

Prevalence of impacted canines among sudanese university students

Prevalência de caninos impactados em estudantes universitários sudaneses

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ABSTRACT

Objective: To determine the prevalence of impacted canines among 17-25 year old Sudanese University students. **Material and Methods:** Descriptive cross-sectional study in University of Khartoum, Sudan. 2401 students were selected according to random stratified sampling technique and screened under natural day light. All students with un erupted permanent canines were referred to the Orthodontic Department for clinical examination and radiographic investigations. **Results:** Forty nine students (2%), 10 males and 39 females out of 2401 students were reported to have at least one impacted canine. Males to females ratio was approximately 1:4. Impacted canines were more common in the maxilla (1.6%) than in the mandible (0.33%). Majority of the cases with impacted canines (73.5%) had unilateral impaction $p < 0.05$, whereas 24.5% had bilateral impactions and only 2% had three impacted canines. Location of the impaction either: palatal, buccal or in the line of arch and the palatal impactions were the most common one (45%), whereas buccal and in the line of arch impaction were found in 20% and 35% respectively. Retained deciduous canines were observed in most of the cases with impacted canines (81.6%). **Conclusion:** Prevalence of impacted canines was noticeable and comparable to the findings reported in other populations. The study gives a clue about the magnitude of the problem. However, strong conclusion can not be drawn since the sample is not representative to the whole Sudanese population. Further study is essential for a great sample from different provinces of the Sudan in order to draw a real conclusion.

KEYWORDS

Cuspid; Tooth, Impacted; Palate; Dental arch; Maxilla; Mandible.

RESUMO

Objetivo: Determinar a prevalência de caninos impactados em universitários sudaneses com idade entre 17 - 25 anos. **Material e Métodos:** Este é um estudo transversal descritivo realizado na Universidade de Cartum, Sudão. Dois mil, quatrocentos e um estudantes foram selecionados de acordo com técnica de amostragem aleatória estratificada e avaliados sob a luz natural do dia. Todos os alunos com caninos permanentes não irrompidos foram encaminhados para o Departamento de Ortodontia para investigações por meio de exames clínico e radiográfico. **Resultados:** Quarenta e nove alunos (2%), 10 do sexo masculino e 39 do sexo feminino, dentre os 2.401 estudantes avaliados, apresentaram pelo menos um canine não irrompido. A relação deste episódio entre homens e mulheres foi de aproximadamente 1: 4. Caninos não irrompidos foram mais frequentes na maxila (1,6%) do que na mandíbula (0,33%). A maioria dos casos de caninos não irrompidos (73,5%) eram impações unilaterais ($p < 0,05$), enquanto que 24,5% apresentavam impação bilateral e somente 2% dos pacientes apresentavam três caninos não irrompidos. A localização da impação foi por palatino, vestibular ou na linha média; sendo que impações por palatino foram mais frequentes (45%), enquanto que 20% e 35% estavam por vestibular ou na linha média, respectivamente. Caninos decíduos retidos foram observados na maioria dos casos de caninos não irrompidos (81,6%). **Conclusão:** A prevalência de caninos não irrompidos foi relevante e comparável com os achados em outras populações. Este estudo fornece noções sobre a magnitude do problema, no entanto, conclusões generalizadas não podem ser tomadas, pois a amostra não é representativa de toda a população sudanesa. Um estudo mais aprofundado é essencial para uma conclusão real, considerando-se amostras de diferentes províncias do Sudão.

PALAVRAS-CHAVE

Canino; Dente impactado; Palato; Arco dental; Maxila; Mandíbula.

INTRODUCTION

Impacted teeth, especially canines, can cause many problems during orthodontic treatment. However, impacted canines often hinder orthodontic movement and compromise aesthetic outcomes. In some cases the impacted canines may cause root resorption of the adjacent teeth.

The permanent canines are the foundation and pillar of an aesthetic smile and functional occlusion. It stands at the corner of the dental arch forming the canine eminence for support of the alar base and upper lip. Functionally; it supports the dentition contributing to its disarticulation in lateral movements in certain individuals, its root length and particularly its volume, makes it one of the most outstanding abutments for prosthetic replacement of other maxillary teeth. Impacted teeth, especially canines present many problems for orthodontist. They can compromise tooth movement, aesthetics and functional outcomes [1].

Canine impaction has been with man for thousands of years. A case has been reported in an excavated skull dated at 2700 to 2724 BC, so it seems likely that abnormal eruption of human teeth is not caused by modified conditions brought about by modern civilization [2].

Impaction occur when the canine is prevented from erupting into its normal functional position by bone and tooth or fibrous tissue. Impacted canines are those with a delayed eruption time or that are not expected to erupt completely based on clinical and radiographic assessment [3]. If the tooth is not exposed to the oral cavity and the age of the patient was above 16 years the canine is considered to be impacted [4].

Dewel [5] stated that no tooth is more interesting from developmental view than the upper canines, because it has the longest period of development, the deepest area of development and the most devious course to travel from it is point of origin to full occlusion. Although it

starts to calcify almost as early as the first molar and central incisor, it takes nearly twice as long to achieve complete eruption.

Moyers [6], stated that the maxillary cuspid follows a more difficult and tortuous path of eruption than any other tooth. At the age of three it is high in the maxilla, with its crown directed mesially and somewhat lingually. It moves towards the occlusal plane, gradually up righting itself until it seems to strike the distal aspect of the root of the lateral incisor. It then seems to be deflected to a more vertical position; however, it often erupts into the oral cavity with a marked mesial inclination.

The maxillary canine is the second most frequently impacted tooth in the dental arch after the third molars. The majority of maxillary impactions occur unilaterally, only 8-10% occurs bilaterally [1,7].

In the literature the prevalence of maxillary impacted canine among different population was reported between 0.8 and 2.8% [8,8].

The strategic position of the canine at the angle of the arch is significant in the maintenance of harmony and symmetry of occlusal relationship and in determining the contours of the mouth as whole. Impacted canines may compromise dental health and could cause resorption of roots of the neighbouring teeth therefore their early detection is of great importance. Many studies in different parts of the world had reported the incidence of canine impaction. However, various results have been reached by several authors showing different values in prevalence among diverse populations. In Sudan no study whatever is available concerned with this anomaly. The present study was carried out to give a clue about the magnitude of the problem in the Sudanese society by revising a selected sector of this community.

This study was conducted to determine the prevalence of impacted maxillary and mandibular canines at different location among Sudanese students in the Medical campus, University of Khartoum, Sudan.

MATERIALS AND METHODS

A descriptive cross-sectional study carried out in the Medical Campus, University of Khartoum for 2401 university students.

Ethical approval was obtained from Faculty Research Committee and written consent was obtained from each participant in the study.

Students were selected according to random stratified sampling technique with probability proportional to size. The total number of the students in the medical campus was 4857 in the different faculties (medicine, dentistry, pharmacy, nursing, laboratory science and public and environmental health) (Table1)

Fraction from each faculty screened are $2401/4857 = 0.49$.

Table 1 - Number of Students in the campus in the different faculties

Faculty	Total number of Students	Target Fraction
Medicine	2169	$2169 \times 0.49 = 1072$
Dentistry	561	$561 \times 0.49 = 277$
Pharmacy	707	$707 \times 0.49 = 350$
Nursing	472	$472 \times 0.49 = 234$
Laboratory science	401	$401 \times 0.49 = 198$
Public & Environmental health	547	$547 \times 0.49 = 270$
Total	4857	2401

Methodology

The initial screening for the selected students from the students list was carried out by the principle investigator and under the natural illumination. The permanent canine was considered to be impacted if it was not expected to erupt completely based on clinical and radiographic assessment and no history of extraction. All students with unerupted permanent canines were referred to the Orthodontic Department for further investigations.

A questionnaire consisted of personal data; clinical examination and radiographic investigation were filled by the principle

investigator for each student with un erupted permanent canines.

Two X- ray views (panoramic and anterior occlusal) were taken for each student by a well trained technician at Department of Radiology, Faculty of Dentistry.

The maxillary anterior radiographs were taken by Kodak Ultra-speed film at 70 degree to increase the effect of parallax [9] and the Panoramic radiographs by Cranex 3 + Cephalostat (orion corporation sordx) TM (China), using extra oral films (Kodak MXG green sensitive). Students were positioned properly using the head- positioning devices and light beam marker positioning guides. The teeth were positioned to lie within the focal trough [10].

The orthopantomograms showed the condition of the impacted canine in relation to adjacent teeth.

The estimated positions of maxillary permanent canines were determined by vertical parallax technique) rotational panoramic radiograph and an occlusal radiograph) [11]. The impacted canines were recorded in three positions Palatally, Buccally and in the line of the arch [12].

Data analysis

The Statistical package for social sciences SPSS computer program Version 11 (Spss In, Chicago, III) was used for statistical analysis, chi-square test were used for data analysis. The level of significance was at 0.05% (P value).

RESULTS

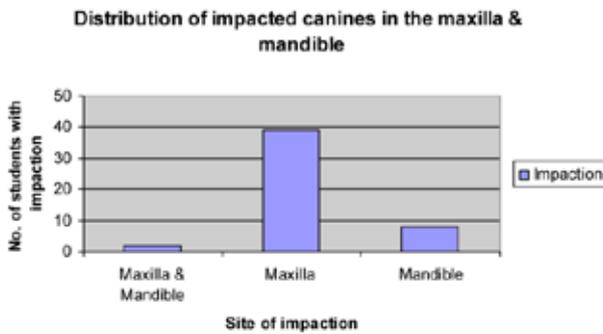
A total of 2401 students (718 male and 1683 female) were screened in the present study. Fifty nine students (12 males and 47 female) were observed to have un erupted permanent canines. Radiographic investigations were done for 57 students and two students refused to contribute in the study.

The result showed that 49 (2%) of the total sample had impacted permanent canines and

eight students (0.3%) had congenital missing permanent canines.

Prevalence of maxillary and mandibular impaction

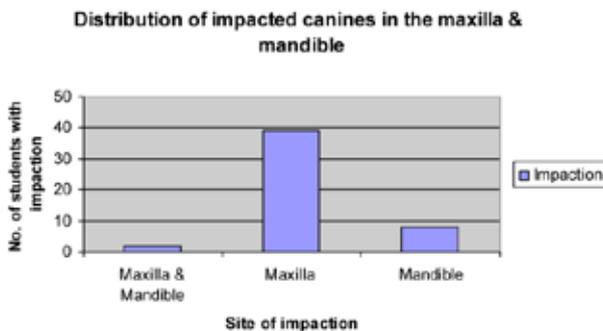
Impacted permanent canines recorded in 39 students in the maxilla (1.60%), eight students (0.33%) in the mandible and two students (0.08%) in both jaws (Graph. 1). Therefore, impacted canine was more frequent and highly significant in the maxilla than the mandible, $p < 0.05$ Chi = 26.596



Graph 1 - Showed distribution of impacted canines in the maxilla and the mandible.

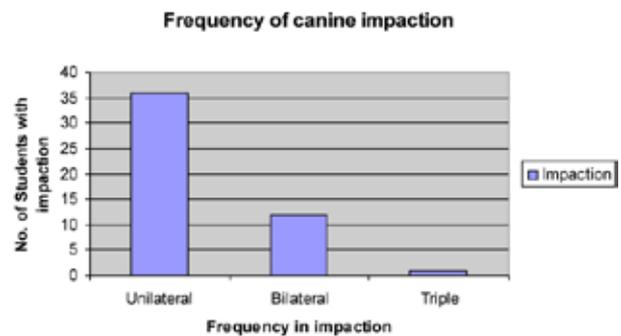
Canine impaction and Gender

In the examined sample male to female ratio was 1:2.3. Impacted canines were observed in 39 females (2.3%), whereas only 10 males (1.4%) had canine impaction with a ratio of 1:4. No statistical significance was noted between the two genders $p > 0.05$ Chi = 2.152, (Graph. 2).



Graph 2 - Showed distribution of impacted canines among gender.

Graph 3 showed that the distribution of the impacted canine among 49 students was either unilateral or bilateral. Unilateral impaction was observed three times more than bilateral, (73.5% and 1224.5%). Statistical significance difference was noted between unilateral and bilateral impaction ($p < 0.05$ Chi = 26.596). Bilateral impactions were usually symmetrical in the same arch, except in one case. Triple impaction recorded in one case (2%).



Graph 3 - Showed the frequency of canine's impactions.

Position of impacted maxillary canines

The total number of impacted teeth was 63. Fifty one impacted canines were observed in the maxilla whereas only 12 impacted canines were observed in the mandible. The result of the parallax technique showed that maxillary canines were observed in three positions, palatal 23 (45%), buccal 10 (20%) and 18 (35%) in the line of the arch. Palatal impaction was the most frequent one (45%) $p = 0.006$ (table 2).

Table 2 - Showed distribution of impacted maxillary canines a according to position of impaction

Position	Total (no of teeth)
Palatal	23* (45%)
Buccal	10 (20%)
In the line of the arch	18 (35%)
Total	51 100%)

*Significant $p = 0.006$

Clinical finding associated with canine's impaction

Persistence deciduous canines are the most clinical finding associated with impacted canine and it was noticed in 40 cases (81.6%), two cases have transmigrated mandibular canine, one case had Odontoms, one case had multiple impaction of other teeth, 4 cases with congenital missing lateral incisor, one case with dentigrous cyst and 4 cases had other clinical anomalies (Table 3).

Table 3 - Showed clinical finding associated with canine's impaction

Clinical finding	Male	Female	Total
Persistence deciduous canine	8 (16.3%)	32 (65.3%)	40 (81.6%)
Congenital missing lateral Incisor	1 (2%)	3 (6.2%)	4 (8.2%)
Transmigrated mandibular Canine	0 (0%)	2 (4%)	2 (4%)
Small shape lateral incisor	0 (0%)	1 (2%)	1 (2%)
persistence primary second molar	0 (0%)	3 (6.2%)	3 (6.2%)
Impaction of other teeth	0 (0%)	1 (2%)	1 (2%)
Odontoms	1 (2%)	0 (0%)	1 (2%)
Dentigrous cyst	0 (0%)	1 (2%)	1 (2%)

DISCUSSION

In the present study the overall percentage of impacted permanent canine was found to be 2%.

Great numbers of studies demonstrated the prevalence of impacted permanent canine among different population, in the maxilla it reported between 0.8% and 5.4% [5,8,13,14,15,16]. Whereas in the mandible less

percentage had been reported 0.3% and 0.44%. [5,13]

The results of the impacted canine in the Sudanese sample were similar to the finding by Ericson & Kuroi [7] among Swedish population (2.05%). However, it was less than the finding among Saudi population (3.6%) and Turkish (3.73%) [4,13]. The higher prevalence of impaction can be attributed to the younger age group of patients in both studies in addition to the racial differences among these reports.

The prevalence of maxillary impaction in the present study was (1.6%) which was in harmony with the prevalence (1.7%) in Swedish17 and Colombian children [18] despite the later studies were conducted in younger age group. A higher prevalence (3.29%) reported in Turkish patients [4]. Even higher prevalence (5.4%) was reported in Hungarian patients [14]. Much less percentage (0.8%) was reported among Chinese patients [19]. Racial disparity and age dissimilarity between these groups can make the variability in prevalence reasonable.

Mandibular canine impaction in the current study were observed in 12 cases (0.33%) which relatively similar to Ericson and Kuroi [9] result (0.35%). Aydin [4] obtained a little bit higher percentage (0.44%) among Turkish patients.

Impaction of mandibular canine is a rare phenomenon4. In the present study the prevalence impacted canine in the maxilla was higher (1.6%) than in the mandible (0.33%); this finding in consistence with other studies [13,5]. The dissimilarity between maxillary and mandibular canine impactions can be attributed to the fact that, maxillary canines is the last teeth to develop and travel a long path before eruption into the dental arch, thus increasing the potential for mechanical disturbances resulting in displacement and impaction.20

Mulick1 stated that; precise incidence of impacted maxillary canines varies according to the epidemiologic study for the following reasons: these studies have not established

criteria for the definition of impaction, and most epidemiologic studies are done from full-mouth x-rays alone and probably only measure severe impactions.

Peck¹⁵ reported that a dichotomy in palatally displaced canines prevalence seems to exist between subject from European ancestry and from Asian or African ancestry. The predominance published cases of canine's palatal displacement was from European origin. Reports and studies of such phenomena in Africans or Asians population were quite rare. The prevalence ratio between European: Asian was 2:1 and between Caucasian: Chinese samples were 2:1. In a predominantly 95% African-American sample [19] a lower prevalence (1.2%) of maxillary impaction was observed. In the present study the prevalence of maxillary canine impaction (1.6%) which slightly higher than African-American, and this may be due to Afro-Arabian mixture of Sudanese population.

Congenital absence of so-called key teeth, such as upper central incisor, canine and first molar, is extremely rare [21]. The incidence of congenital absent canine in previous studies ranged from 0.06% to 0.45% [21,22]. In the present study the prevalence of congenital absent canine was 0.3% which was consistent with previous reports.

A male to female's ratio for impacted canine was 1:4 in the present study, in Hungarian sample¹⁴ the ratio was 46:55, whereas in Turkish [5] 1:1.51. Peck [15] reported that gender difference attributed to biological phenomena with genetic links involving the sex chromosomes.

In the present study most of the students (73.5%) had single impaction $p < 0.001$, 24.5% had bilateral canine impactions and 2% had triple canine impaction i-e 26.5% had multiple canine impaction, less percentage 22.9% was reported in Saudi [13] population. In the other hand Ericson & Kurol [7]. observed only 8% of bilateral canine impactions.

In the present study, vertical tube shift using Dental panoramic radiographs and occlusal radiographs were used. This combination is usually the combination of choice because the panoramic radiograph provides information about all the teeth in both arches, the two jaws and the surrounding structures, this combination only requires one additional exposure [23]. This combination enables a greater tube movement and therefore a greater shift of the image of the impacted tooth. It also ensures that the whole of the tooth is captured on the radiograph [24].

In the present sample fifty one impacted canines were observed in the maxilla. Radiographic investigations revealed that 45% in palatal position, 20% in buccal position and 35% in the line of the arch. Some authors [4,18,25,26] reported that impacted canine occur more frequently in palatal position than the buccal one, these results were in consistence to the present study. Whereas Rowena [27] reported a similar finding of impacted maxillary canine position, palatal 43%, buccal in 37.5% and in the line of the arch 18.7%.

Bishara [25] and Jacoby [26] reported that retained deciduous canines are one of the causes of impaction. In the present study retained deciduous canines were observed in majority of the students with impacted canines (80%), moreover most impacted canines which were in the line of the arch have over retained deciduous canines. This finding suggests that over retained deciduous may be a major factor contributing to impaction in the present study.

CONCLUSION

The prevalence of impacted canines in the Sudanese sample was 2%. It significantly higher in the maxilla than in the mandible 0.33% and palatal impacted canine was the most frequent one.

The prevalence of impacted canines in this study was notable and comparable to previous results. Although this study was carried out in a selected group of the Sudanese population

and it gives a clue about the magnitude of the problem. However, the results are inconclusive since the sample is not representative of the Sudanese population.

Further study including various parts of Sudan, diverse age groups, larger sample and utilization of different methods to localize impacted canines are necessary to determine the over all prevalence of canine impaction among Sudanese population.

REFERENCES

- Mulick JF. Impacted Canines. *JC Orthod.* 1997;40:824-34.
- Rajic S, Muretic Z, Percac S. Impacted canine in a prehistoric skull. *Angle Orthod.*1996; 66:477-80.
- Richardson G, Russell KA. A Review of impacted permanent maxillary cuspids: diagnosis and prevention. *J Can Dent Assoc.* 2000;66:497- 501.
- Aydin U, Yilmaz HH, Yildirim D. Incidence of canine impaction and transmigration in a patient population. *Dentomaxillofac Radiol.* 2004;33:164-69.
- Dewel BF. The upper cuspid: its development and impaction. *Angle Orthod.* 1949;19:79-90.
- Moyers RE. *Handbook of Orthodontics.*3rd ed. New York: Mosby;1973. p.55-8.
- Ericson S, Kuroi J. Radiographic assessment of maxillary canine Eruption in children with clinical signs of eruption disturbances. *Eur J Orthod.* 1986; 8:133-40.
- McSherry PF. The ectopic maxillary canine: a review. *Brit J orthod.* 1998;25:209-16.
- Jacobs SG. Localization of the unerupted maxillary canine: how to and when to. *Am J Orthod Dentofacial Orthop.* 1999;115:314-22.
- Whaites E, cawson R. *Essential of dental Radiography and Radiology.* 2nd. New York: Mosby; 1996.P201-205.
- Chaushu S, Chaushu G, Becker A. The use of panoramic radiograph to localise maxillary canines. *Oral Surgery, Oral Medicine, Oral Pathology, Oral radiology and Endodontic.* 1999; 88:511-16.
- Armstrong C, Johnston C, Burden D, Stevenson M. Localizing ectopic maxillary canines- horizontal or vertical parallax. *Eur J Orthod.* 2003;25:585-89.
- Zahrani AA. Impacted cuspids in a Saudi population: prevalence, Etiology and complication. *Egypt Dent J.* 1993; 39:367-74.
- Rozsa N, Fabian G, Szadeczký B, Kaan M, Gabris K and Tarjan I. Prevalence of impacted permanent upper canine and its treatment in 11-18 year-old orthodontic patients. *Fogorv Sz.* 2003;96:65-9.
- Peck S, Peck L, Kataja M. The palatally displaced canine as a dental anomaly of genetic origin. *Angle Orthod.* 1994; 64:249-56.
- Kokich VG, Mathews DP. Surgical and orthodontic management of impacted teeth. *Dent Clin North Am.* 1993; 37:181-204.
- Ahlgvist M, Grondahl HG. Prevalence of impacted teeth and Associated pathology in middle-aged and older Swedish women. *Community Dentistry and Oral Epidemiology.* 1991;19,116-9.
- Thilander B, Pena L, Infant C, Parada SS, Mayoraga C. Prevalence of malocclusion and orthodontic treatment need in children and adolescents in Bogota, Colombia. An epidemiological study related to different stages of development. *Eur J Orthod.* 2001;23:153-67.
- Chu FC, Li TK, Lui VK, Newsome PR, Chow RL, Cheung LK. Prevalence of impacted teeth and associated pathologies a radiographic study of Hong Kong Chinese population. *Hong Kong Med J.* 2003; 9:158- 63.
- McSherry P, Richardson A. Ectopic eruption of the maxillary canine Quantified in three dimensions on cephalometric radiographs between The ages of 5 and 15 years. *Eur J Orthod.* 1999; 21:41-8.
- Brenchley Z, Oliver RG. Morphology of anterior teeth associated with displaced canines. *Br J Orthod.* 1997; 24, 41-5.
- Davis PJ. Hypodontia and hyperdontia of permanent teeth in Hong Kong schoolchildren. *Community Dent Oral Epidemiology.* 1987; 15:218-20.
- Jacobs SG. Radiographic localization of unerupted maxillary anterior teeth using the vertical tube shift technique: the history and application of the method with some case reports. *Am J Orthod.* 1999;116:415-23.
- Maverna R, Gracco A. Different diagnostic tools for the localization of impacted maxillary canines: clinical considerations. *Prog Orthod.* 2007; 8:28-44.
- Bishara SE. Impacted maxillary canines: A review. *Am J Orthod.* 1992;101:159-71.
- Jacoby H. The etiology of maxillary canine impactions. *Am J Orthod.* 1983; 84:125-32.
- Rowena JR, Mitchell CNT, Willmot DR. Maxillary incisor root resorption in relation to the ectopic canine : a review of 26 patients. *Eur J Orthod.* 1997; 19, 79-84.

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