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*Impacted canines: diagnostic and treatment – review
of literature and own cases*

Impacted canines are a common dentistry problem. “Impacted teeth” deals with completely developed teeth with completed root formation, remaining in bone or in soft tissue of the mouth after the physiological time of eruption (1).

Among all impacted teeth, canines set up almost 50% and are recognized in 1–2% orthodontic patients. According to Fourniers et al. study, impacted canines issue is twenty times more frequent in maxilla than in mandible, and palatal site is three times more frequent than vestibular one. According to Amin and Grgurevic study impacted canines are recognized in 85% in female patients (2–7).

According to Dewel study, canine eruption can be hindered by space and timing. Those teeth are formed high in fossa canina, laterally to piriform aperture. During eruption canines pass the hooked way from the basis of the maxilla to the dental arch. Canines are localized slanting in maxilla and during the eruption take vertical position. In this process lateral incisors play the role of a leading plane. Researchers revealed a correlation between canine impaction and lateral incisor hipodontia or with its atypical root formation (7, 8).

There are different reasons of canine impaction, i.e. atypical localization of tooth germ before enamel formation, the path of the germ eruption, thickness of the bone, atypical localization and formation of the adjacent teeth, lack of space in the dental arch and injury. Canine impaction exists very often with subsistence of deciduous teeth, ankylosis and cysts. It is still unknown if it is a reason or a cause of canine impaction (2, 3, 9).

MATERIAL AND METHODS

Radiological documentation of patients with impacted upper canines was evaluated. Orthopantomogram and dental X-ray (in two projections) were taken as standard procedure to assess the degree of impaction of the canine teeth. In patients with multiple canine impaction and in instances of unsatisfactory conventional radiological imaging, computed tomography examination was indicated.

RESULTS AND DISCUSSION

Leaving of the impacted canine in maxillary or mandibular bone leads to many complications such as cysts, root resorption of adjacent teeth, transmigratio (especially lower canine) and atypical headache (2, 3, 6, 10, 11).

To avoid these complications specialists should start treatment in adequate time. The methods involved are: orthodontic treatment, surgery and orthodontic treatment or surgery treatment. Before choosing the adequate type of treatment precise diagnostics is very important. Not all canines can be brought to the dental arch (12). McSherry suggests that apically, horizontally and distally localized canine teeth in maxillary bone are wrong prognostics in orthodontic treatment (13).

According to Proffit better results gives surgical extraction and transplantation of impacted teeth, prosthetic replacement of the teeth or implant than a long process of bringing the tooth to the dental arch, which sometime is unsuccessful (14).

In some cases decision of impacted teeth extraction is required due to: unfavorable localization, atypical morphology, short and resorbed roots of adjacent teeth and the lack of cooperation with patient (emotionally immature, poor oral hygiene). In some cases orthodontic therapy leads to many complications such as damage of adjacent teeth during surgery exposure of the impacted canine and after using orthodontic force to bring tooth to the dental arch. The patient's approval due to the kind of orthodontic appliance, surgery procedure, time and costs of the treatment is essential in therapy (15).

Indications for surgical extraction of impacted canine should be carefully considered to avoid inter- and post surgery complications. Complication include damage of soft tissue and maxilla bone. Surgery requires removal of cortex bone of alveolar ridge and sometimes thick layer of medullar bone from palatal or vestibular site. It causes vast destruction of the bone structure and is responsible for post surgery gums recession in adjacent teeth. This fact is reflected in many therapeutic problems in orthodontic, prosthetic and implant treatment due to lack of the alveolar bone. Surgery has also an effect on esthetic outcome so in many cases it should be conducted with immediate bone augmentation to rebuild the alveolar bone (16).

Considering the problem of impacted canine, the most important role plays thorough diagnostic process. In the past the typical radiological examination was composed with orthopantomogram, occlusal X-ray or periapical X-rays (Fig. 1, Fig. 2). The last one usually was taken in two projections to estimate the palatal or vestibular localization of the tooth (parallax phenomenon). Orthopantomogram gives a lot of information about the structure of maxilla and mandible bone, maxillary sinuses, TMJ's and teeth. Unfortunately diagnostic information is less precise and in some cases needs verification.

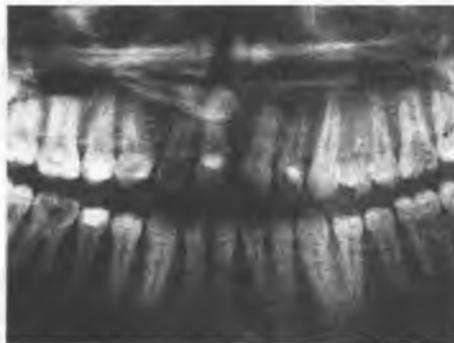


Fig. 1. Impacted upper left canine. No information about incisors apices status can be obtained.
(X-ray from own practice)

Computed tomography gives incomparable better imaging quality with previous methods. This method is about hundred times more sensitive than conventional methods, and problems of anatomical structures superposition are eliminated. High contrast enhancement gives about ten times more sensitive level in tissue differentiation.



Fig. 2. Periapical X-ray, in the same patient. The status of adjacent teeth apices can not be precisely estimated (X-ray from own practice)

Scans from single CT examination can be previewed as axial, frontal or sagittal planes. The disadvantage of CT as a routine diagnostic examination is the cost comparing with common X-ray exams, another is high level of radiation dose and timing of CT. In dental arches CT the effective radiation dose is about 0.21 mSv (which is equivalent of 26 days of natural background radiation dose), in orthopantomogram the dosage is estimated as 0.03 mSv (equivalent of 4 days of natural background radiation dose). Spiral tomography gives better 3D reconstructive imaging, shorter exposure time and radiation dose reduction (17) (Fig. 3, Fig. 4).



Fig. 3. Shaded Surface Display imaging allows analyze in 3-dimensional aspect (scans from own practice)

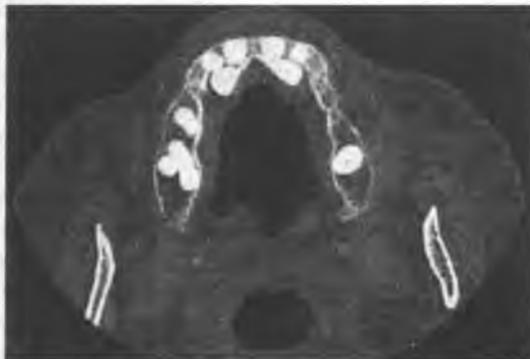


Fig. 4. Axial scans. Palatally localized impacted canines (scans from own practice)

Computed tomography gives precise space localization of impacted teeth, reveals root resorption of adjacent teeth and presents crown-root crook or root apex crook of impacted tooth (Fig. 5).

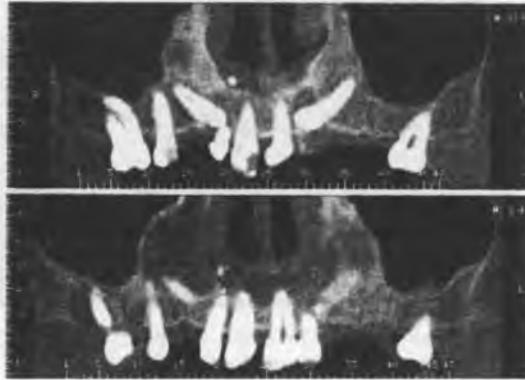


Fig. 5. Dental arch CT scan is similar to orthopantomogram but superposition defect is eliminated. Upper lateral incisors root resorption, dentigerous cyst of upper left canine clearly revealed in examination

Precise tooth localization is very important in extraction cases, during exposing of impacted canine (CT imaging limits surgery area) and during planning orthodontic treatment (helps in adequate planning of orthodontic force direction, reduces the risk of roots resorption of adjacent teeth and limits the time of therapy) (13, 16–19).

Computed tomography can diagnose the presence of roots resorption in central and lateral incisors on palatal and labial surface. Ericsson and Bjerklin used computed tomography in examination and concluded the presence of root resorption in 50% cases (60% of resorptions extended to the pulp chamber), these CT diagnosed resorptions were not recognized in standard X-ray exams. Similarly in Ericson's and Kuroł's study in 156 impacted upper canines resorption of 72 adjacent upper incisors, 58 lateral incisors (38%) and 14 central incisors (9%) was diagnosed (2, 8, 17, 18). The presence and range of roots resorption of upper incisors is a very important factor having an effect on treatment plane.

Early diagnosis of tooth impaction helps to estimate the risk of upper canine retention and sometimes, to avoid sophisticated treatment. Ericsson and Bjerklin study revealed that in 78% cases of improperly erupting canines changes the way of eruption 12 months after extraction of deciduous canine.

To estimate the possibility of eruption of upper canine we use the position of the canine cusp in relation to lateral incisor. Assignment of four sectors described by Lindauer is very useful in this estimation. The first sector (I) is the area distal to lateral incisor crown and root contour, the second sector (II) is localized between the first sector and the line dividing for half the contour of lateral incisor, the third sector (III) extends mesially to the second one and is limited by the tangent to mesial contour of lateral incisor, the fourth sector (IV) is situated mesially to the third one. Lindauer et al. maintained that 78% canines, whose cusp exceeded the mesial line of lateral incisor (i.e. in II-IV sector) presented predisposition to impaction (2) (Fig. 6).

According to Swedish studies (Kuroł et al.) estimation of the canine localization in maxillary bone should be assessed in population of 10-year-old children. If canine crown does not pass sector II, the possibility of proper eruption is 90%. Estimation of canine position before the age of 10 may be inadequate due to unshapely (zigzag) way of canines' eruption (20).

Treatment of impacted canines should be interdisciplinary both in schedule and in realization. The cooperation of orthodontist and oral surgeon should be obligatory from the beginning of treatment.



Fig. 6. Impacted upper right canine in sector III in 20-year-old female patient. The presence of deciduous canine root scrap. Lindauer's sectors (X-ray from own practice)

The advantages of CT imaging in canines impaction seem to exceed the risk of higher radiation dosage comparing to common X-ray examination and the cost of CT examination. CT imaging gives extraordinary quality of scans which facilitate exact diagnosis and the best treatment plan both in orthodontics and as in surgery. This let reduce potential complications in orthodontic and surgery treatment, the time of treatment and total cost of treatment.

CONCLUSIONS

1. Precise impacted canine diagnosis is essential for the best treatment plan: it validates the treatment time and reduces possible complications.
2. Early estimation of canine positioning in adolescents allows to make the best treatment decision and enables spontaneous canine eruption.

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SUMMARY

Aim: evaluation of the best diagnostic method for impacted canines before final diagnosis and treatment of impacted canines. Methods: diagnostic documentation of the patients from the Clinic of Maxillofacial Surgery and Department of Pediatric Dentistry of Medical University of Lublin was evaluated in cases of impaction of the upper canines. Results: in the majority of cases of canine impaction, conventional radiological examination was not satisfactory due to lack of precise information. CT imaging gave very precise diagnostic information for evaluating the best treatment. Conclusions: precise impacted canine diagnosis is essential for the best treatment plan; it validates the treatment time and allows to reduce possible complications.

Kły zatrzymane: diagnostyka i postępowanie lecznicze – przegląd literatury
i prezentacja własnych przypadków

Celem pracy jest dokładna ocena położenia zatrzymanych kłów górnych. Do badań wykorzystano dokumentację radiologiczną pacjentów leczonych w Zakładzie Chirurgii Szczękowo-Twarzowej i Zakładzie Stomatologii Wieku Rozwojowego AM w Lublinie. W wielu przypadkach dopiero zdjęcia tomografii komputerowej dawały jednoznaczną wizualizację przypadku przez eliminację efektu nakładania obrazów oraz przekroje w różnych płaszczyznach. Dokładna diagnostyka zębów zatrzymanych pozwala precyzyjnie zaplanować leczenie, skraca czas terapii i eliminuje liczbę powikłań.