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Canine transmigration accompanying mandibular retrognathism secondary to osteitis

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Abstract: Transmigration is a tooth pathology in which the migrating tooth bud passes the median plane. Methods: This study is a presentation of the diagnostic and therapeutic outcomes in the cases of 4 stomach teeth transmigrations diagnosed in 3 patients with mandibular retrognathia which was a complication after osteitis in the postnatal period and infancy. Results: Extending imaging diagnostics to include CT, most preferably CBCT, makes it possible to precisely evaluate a transmigrated canine's position and to plan a course of treatment. Conclusions: Planning of the treatment of teeth in transmigration in patients with temporomandibular ankylosis should be done by a team consisting of an orthodontist and a surgeon.

Keywords: transmigration, CT, retrognathia,canines, osteitis, impacted

Introduction

Transmigration is a dental pathology in which a migrating tooth germ passes across the median plane. This problem is very rare and is estimated to affect 0.1% of the general population. However, this disorder is being detected more frequently due to routine panoramic radiographs taken before patients undergo orthodontic treatment.

Transmigration was first described by Thoma in 1952, and the term itself was originally used by Ando et al. [1,2]. However, Tarsitano and collegues were the first to define transmigration as the passing of an unerupted tooth across the median line [3]. Javid claims that the term transmigration can be applied when at least half the length of a tooth has passed the median line [4]. Joshi and others consider this view to be incorrect. In their opinion, what is more important is the tendency of a tooth to migrate and pass the median plane rather than the distance a tooth has passed [5]. Howard observed a link between the migration of a tooth and the angle between the longitudinal axis of the impacted canine and the median line. Transmigration does not occur if the angle is 25-30˚. An angle of 30-95˚ promotes transmigration [6].

Transmigration of a tooth germ most commonly occurs during maturation, when the alveolar processes grow intensely. Transmigrating teeth are frequently impacted in the bone, usually without causing any clinical symptoms [4]. However, some authors have described rare cases of displaced teeth erupting in places atypical for canine teeth. According to Joshi, in 20% of all cases canines erupt in the median line area, or on the opposite side of the dental arch, usually in the vestibular aspect. In the case of the longest recorded displacement, a canine migrated to the mesial root of the first molar. The rate of migration varies. Joshi observed a displacement of up to 3 mm during the course of one year [7]. Other authors describe cases of a canine remaining in a stable position over a period of up to five years [5,8].

In percentage terms, transmigration occurs more frequently in women than in men. This condition most commonly affects the lower canines, although the literature also includes cases of transmigration in the upper arch. More cases of unilateral transmigration have been described than bilateral cases [3]. According to Costello, transmigration occurs more frequently in the right canines [9].

Mupparapu distinguished between five different types of transmigration. Type I is diagnosed when the coronal part of the tooth passes the median line and the canine is in a mesial or distal position in relation to the incisor

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and its long axis is inclined mesially. In type II, the canine is positioned horizontally, close to the lower border of the body of mandible and below the roots of the incisors. In type III, the canine erupts mesially or distally in relation to the canine on the opposite side. In type IV, the canine is in a horizontal position close to the lower border of the body of the mandible and below the root apices of premolars or molars. Finally, in type V the canine is in a vertical position, and its axis passes beyond the median line [10].

The etiology of transmigration is not fully understood. Javid and Joshi believe it is caused by an excessively high eruption force, which displaces the tooth germ beyond the median plane [4,5]. However, Broadway claims that the process is due to the incorrect position of the tooth germ in the mandible [11]. Other etiological factors that need to be considered include odontogenic tumors, cysts [12,13], premature loss of deciduous teeth, tooth crowding, supernumerary teeth, hypodontia, and an abnormal canine anatomy where the crown is excessively long [14,15]. These can impede proper canine eruption and potentially promote transmigration [7,16]. Some authors have highlighted cases of inflammation surrounding a deciduous tooth, which ruptures the band of cells connecting the tooth germ with the oral cavity [9,14]. Mitchell has also described cases of canine migration caused by mandibular fractures in the area of growing tooth germs [17]. Holla, Saity, andParashar consider that Dental Class II malocclusion with deep bite, deep curve of Spee, excess tooth material, and increased lower anterior facial height indicating an increase in space available apical to the mandibular incisors may be predisposing factors in the etiology of the transmigrating canine [18].

Five procedures for treating canine transmigration have been described in the literature and the choice of method depends on the severity of the transmigration. The procedures are as follows:

1) surgical extraction of a displaced canine with retarded eruption, 2) autotransplantation, 3) surgical exposure of a transmigrated tooth, 4) the alignment of the tooth in the dental arch using a fixed orthodontic appliance, and 5) observation of a displaced tooth without therapeutic intervention. Autotransplantation is recommended in cases where the lower incisors are in the correct position and when there is sufficient space in the dental arch to accommodate the transplanted canine.

There have been no case reports of canine transmigration in patients with mandibular hypoplasia secondary to neonatal and infantile osteitis. The purpose of this paper is to present a series of three cases in which the transmigration of four lower canines was diagnosed.

Case I

Female patient K.U. was treated for bilateral suppurative otitis during the neonatal period when she was eight days old, which resulted in sepsis. At the age of five, the patient was diagnosed with the following disorders: facial asymmetry and mandibular retrognathism secondary to right-sided temporo-mandibular joint ankylosis. We detected impaired mandibular kinetics in the form of limited opening and excursion to the left. During protrusion, the mandible deviated to the right. The patient was fitted with a functional orthodontic appliance type Klammt 1 with a reduced palatal plate to compensate for mandibular retrognathism and facial asymmetry. The mandible opening was improved to 37 mm. A panoramic radiograph taken when the patient was aged eight years and nine months revealed significant mesial inclination of both lower permanent canines in relation to the median plane. The lower right canine (tooth 43) was angulated at 86^0, while the lower left canine (tooth 33) was angulated at 80^0. In addition, there was no space for tooth 43. Using a fixed appliance, space was created for tooth 43. When the patient was aged 11 years and nine months, part of crown 43 appeared in the oral cavity, which was brought into the arch using elastics. Over a period of three years, tooth 33 migrated from a position distal to tooth 72 to a position mesial to the root of tooth 44. This tooth was inclined at 80° in relation to the median plane, which had not changed over the three-year period. A panoramic radiograph taken when the patient was aged 12 years and two months revealed a short and deformed ramus of the mandible on the right side. Horizontally positioned impacted tooth 33, which had transmigrated from the opposite side, was visible close to the border of the body of the mandible in the area of teeth 43-41. Its crown was oriented distally (towards the angle of mandible on the ankylosis side), while its root was positioned towards the median line. The crown of transmigrated tooth 33 was located between the root apex of tooth 44 and the lower border of the body of the mandible and was more radiopaque than the root, which indicated that the tooth was inclined in the vestibular-lingual plane. The angulation of the inclination was 94 degrees. The image of tooth 33 was blurred at mid height of the body of the mandible below the root apices of teeth 41 and 31 .

A CT scan showed that the lateral surface of crown 33 and part of its incisive cusp were covered only by a thin layer of compact bone, whereas the apex was oriented towards the lingual cortical plate. An odontogenic cyst was detected. The 1-2-mm thick lower border of the body of the mandible below crown 33 remained undamaged by

the dentigerous cyst (Fig.1,2). The transmigration observed in this case corresponded to Class IV on the Mupparapu scale.

Because of the cyst and the possibility of injuring the lower incisors when aligning tooth 33 in the arch, we decided to extract the tooth with the cyst capsule.

Case II

Female Patient R.A., age 11, contracted a staphylococcal infection during the perinatal period, which developed into omarthritis on the right side as well as inflammation of the right temporo-mandibular joint. As a result, ankylosis of the temporo-mandibular joint occurred together while the right upper extremity was underdeveloped. At the age of 11, the patient sought orthodontic treatment. An examination revealed facial asymmetry, protrusion of the upper lip and significant recession of the chin. Scars caused by a mandibular distraction procedure were visible on the skin of right cheek . The distractor was founded at the age of 8 years.

The following conditions were diagnosed: mandibular retrognathism, left-side displacement of the mandible, impaired kinetics of the mandible with an opening limited to 30 mm, a limited left-sided excursion, and an asymmetric protrusion.

There was insufficient space for the lower left canine (tooth 33) (Fig. 3,4). The diagnostics were confirmed with a CT scan. This made it possible to establish the presence of tooth 33, which was impacted and displaced beyond the median line. It was positioned vertically in the projection of the lower central incisors (teeth 41-31). Crown 33 was not covered from the vestibular aspect by the cortical plate, and its cusp was located at the height of the root apices of teeth 41 and 31, which were positioned lingually. The root apex of tooth 33 was oriented towards the lower border of the body of mandible and positioned midway along the body, between the vestibular and lingual cortical plate. Tooth 33 was rotated. This type of canine transmigration corresponded to Class V on the Mupparapu scale. The angulation was 62 degrees.

It was decided to surgically expose tooth 33 in order to align it in the dental arch using a fixed appliance (Fig.5).

Case III

Female patient Ć.D. had been receiving orthodontic treatment since she was one year old due to left temporo-mandibular joint ankylosis (a complication of

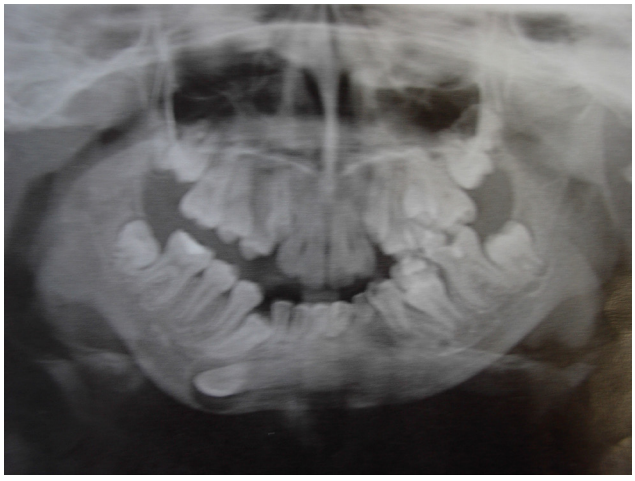

Figure 1: Patient K.U age 11,9 Panoramic radiograph.

Figure 2: Patient K.U age 11,9 Extraoral photography.

Figure 3: Patient R.A age 11 Panoramic radiograph.

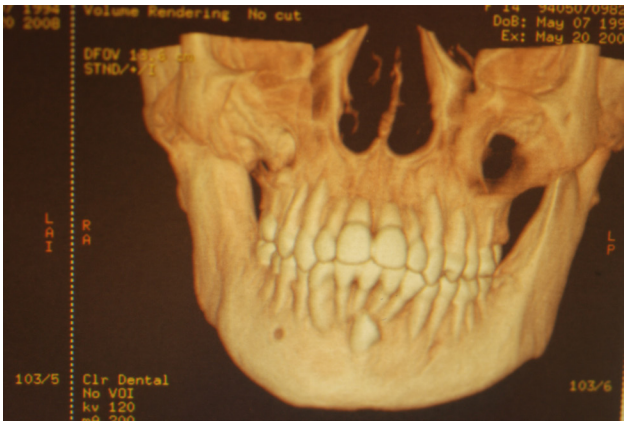

Figure 4: Patient R. A. age 11CT and 3D visualization.

Figure 5: Patient R.A age 14. Intraoral photography. Tooth 33 in transmigration inserted into the dental arch.

Figure 6: Patient C.D age 12. Panoramic radiograph of patient C.D.

inflammation: local infections in the neonatal period can lead to generalized, dangerous infections called sepsis) and mandibular retrognathism. The child received an oral screen in order to train the orbicularis oris muscle and duce the distal position of the mandible. Symptoms of ankylosis were diagnosted when the child was 4 years old and could not open her mouth wide during spoon-feeding. Because of the recurring stiffness of the left temporo-mandibular joint, surgical release of this joint was performed three times when the patient was six, nine and 12 years old. Lateral and anterior-posterior cephalograms revealed that the ramus of the mandible on the side of the defect was shortened by five mm, and the body of mandible was shortened by six mm and recessed by 18 mm . The overjet was increased by 11 mm. The patient was fitted with upper and lower fixed light-archwire appliances. The treatment plan was to even out skeletal discrepancies in the form of mandibular retrognathism and open bite.

A radiograph taken when the patient was aged 13 years revealed the absence of the coronoid and condylar processes in the mandible on the left side and the presence of an impacted upper left canine (tooth 23), lower left first premolar (tooth 34), lower left canine (tooth 33), and lower right canine (tooth 43). In the anterior segment of the mandible, which was shown in a number of projections, horizontally positioned teeth 33 and 43 were identified, which were displaced parallel to one another and below the incisor roots. Increased translucency around the displaced and impacted canines was evident, which suggested a dentigerous cyst. Tooth 43 was positioned transversally with the cusp between teeth 32 and 34, and the root apex was near to the lower border of the mandible body in the projection of tooth 42. The crown of tooth 43 was in a vestibular position and was partially covered by the cortical plate, while the apex of its root was close to the lingual cortical plate of the body of the mandible. Tooth 33 was positioned below tooth 43, horizontally along the lower border of the body of the mandible. The incisor cusp of tooth 33 was located in the projection of the root apex of tooth 42 and the root apex of tooth 34. The crown of the tooth was in a vestibular position, adjacent to the lower margin of the body of the mandible and was not covered by the cortical lamella in the cusp region. The root apex of tooth 33 was located midway along the body of the mandible in the region of its lower margin. An osteolytic defect indicating a forming dentigerous cyst was only evident around the crown of tooth 33 (Fig. 6,7). Teeth 43 and 33 were in class IV transmigration according to Mupparapu. The angulation of the impacted canine 33 to the midline was 75 degrees and of the second impacted canine 43 – 94 degrees.

The impacted tooth 34 was exposed, and then orthodontic brackets were bonded to their surfaces. Elastics were engaged to bring these teeth into the arch (Fig.8,9). The transmigrated tooth 33 and tooth

Figure 7: Patient C.D age 12. CT and 3D visualization.

Figure 8: Patient C.D age 12. Impacted tooth 34 was exposed.

Figure 9: Patient C.D age 12. Intraoral photography. After treatment.

43 were removed with a developing dentigerous cyst. The impacted tooth 23 was exposed as well and bring these teeth into the arch.

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent: Informed consent has been obtained from all individuals included in this study.

Conclusions

In the cases described in the present study, canine transmigration occurred in parallel with mandible hypoplasia, which was an osteitic complication that developed when the patients contracted general infections in the neonatal stage and in infancy. The available literature includes no discussion of the etiology of the disorder discussed in the present paper. In the present article, transmigration was diagnosed in adolescent girls. Other authors have also noted that the complication occurs more frequently in female patients and usually develops during puberty [4,7,19,20]. One of the cases described above involved a very rare bilateral displacement of canines in the mandible - three of the four transmigrating canines had been displaced from the left to the right side. Costello claims, however, that this anomaly is more common in teeth on the right side [9]. The transmigrated teeth showed a tendency to erupt on the vestibular surface of the body of the mandible in the region of the median line or in the projection of the incisors. This could be confirmed by the absence of cortical bone covering the crowns of the transmigrated teeth. Such a tendency has also been observed by other authors [14,16,21,22].

Due to the significant retrusion of the anterior segment of the mandible, the three cases presented above were difficult to diagnose based on standard radiological diagnostics. Panoramic radiographs proved to be useless because they represent flat (2D) pictures. Because of mandible hypoplasia, the chin area fell outside the imaging layer, which made X-ray images also useless. Therefore, it was decided to extend the imaging diagnostics through the use of CT. A reconstruction of the picture was obtained with transverse cross-sections of the mandible. In addition, a three-dimensional (3D) reconstruction was made, which allowed us to assess the position of the transmigrated canines with regard both to the vestibular and lingual cortical plate and to the roots of other teeth. This information ensured a better evaluation of the existing conditions, which proved helpful when selecting therapeutic management. There is no data in the available literature regarding the use of computer tomography in imaging transmigrations. Currently, the preferred diagnostic approach in such cases should

include cone beam CT (CBCT) imaging as it reduces the radiation dose.

The practice of surgical exposure and aligning a transmigrated canine into the dental arch was first described in 1994 by Wertz [23]. However, this approach is difficult and depends greatly on the maturity as well as the position and degree of tooth transmigration. Many authors have opted to observe this disorder, because the process is asymptomatic in most patients [3,7,15,17,19]. However, it is absolutely essential that a follow-up X-ray be taken, in order to assess any possible development of dentigerous cysts, root resorption of adjacent teeth or potential infection foci. These signs are indications for extracting a tooth [14]. It is also important to be aware of any possible neurological symptoms caused by the compression of a transmigrated tooth on nerve endings [3,4,14].

In the case of our study, we decided to extract transmigrated canines if they were horizontally positioned along the lower border of the mandible body (class II according to Mupparapu) and if we observed signs of a dentigerous cyst. Two-thirds of the length of one of the teeth was displaced beyond the median line, and up to half of the length of the other was similarly displaced. The remaining two canines were surgically exposed in an attempt to align them in the dental arch.

Our observations indicate that patients with mandibular hypoplasia secondary to osteitis in the growth period should undergo screening with panoramic radiographs at the age of eight to nine years (when canine roots achieve a third of their maturity) to ensure early detection of a canine's eventual tendency to transmigrate. Extending imaging diagnostics to include CT, most preferably CBCT, makes it possible to precisely evaluate a transmigrated canine's position and to plan a course of treatment.

Treatment planning in such cases should be performed by a team comprising an orthodontist and a surgeon. Such a management approach makes it possible to determine the optimal time for commencing treatment and to choose the optimal procedure for teeth at risk of transmigration.

Conflict of interest statement: Authors state no conflict of interest

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