy of double teeth and finally the treatment method.

4. Results

Out of 43976 patients treated over 10 years in the Department of Oral Surgery, Silesian Medical University, Katowice, thirteen were found to have double teeth. Among them, eight were females and five were males. Seven patients were children aged up to 12 years old. Two were 27 years old and four were over 50.

Ten double teeth were in the maxilla compared with two in the mandible. The maxillary condition was most often seen among incisors: central in four patients and lateral in two. Four patients had double teeth among molars. Mandibular abnormality referred to the lateral incisor in one patient and to the molar in two.

All incisive double teeth were recognized in children aged between 9 and 12, including four boys and three girls. The abnormality was connected with a deciduous tooth in one child (case no.6) and with permanent teeth in the rest. Normal incisors were found conjoined to supernumerary teeth in four cases (cases no.1,2,5, and 12), and fused in two (cases no.3,6).

One boy, aged 10, (case no.11) had a supernumerary dens in dente, impacted and positioned palatally against impacted tooth 21. There was persistent tooth 61 in the dental arch. Double tooth 21 became impacted in a girl aged 9 (case no.5). A boy, aged 9, (case no.6) had persistent double tooth 61 accompanied by an impacted supernumerary tooth in region 21 and impacted normal tooth 21 (Figure 5).

The remaining patients had crowded teeth in the anterior part of the upper and lower dental arches. Double tooth 12 (normal plus supernumerary) was noted in a boy aged 11 (case no.2). Another supernumerary tooth was noted in region 22. This, however, did not join the normal tooth 22 (Figure 2).

Adult patients (cases no.4,7,8,9, and 10) demonstrated double teeth among molars, namely four (cases no.4,8,9, and 10) in the maxilla and two (cases no.7 and 13) in the mandible. Double teeth were discovered in four women and one man. Maxillary second and third molars were conjoined in four patients (cases no.4,8,9, and 10), and mandibular third molar was joined to supernumerary tooth 39 in two (cases no.7 and 13). Maxillary third molars and the supernumerary tooth 39 were all impacted. In one case a geminated tooth, consisting of a fusion between tooth 38 and tooth 39 (case no.13), was partially erupted.

Systemic diseases were only manifested in two patients (case no.4: arterial hypertension, glaucoma, postoperative condition after thyroidectomy; case no.9: blindness as a complication after cerebral meningitis suffered in childhood).

Four children with double teeth among incisors were referred to surgical treatment by an orthodontist (cases no.2,6,11 and 12), one – by a general dentist concerned about non-typical shape of tooth 21 (case no.3), one – by a dentist who had found mobility of conjoined tooth 12 and a supernumerary tooth when trying to extract the supernumerary tooth (case no.2), one child was referred by his parents who were concerned about missing tooth 21 (case no.6). Four adult patients with double teeth among molars came to have their impacted third molars removed before prosthetic treatment (cases no.4,8,9 and 10), and one patient (case no.13) presented with caries in a partially erupted geminated tooth. Out of this group, only one female patient aged 27 reported pain caused by her tooth 38 (case no.7).

Double teeth were only discovered during surgical procedures in five patients (cases no.4,7,8,9 and 10). The condition was revealed in one child by a dentist who was trying to remove a supernumerary tooth in region 12. The condition was only revealed in seven patients before surgical procedures, based upon clinical and x-ray examinations. These cases (no.1,3,5,6,11 and 12) were children with abnormal incisors, and only one adult patient with a molar geminated tooth (case no.13).

The most frequent x-ray projections were pantomographs (eleven patients, cases no. 1,3,4,5,6,7,8,9,10,12 and 13), followed by periapical radiographs (seven patients, cases no. 1,2,3,5,6,11 and 12), whereas occlusal radiographs (two patients, cases no.2 and 3) were rare. Computed tomography (CT), including 3D reconstruction and Cone-beam CT (CBCT) was additionally performed in two patients (cases no.3 and 11). One x-ray only, a pantomograph, was taken in six patients who had double teeth among molars (cases no.4,7,8,9,10, and 13). Two different x-ray projections



Figure1a.

Figure1b.

Figure 1a. Case 1 (tab.1). Periapical radiograph.

Figure 1b. Case 1 (tab.1). Removed concrement tooth 42 and supernumerary tooth.



Figure 2. Case 2 (tab.1). Concrement tooth 12 and supernumerary tooth- preoperative view.



Figure 3. Case 3 (tab.1). CBCT – frontal plane .

were performed in six patients (cases no.1,2,5,6,11,and 12), and four projections in one (case no.3).

In case 3 (fused tooth 21), orthopantomography only enabled the discovery of the presence of an atypical tooth, excessively wide, with its distal part shadowed by palatally positioned tooth 22. Evaluation of the tooth crown or root canal was not possible. Tooth and occlusal x-rays, compared with pantomographs, only provided some information on the chamber and root canal in the mesial part of the tooth because its distal part again was shadowed by tooth 22. Finally, CBCT was performed for tooth 21 to show that two teeth were conjoined along crowns and half roots by enamel, dentin and cementum.



Figure 4. Case 5 (tab.1). Periapical radiograph..



Figure 5. Case 6 (tab.1). Preoperative view.

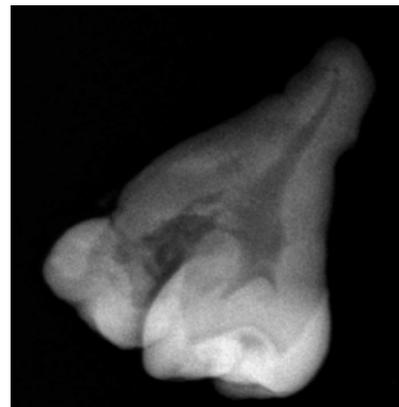


Figure 6. Case 7 (tab. 1). Radiograph of removed geminated tooth .

Furthermore, a transverse bridge between the two root canal pulps was noticed visualized (Figure 3). In case 11 (dens in dente, additional tooth in region 21), compared with x-ray, CT showed the structure of the atypical formation and its position against the impacted tooth 21 and persistent 61.

In the case of conrescence between maxillary lateral incisor (cases no.2,12) or mandibular lateral incisor (case no.1) and a supernumerary tooth, tooth x-rays



Figure 7. Case 9 (tab. 1).). Removed a conglomerate of impacted tooth 18 conrescent with 17

enabled the evaluation of shape, crowns and root canals of the conjoined teeth. It was also possible to see the overlapping contact surfaces of the crowns (cases no.2 and 12) or crowns and roots (case no.1). This could suggest an abnormality (Figure 1a). Orthopantomography did not provide information on chambers or root canals in case no.1, but they could be well seen on the periapical x-ray.

In cases no.5 and 6, orthopantomographs showed the presence of supernumerary teeth. In case no.5 neither pantomography nor periapical x-ray examination enabled the discovery of conrescence between tooth 21 and the additional tooth or bent root of the conrescent tooth (Figure 4). Pantomographs taken for conrescent teeth among molars showed only impacted third molars overlapping the roots of the second molars (cases no.4,8,9 and 10), or roots of the impacted supernumerary tooth 39 overlapping the roots of the third molar (case no.7). The periodontal ligament space around overlapping tooth roots was not visible on the pantomographs.

Therapeutic management depended on the position and structure of the double tooth. Problems caused by such teeth were also taken into account. Conrescent teeth among molars were usually removed. The procedure was performed under local anesthesia. The mucoperiosteal flap was lifted to enable the removal of the bone around the impacted teeth. As soon as the impacted tooth was found to be joined to the adjacent molar, they were removed in one block. In case no.10, a maxillary sinus communication was noted after the removal of the conrescent tooth. In case no.13, the gingival fragment that covered the distal crown of the geminated tooth, consisting of fusion between tooth 38 and tooth 39, was excised using a diode laser.

The management of double teeth among incisors was more complicated. The patients were under orthodontic treatment and surgical procedure was a

component of team management. In case 1, the erupted conrescent tooth (tooth 42 joined to a supernumerary tooth) was removed because of dental arch overcrowding. In cases 2 and 12, the conrescent tooth (tooth 12 joined to a supernumerary tooth) was sectioned and the supernumerary tooth was removed. To perform this procedure it was necessary to separate a mucoperiosteal flap and remove the compact bone lamella over the supernumerary tooth roots. Due to this, the teeth retained their vital pulp.

In case 5, tooth 21, positioned sub nasally, was removed upon separating a mucoperiosteal flap and drilling the compact bone lamella. Tooth 21 root was bent at a right angle. Tooth 21 crown was only in part covered with enamel, and an atypical additional tooth adhered firmly to its palatal surface (Figure 4). The child is still under orthodontic treatment and the defect will be restored with an implant at a later date.

In case 6, persistent fused tooth 61 was removed, and the mucoperiosteal flap was separated to enable the necessary removal of an additional tooth as it prevented the impacted tooth 21 from erupting.

In case 3, a decision was taken to perform endodontic treatment for the mesial part of the fused tooth 21 and remove its distal part. Therefore tooth 22, erupted palatally, will be inserted by orthodontic means. Endodontic treatment will only be performed after the root apex of tooth 21 mesial part is formed.

In case no.11, persistent tooth 61 was removed together with a dens in dente, the latter positioned palatally against impacted tooth 21. Furthermore, the impacted tooth 21 crown was exposed to prepare for orthodontic insertion into the dental arch.

The double teeth were carefully inspected after removal and x-rayed in different projections to visualize the amount of union and the topography of chambers or root canals. This helped to qualify the teeth according to double teeth types.

Among double teeth, the largest group was represented by conrescent teeth (cases no.1,2,4,5,8,9,10 and 12). Fused teeth were second in frequency (cases no.3 and 6). Gemination was represented by two cases (cases no.7 and 13) and “dens in dente” abnormality by one (case no.11). Conrescent teeth in the molar region were united along the entire root cementum length. Root hypercementosis could be recognized based on their thickened apices (Figure 7). As shown by radiography, the removed teeth had separate chambers and root canals. These features were not visible on preoperative pantomographs.

Conrescent lateral incisors (cases no.1,2 and 12) were conjoined by enamel and root cementum. They had separate chambers and root canals. Tooth 42 was

united with a supernumerary tooth along their contact surface by the entire length of crown and root. Tooth 12 was united with a supernumerary tooth along the crown and 1/3 part of the neck root (Figure 1b).

In the group of conrescent teeth, the most unusual abnormality was represented by case no.5 i.e. conrescence between impacted tooth 21 and an atypical additional tooth. The root of tooth 21 was bent at a right angle to the crown, the latter only covered partially by enamel. The additional tooth adhered firmly to its palatal surface. The teeth had separate chambers. The additional tooth chamber did not join tooth 21 root canal.

Fused teeth were united by enamel, dentin and root cementum. In case no.3, fused tooth 21 had two separate chambers and root canals were united by a transverse pulp bridge. In case no.6, both parts of tooth 61 were united by enamel, cementum and dentin. However, they had separate chambers and root canals.

A geminated tooth was recognized in case no.7. Upon removing a conglomerate of tooth 38 and impacted additional tooth 39, they were found to have a common root system. Radiography of the removed tooth showed that tooth 38 and tooth 39 were united by enamel, dentin and cementum. They had separate chambers and a common root canal (Figure 6). These features were not visible on preoperative pantomographs. They helped to classify the double teeth as a geminated double tooth.

A supernumerary tooth in region 21 had a different type of structure (case no.11). It was categorized as "dens in dente" because a big tooth-like formation contained a smaller tooth-like formation with a separate pulp chamber.

5. Discussion

It is generally believed that double teeth represent a rare abnormal condition [4,12,19,21,22,26,31]. The literature usually reports single cases. Reports of more extensive clinical material are rare. This paper is a review of 10-years worth of clinical material. Although double teeth were only recognized in 13 patients, the group seems to be quite large compared to other reports.

Many authors believe that double teeth usually affect deciduous dentition. Some predict that half of the patients with double teeth in their deciduous dentition will develop disorders in their permanent teeth [1,5,19,25, and 27]. Based on personal material, double deciduous tooth (tooth 61) was only noted in one patient. This condition was accompanied by impaction of tooth 21 and the presence of a supernumerary tooth in the region. However, it seems that such disorders in deciduous dentition may often be overlooked if no symptoms

are observed in connection with permanent dentition.

There are different opinions presented in the literature as to the predisposition to the abnormality in light of gender. In this personal material, double teeth were diagnosed in eight females and five males.

In the presented clinical material seven patients were children, aged between 9 and 12, and six were adults. Double teeth in the children were all connected with maxillary or mandibular incisors. In the adults, double teeth were all connected with maxillary or mandibular molars. In the latter situation, second molars were united with third molars (4) or a third molar was united with a supernumerary fourth (2). Other authors confirm that double teeth are usually revealed in incisors [6,21,26,32,33,35], most often in the maxilla [21]. Ikada *et al* [21] reports that the abnormality most often affects lateral incisors. Other authors noted double teeth most often in maxillary molars, usually between the second and third [8,12,15,16]. Schulz *et al* [8] described an interesting case of bilateral conrescence between a maxillary third molar and multiple supernumerary teeth. Gunduz *et al* [14] and Romito [13] state that double teeth rarely affect mandibular molars. They described a conrescence between mandibular third molar and a supernumerary tooth. Two similar cases appeared in our personal material, namely a union between tooth 38 and tooth 39, but no double teeth were noted in canines or premolars. Only Attung-Atac and Erden [26] report that double teeth most often affected maxillary incisors and canines in their study group of 3034 Turkish children.

Practically no concomitant diseases were found in the presented clinical material. Only two adult patients with maxillary conrescent second and third molars reported systemic diseases in their histories. Disturbances and troubles caused by double teeth usually depend on the location of the abnormality. The most troublesome symptoms are those connected with double teeth in the anterior part of the maxilla or mandible. In addition to esthetic problems, they usually cause malocclusion including traumatic occlusion, crowding and rotations of teeth, shifting in symmetry line, protrusions, diastemas, false distocclusion and buccal occlusion [4,12]. These are sometimes accompanied by periodontological problems like gingival recession [4]. Deep grooves that often occur on crowns of the double teeth may lead to dental plaque and caries problems [4,36]. Using electron microscopy, Erdem *et al* [37] observed that deep grooves were accompanied by cracks in enamel and dentin. These will activate caries process and pulp-related complications [18,32,33,36]. Hattab and Hazzaa [38] even described a case of tongue hurting by additional nodules that occurred on a double tooth crown. In our personal material, the symptoms caused

by double teeth were connected chiefly with incisors. Apart from esthetic problems, they led to malocclusion: all children were referred to orthodontic treatment. Therefore, the anomaly was recognized at an age between 9 and 12. On the other hand, double teeth in molars were usually asymptomatic and were only recognized in adulthood, in four cases as late as over 50.

Children with double teeth were most often referred to surgical treatment by orthodontists, sometimes by general dentists, and once by parents who had worried about missing tooth 21 in their child's dental arch. Double teeth were recognized in these patients before surgical treatment, based on clinical and radiographic examinations. However, in one case a dentist started the extraction of a supernumerary tooth but discovered mobility of a conjoined lateral maxillary incisor and discontinued the procedure.

Adult patients with double teeth presented for treatment in order to remove impacted third molars, usually before intended prosthetic treatment. In one case only, the patient reported pain and a carious defect in tooth 38. This tooth was joined to tooth 39. The anomaly was only recognized during surgical procedure in most of the patients. Other authors also admit that double molars are usually recognized during the extraction or surgical removal of an impacted third molar [7, 12, 13, 15, 16]. They point out further that failure to recognize this anomaly will lead to the loss of two teeth instead of one without prior informing of the patient. Such situation may involve legal consequences [12, 13, 15, 16]. Anterior double teeth are usually recognized earlier due to esthetic problems and malocclusion [12, 18, 26, 35, 37, 39]. In one case of mandibular molar gemination, the tooth was preserved after excising the gingiva over its masticatory surface using a diode laser. Such a procedure enabled the proper treatment of caries and preservation of the tooth in the arch as the first molar had already been removed in childhood.

Radiographic examination is a necessary component of double teeth diagnostics as it provides data allowing the recognition of the anomaly. It further helps to evaluate the type of the anomaly and to set the treatment plan.

Some authors state that such features of an x-ray as overlapping teeth, hypercementosis or lack of clear limits between the roots of adjacent teeth may suggest conrescent teeth [7, 8, 15, 16]. The evaluation of pulp cavity topography is also very important. If conjoined chambers or tooth canals are observed, a specific type of double teeth can be diagnosed and therapeutic management, including endodontic, will be decided accordingly [1, 4, 6, 9, 12, 17, 18, 22, 35, 36, 40]. However, it is often stressed that recognizing double teeth on radiographic

examination is not always easy. Root hypercementosis is not always connected with double teeth, and overlapping adjacent tooth roots are often difficult to separate, especially if impacted third molars are involved [7, 13, 15, 16]. This is confirmed by our experience too. Second molars overlapped by impacted third molars, as seen on a radiograph are often ignored, and double teeth are only revealed during surgery.

It is expected that radiographic examination will provide more data on the teeth structure (e.g. the shape of the roots), the presence of other pathologies like supernumerary teeth, or impaction of teeth. If impacted teeth are shown, it is important to know their topography within the alveolar ridge or relative to adjacent anatomical structures (maxillary sinuses, nasal cavity, mandibular canal). The most common x-ray projections are pantomographs and periapical radiographs [7, 8, 13, 15, 16]. However, in some cases CT is additionally performed [41]. 3D reconstruction and transverse scans are found to be very useful. Schultz et al describes the advantages of CBCT in diagnostics of double teeth [8]. CBCT is a decisive examination if there are still doubts upon routine radiography. The most common x-ray projections performed among patients in our clinical material were pantomographs and tooth radiographs. Occlusal radiographs were used rarely and CT only in two cases. Pantomographs provided no sufficient information on the topography of chambers and root canals, either in incisors or molars. These features were better visualized on tooth radiographs. However, it was difficult to evaluate malformation of double teeth structure based on pantomographs or periapical radiographs. An additional problem arose when supernumerary or impacted teeth were present, especially if the latter were overlapping the double teeth. CT enabled the obtaining of accurate diagnostic data and therefore to plan the treatment accordingly. It is suggested that CT should be more often used in doubtful cases. On the other hand, CBCT has already become largely accessible to dental clinicians and proved to be a useful diagnostic tool. Much lower doses of radiation, together with very accurate imaging make it more beneficial to patients, especially adolescents, than conventional CT.

There are a number of terms in the literature used to describe a pathology of conjoined teeth. The terms are usually based on odontogenetic disturbances underlying the abnormalities. However, clinical examinations, or even radiography, do not always effectively help to evaluate ectopathogenesis of the anomaly. The number of teeth in the dental arch is not always a reliable criterion either to distinguish between a fused tooth and a geminated tooth because a normal tooth germ might have united with an additional tooth [1, 4, 14].

Therefore many authors suggest that clinicians use the term “double teeth” to cover quite a large group of such anomalies [1,3,4,6]. Our own experience and analysis of the reports presented in the literature show that accurate diagnosis is sometimes only possible upon removal of the pathological formation and on its postoperative inspection, despite careful clinical examination and radiographic analysis performed prior to surgery. Additional radiographic projections (at different angles) of the removed double teeth are also a good help as they allow the evaluation of the character of the connection between the two teeth and the interrelationship between their pulp cavities and root canals, often indistinguishable on preoperative radiographs.

Radiographic examinations of teeth after their removal are also performed by other authors [7,13]. Analysis of the presented clinical material indicated that the most common type of double teeth were conrescent teeth, whereas other abnormalities, like fusions, geminations or invaginations, were rather rare. In our personal experience, double teeth, if impacted and/or connected to a supernumerary tooth, can be accompanied by additional structural abnormalities like a bent root or distorted crown.

Double teeth in deciduous dentition usually require no treatment. However, deep grooves on their crown surfaces require that dental plaque should be very carefully removed due to a high risk of caries. Furthermore, it is particularly important to observe the resorption process of their roots as it can run asymmetrically causing the abnormality of persistent double teeth in deciduous dentition, this being often associated with impaction of permanent teeth [27]. Such a situation was noted in our personal material: a 9-year old boy developed persistent tooth 61, impacted tooth 21 and additional impacted tooth in that region. A necessary decision was taken to remove the persistent double tooth 61 and to extirpate the additional impacted tooth. Afterwards the tooth 21 was inserted into the arch by surgical orthodontic procedure.

Therapeutic management of double teeth in permanent dentition depends on the region where the anomaly occurs, the disturbances involved and the structure of the tooth chamber and root canals. Molar double teeth are usually removed, as was done in our clinical material. However, such procedures can be difficult and sometimes risk complications if a second molar is connected to impacted third molar or a third molar is connected to supernumerary fourth molar with a different anatomic structure [7,12-16]. A dangerous situation arises in connection with the maxilla when the maxillary tuber breaks off or a fracture of the alveolar ridge occurs [7,13,15]. In the literature there have been

rare case reports on successful endodontic treatment of double molar teeth [40].

Double teeth in the anterior arch may cause esthetic problems and occlusal disturbances [4,6]. Therapeutic management will take into consideration: (1) leaving the double tooth in its place and improving its appearance through odontoplasty, (2) dividing the tooth with or without retaining its pulp vitality, (3) removing the tooth and reconstructing the dental arch continuity by orthodontic, implantological or prosthetic methods [4,6,9,18,35,39].

In the presented personal material, a decision on the type of management was taken in cooperation with an orthodontist. Permanent double teeth among incisors were only removed if they were found impacted and much distorted in anatomical aspect (*dens in dente*). Erupted double teeth were only removed if occlusal conditions required such management. Surgical intervention also usually involves the removal of additional teeth and exposure of permanent impacted teeth followed by their insertion into the arch. The remaining patients underwent division of the teeth, with positive vitality, and odontoplasty. One patient was planned to receive endodontic treatment and division of the fused tooth as soon as its root development was complete. Whether endodontic treatment is necessary or whether pulp vitality can be preserved in the remainder of the double tooth depends largely on the presence or absence of the connection between pulp cavities and/or root canals of the teeth [7,9,18]. Haskell *et al* [9] described a few cases of replacing endodontic by treating the pulp stumps in the remaining tooth fragment with calcium hydroxide and zinc oxide agents. They observed production of reparative dentin on the tooth hemisection site and good pulp vitality. In our personal material, all patients with double teeth were supervised by an orthodontist throughout the treatment. Such interdisciplinary management, if double teeth are involved, is recommended also by Rajab and Hadman [12].

6. Conclusions

1. The most common type of double teeth is conrescence.
2. Although reports in the literature suggest that double teeth are more typical for deciduous dentition, they are rarely found among deciduous teeth. The reason may be that the abnormality escapes detection by both patients and doctors as long as there are no disorders in permanent dentition.
3. Double teeth are most often seen in the region of maxillary incisors and molars (second and third molars), but very rarely in the mandible.

4. Incisive double teeth are usually found in children while molar double teeth in adult patients.
5. Double incisors are usually diagnosed prior to treatment while double molars – during their extraction.
6. Intraoral radiographs or pantomographs do not always allow the definitive confirmation of the presence of double teeth. Nor do they provide enough information

- on their structure, position in the alveolar ridge or the topography of their pulp cavities and root canals to plan treatment. In such cases it may be necessary to use CT or CBCT in addition to imaging examination.
7. Incisive double teeth are usually accompanied by occlusal disturbances and therefore therapeutic management is conducted by a team including orthodontists.

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