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Prevalence of Ectopically Erupting Canines in Preadolescents Reporting to the Dental Outpatients Department at Children Hospital, Pakistan Institute of Medical Sciences, Islamabad, Pakistan

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Abstract

Introduction: This study was aimed to identify the prevalence of ectopically erupting canine in pre-adolescent patients reporting to the Dental Outpatients Department (OPD) at Children Hospital, Pakistan Institute of Medical Sciences (PIMS) which is a primary care dental setup, using orthopantomogram (OPG) radiographs. Study design: Cross-sectional design.

Methodology: This study was conducted on a sample of 1000 consecutive patients, limited to those aged 10 to 13.5yrs with mixed to late mixed dentition, with no history of orthodontic treatment. Patients with missing canines on clinical examination based on Bishara's criteria clinical signs, were referred to the Radiology department for OPG to confirm displacement from normal path of eruption. On the OPG, the image of the canine was analyzed.

Results: The studied sample consisted of 1000 patients with 33% males and 67% females. The age range of subjects was between 10 years to 13.5 years with a median age of 11.0 years. There were a total of 131 cases of ectopically erupting canine. In these cases, 37 were on the right, 78 on the left and 16 were bilateral. In females, there were 74 cases with 9 bilateral, 23 on the right and 42 on the left. As for males, a total of 57 cases, 7 bilateral, 14 on the right and 36 on the left side.

Conclusions: The Prevalence of ectopically erupting canines in patients reporting to Children Hospital, PIMS Outpatient department was calculated to be 13.1% with more female predominance and are more common on the left side.

Keywords: Impactions, Canine, impaction, pre-adolescent

Introduction

An impaction, a pathological entity defined as the lack of eruption of a tooth in the oral cavity within the time and physiological limits of the normal eruption process.[1-3] An ectopically erupting canine has an abnormal path of eruption which can either lead to eruption in an abnormal erupted position or an impaction.[4] Based on panoramic radiographic evaluation, the prospect of maxillary cuspid impaction is high if the cuspid tip deviates from the normal eruption path of the maxillary canine.[4] The two prominent theories reciprocally aligned with displaced maxillary canines are the guidance theory and the genetic theory.[5-7]

The permanent maxillary canine impaction or ectopic eruption is 0.8–2% prevalent in the general population [8-11] However, this value varies depending on the population being studied. Prevalence of maxillary cuspid

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impaction in Pakistan has been reported to be between 4-5%.[12-14] Prevalence of ectopia in canines is much higher. This is a condition where a tooth has erupted and positioned in a location which was not destined for that was reported to be 24% in a Pakistani study.[15] A similar study in Iran reported it to be 11.4%.[16] Permanent canine eruption anomalies are primarily being diagnosed by evaluating the patient clinically.

The primary sign of ectopic eruption path is by evaluation of unerupted permanent maxillary cuspids when a patient's dental developmental age averagely correlates to the chronologic age.[17,18] Both radiography and clinical diagnosis are used to identify an impacted canine. Two-dimensional radiographs such as periapical, upper occlusal and orthopantomograms have traditionally been used for detection of location of unerupted canines. CBCT has greater sensitivity and specificity but is more expensive than 2D.[12] An OPG can be used as a screening tool to determine if a canine is deviating. Several factors have been identified which can be used in this prediction. The angle of developing canine with the long axis of lateral incisor for a normally erupting canine is between -10^{o} and -30^{o} [18] and there is very little overlap of the lateral incisor root.[19] Any deviation from these norms would most likely increase the probability of displacement.

This study aims to measure the prevalence of ectopic canine eruption in patients reporting to the Primary dental care Outpatients Department (OPD) at Children hospital, Pakistan Institute of Medical Sciences (PIMS), Islamabad using OPG (orthopantomogram) radiographs. Although scattered data exists regarding the frequency of impacted maxillary canines in Pakistan, there is no specific data about the population of the Potohar plateau or the prevalence of canines erupting abnormally. Timely detection of the presence and position of ectopic canines is crucial for orthodontists, as it aids in determining the appropriate timing for any necessary interceptive treatment. This proactive approach can help prevent potential problems associated with impacted canines and associated side effects.

Methodology

A cross-sectional study, was performed at the Dental OPD, Children hospital, PIMS, Islamabad, Pakistan. The sample was collected consecutively from all the patients reporting to the dental department of the Children hospital, over a period of 6 months from July 2023 to Dec 2023. Sample size was calculated to be n=666, using the sample size calculator with a confidence interval of 99%, a margin of error of 5% and expected proportion of 50%. This was rounded up to n=1000. Our sample was limited to patients aged 10 to 13 years with mixed to late mixed dentition, with no history of orthodontic treatment. This sample was restricted to patients who were examined for dentoalveolar issues. based on Bishara's criteria Those who had unilateral or bilateral missing maxillary canines altogether absence of labial bulge on clinical examination, are might be indicative of canine impaction: [11] OPG was taken for such patients and were subjected to assessment as shown in fig I & II.

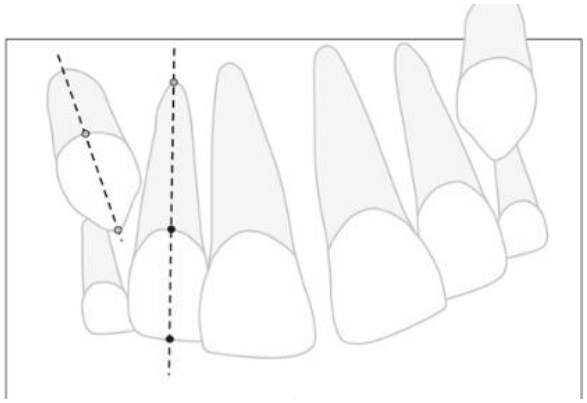

Fig. I: Showing canine angulation to vertical long axis of maxillary lateral incisor

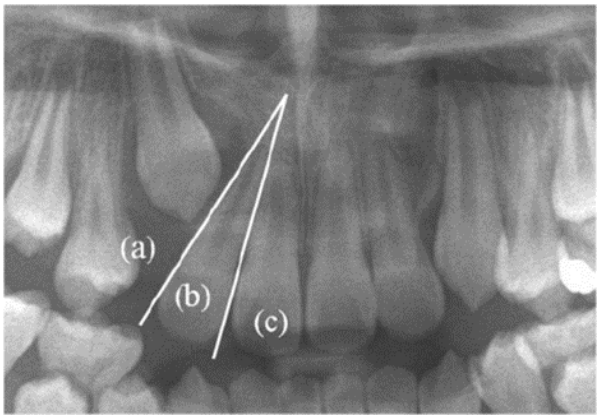

Fig. II: Showing the method used to assess overlap between canine crown and lateral incisor root

Statistical analysis:

The data, was collected, archived, and analyzed by using IBM SPSS version 12 software. Descriptive statistics were used to describe age, including mean and standard deviation. Categorical variables like gender, prevalence of ectopically erupting canines, and location in the jaw were presented as frequencies.

Result

In our study, the sample consisted of 1000 patients reporting to the OPD. About one third of all patients were male and the remaining were female.

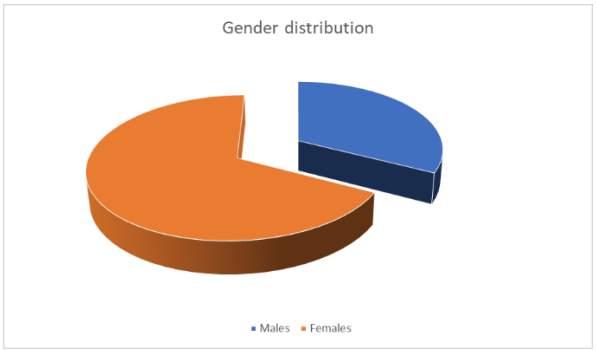

Fig. III: Pie chart of gender distribution

Patients were aged between 10 years to 13.5 years with a median age of 11.0 years.

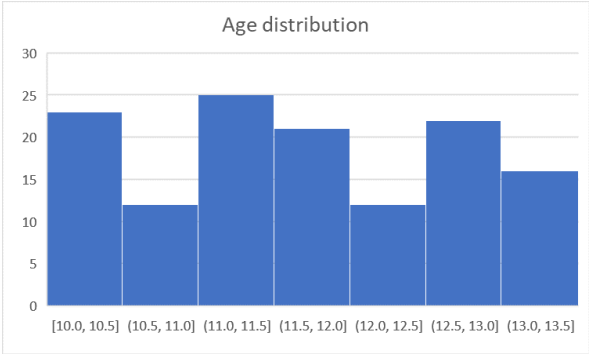

Fig. IV: Bar chart of age distribution

There was a total of 131 cases of ectopically erupting canines, where the canine was either too angulated or was overlapping the root of lateral incisor.

Gender	N=131	Bilateral	Unilateral	
			Right	Left
Male	57	7	14	36
Female	74	9	23	42
Total	131	16	37	78

Table. I: Frequencies of side of ectopically erupting canine

In the 131 cases, 37 were on the right, 78 on the left and 16 were bilateral.

Prevalence of ectopically erupting canines in patients reporting to Children Hospital, PIMS Outpatient department was calculated using the formula:

Prevalence = (Total number with disease) / (Population at risk for the disease)
= 13.1%

Female predominance and left sided predominance

Discussion

The displacement is defined as anomalous infra-bony submerged location of the developing tooth bud before the expected eruption timing whereas the infra-bony submerged position of the tooth at the expected eruption timing is called tooth impaction.[20, 21, 22]

There is no single identified cause that can fully explain the occurrence of most ectopic

eruptions, nor can it distinguish between those that occur on the labial or palatal sides.[17] The multifactorial etiology of ectopically erupting canine might results in to either ectopic eruption, labial or palatal and or impaction, or spontaneous correction.[17] The primary cause of buccally impacted canines is thought to be an Arch length - tooth material discrepancy [23], whereas numerous causative situations have been proposed for palatally impacted cuspids.[24] Baccetti hypothesized that congenital anomalies such as enamel hypoplasia, submerged primary posterior teeth, congenitally missing second bicuspids, and peg lateral incisors are genetically reciprocally associated with palatal canines impacted.[25] Numerous clinical presentations are suggested to be indicating canine impaction, including delayed eruption of the permanent canine, over-retained primary cuspids beyond age of 14–15 years, absence of a labial canine bulge at the erupting time, or presence of a palatal bulge, and delayed eruption, distal tilting, or migration (splaying) of the lateral incisor.[11]

Maxillary cuspids are considerably the most common impacted teeth, excluding third molars[7], particularly due to two reasons. Firstly, it takes a long tortuous path of almost 22mm and secondly, it usually erupts after the maxillary lateral incisor and the first bicuspid have erupted.[11] Females are twice as likely as males to have it. More than twice as many cases of canine impaction occur in the maxilla as in the mandible. Only 8 %of patients with impacted maxillary canines have bilateral impactions.[11,27,28]

In the present study, it was observed there were twice as many females reporting to the dental OPD compared with males. This could be associated to the generally cavalier attitude of teenage boys towards oral hygiene and to parents of teenage girls seeking treatment for milder orthodontic conditions.[29] Canines ectopically erupting were found to be more common in females which is coincident with other studies where canine impaction was found to be more common in females.[11]

In accordance with previous research, our study showed that bilateral ectopically erupting canines were much more uncommon than unilateral issues, leading to more unilateral impactions.[11]

Our results showed that the maxillary left canine eruption is more aberrant comparing to the opposite side, which is similar to the finding in a previous study with regards to canine impaction.[12]

Reviewing the relevant research papers on the topic for the last 70 years presented a broad range for prevalence of canine impaction from 0.80% to 5%.[27] A Pakistani study using CBCT found a 5% prevalence in their studied population set.[12] Our 13.1% implies that less than half of these ectopically erupting canines result in impactions, the rest erupt. This eruption could be in a normal position or an abnormal one.

Today's orthodontists still face difficulties when it comes to treating impacted maxillary canines. In order to treat this clinical condition, the impacted tooth is typically surgically exposed, and then it is guided and aligned into the dental arch using orthodontic traction. The most prevalent side effects are gingival recession, bone loss, and root resorption of the treated teeth.[30]

Surgical exposure can be closed or open with both procedures presenting their own cons. With a closed eruption protocol, the canine can be moved with fine control, moving it along a more natural path to eruption and finally an aligned position. This, however, can be uncomfortable for the patient as the stainless-steel attachment travels under the sensitive oral mucosa. Alternatively, with an open exposure, there is uncontrolled eruption of the canine. Even though this may result in a shorter treatment time and a reduction in patient discomfort, there is a risk of loss of gingival margin.[31]

Because of the ectopically erupting maxillary canines, permanent incisors have been

resorbed in an estimated 0.71% of children aged 10 to 13. On the contrary, an impacted maxillary canine may have no negative effects throughout a person's lifetime.[32] Shafer *et al*. has also suggested a sequela for canine impaction.[33]

More research is needed to analyze them. In our study, a considerable number of the patients who presented with canines deviating from the normal path, also exhibited other dental anomalies; similar to another Pakistani study that found a high prevalence of peg lateral incisors with buccally displaced canines (28%).[34]

Appreciation of canine developmental disorders in early mixed dentition can reciprocally aid clinicians in the early diagnosis and management of the clinical situation.[35-38]

Limitations of this study included the lack of 3D data as our research relied on OPG data. Further studies on the same topic using CBCT data would be much more in depth.

Conclusion

The Prevalence of ectopically erupting canines in patients reporting to Children Hospital, PIMS Outpatient department, Islamabad was calculated to be 13.1% with more female predominance and are more common on the left side.

Further research is required on this topic to extrapolate this finding to the entire country.

Ethical Approval

The approval of the study was granted by the Ethical Review Board of School of Dentistry, Shaheed Zulfiqar Ali Bhutto Medical University.

Disclaimer

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Conflict of Interest

It is declared that the authors don't have any conflict of interest.

Authors' Contribution

APS: Introduction and Discussion
AF: Methodology, Statistics and Results
OKD: Expert Advice
GIA: Data Collection

References

1. Coupland M. A. (1984). Localization of misplaced maxillary canines: orthopantomograph and P.A. skull views compared. *British journal of orthodontics*, *11*(1), 27–32. https://doi.org/10.1179/bjo.11.1.27
2. Grisar, K., Luyten, J., Preda, F., Martin, C., Hoppenreijs, T., Politis, C., & Jacobs, R. (2021). Interventions for impacted maxillary canines: A systematic review of the relationship between initial canine position and treatment outcome. *Orthodontics & craniofacial research*, *24*(2), 180–193. https://doi.org/10.1111/ocr.12423
3. Howard R. D. (1972). The displaced maxillary canine: positional variations associated with incisor resorption. *The Dental practitioner and dental record*, *22*(7), 279–287.
4. Shin, J. H., Oh, S., Kim, H., Lee, E., Lee, S. M., Ko, C. C., & Kim, Y. I. (2022). Prediction of maxillary canine impaction using eruption pathway and angular measurement on panoramic radiographs. *The Angle orthodontist*, *92*(1), 18–26. https://doi.org/10.2319/030121-164.1
5. Richardson, G., & Russell, K. A. (2000). A review of impacted permanent maxillary cuspids--diagnosis and prevention. *Journal (Canadian Dental Association)*, *66*(9), 497–501.
6. Hartman, M. J., & Block, M. S. (2024). The Impacted Maxillary Canine in the Adult: A Narrative Review and Implant Treatment Options. *Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons*, *82*(1), 65–72. https://doi.org/10.1016/j.joms.2023.09.011
7. Peck, S., Peck, L., & Kataja, M. (1994). The palatally displaced canine as a dental anomaly of genetic origin. *The Angle orthodontist*, *64*(4), 249–256. https://doi.org/10.1043/0003-3219(1994)064<0249:WNID>2.0.CO;2
8. Dasgupta, I., Saini, S., Khan, M.A. & Chaudhary, K. (2023). Population-level differences in COVID-19 prevalence, severity, and clinical outcome. In R. Pandey (ed.) *Genomic Surveillance and Pandemic Preparedness*. Academic Press, pp. 3–25. Available at: https://doi.org/10.1016/B978-0-443-18769-8.00008-8.
9. Bedoya, M. M., & Park, J. H. (2009). A review of the diagnosis and management of impacted maxillary canines. *Journal of the American Dental Association (1939)*, *140*(12), 1485–1493. https://doi.org/10.14219/jada.archive.2009.0099
10. Fleming, P. S., Scott, P., Heidari, N., & Dibiase, A. T. (2009). Influence of radiographic position of ectopic

canines on the duration of orthodontic treatment. *The Angle orthodontist*, *79*(3), 442–446. https://doi.org/10.2319/042708-238.1

11. Bishara S. E. (1992). Impacted maxillary canines: a review. *American journal of orthodontics and dentofacial orthopedics: official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics*, *101*(2), 159–171. https://doi.org/ 10.1016/0889-5406(92)70008-X
12. Khan, H., Ashraf, A., Anwar, A., Najam, E., Ahmad, F., & Khan, T. (2018). Prevalence and patterns of impacted maxillary canines: a cbct based retrospective study. Pakistan Oral & Dental Journal, 38(2), 211-214.
13. Sathyanarayana, H. P., Nucci, L., d'Apuzzo, F., Perillo, L., Padmanabhan, S., & Grassia, V. (2023). Prevalence, etiology, clinical features and management associated with impacted and transmigrated mandibular canines: a systematic review. *BMC oral health*, *23*(1), 975. https://doi.org/10.1186/s12903-023-03717-1
14. Nausheen, N., Nisar, P., Jamil, M., Humayun, A., Mahayyudin, M., Shehzadi, U. & Aslam, M. (2022). Incidence of impacted canine in patients visiting tertiary care hospital of Peshawar, Pakistan. *Pakistan BioMedical Journal*, 5(6), pp. 89–92. https://doi.org/10.54393/pbmj.v5i6.587.
15. Khan, A., Marwat, H. U. J., Ali, S., Malik, F., Naureen, S., & Mahmood, M. A. (2010). FREQUENCY OF ECTOPIC CANINES--A STUDY. Pakistan Oral & Dental Journal, 30(1).
16. Ng, W. L., Cunningham, A., Pandis, N., Bister, D., & Seehra, J. (2024). Impacted maxillary canine: Assessment of prevalence, severity and location of root resorption on maxillary incisors: A retrospective CBCT study. *International orthodontics*, *22*(3), 100890. https://doi.org/ 10.1016/j.ortho.2024.100890
17. Sachan, A., & Chaturvedi, T. P. (2012). Orthodontic management of buccally erupted ectopic canine with two case reports. *Contemporary clinical dentistry*, *3*(1), 123–128. https://doi.org/10.4103/0976-237X.94563
18. Le Ven, M., Rafflenbeul, F., Gros, C. I., Lefebvre, F., & Bolender, Y. (2024). Do erupting maxillary canines resorb adjacent teeth? A study focusing both on the ipsilateral and contralateral sides among individuals with unilaterally impacted canines. *The Angle orthodontist*, *94*(5), 541–548. https://doi.org/10.2319/092723-655.1https://doi.org/10.2319/030121-164.1
19. Ristaniemi, J., Rajala, W., Karjalainen, T., Melaluoto, E., Iivari, J., Pesonen, P., & Lähdesmäki, R. (2022). Eruption pattern of the maxillary canines: features of natural eruption seen in PTG at the late mixed stage-Part I. *European archives of paediatric dentistry : official journal of the European Academy of Paediatric Dentistry*, *23*(2), 223–232.
20. Ericson, S., & Kurol, J. (1987). Radiographic examination of ectopically erupting maxillary canines. American journal of orthodontics and dentofacial orthopedics : official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics, 91(6), 483–492. https://doi.org/ 10.1016/0889-5406(87)90005-9
21. Ericson, S., & Kurol, P. J. (2000). Resorption of incisors after ectopic eruption of maxillary canines: a CT study. *The Angle orthodontist*, *70*(6), 415–423. https://doi.org/10.1043/0003-3219(2000)070<0415:ROIAEE>2.0.CO;2
22. Aktı, A., Dolunay, U., Kaya, D. I., Gürses, G., & Yeşil, D. (2024). Evaluation of the Relationship between Impacted Maxillary Canine Teeth and Root Resorption in Adjacent Teeth: A Cross-Sectional Cone Beam Computed Tomography Study. *Diagnostics (Basel, Switzerland)*, *14*(14), 1470. https://doi.org/10.3390/diagnostics14141470
23. Yatabe, M., Kripfgans, O., Chan, H. L., Xu, J., Cook, J., & Soki, F. (2024). Ultrasonography as an additional tool to localize impacted canines. *Oral radiology*, 10.1007/s11282-024-00769-z. Advance online publication. https://doi.org/10.1007/s11282-024-00769-z
24. Power, S. M., & Short, M. B. (1993). An investigation into the response of palatally displaced canines to the removal of deciduous canines and an assessment of factors contributing to favourable eruption. *British journal of orthodontics*, *20*(3), 215–223. https://doi.org/ 10.1179/bjo.20.3.215.
25. Baccetti T. (1998). A controlled study of associated dental anomalies. *The Angle orthodontist*, *68*(3), 267–274. https://doi.org/10.1043/0003-3219(1998)068<0267:ACSOAD>2.3.CO;2
26. Peralta-Mamani, M., Rubira, C. M., López-López, J., Honório, H. M., & Rubira-Bullen, I. R. (2024). CBCT vs panoramic radiography in assessment of impacted upper canine and root resorption of the adjacent teeth: A systematic review and meta-analysis. *Journal of clinical and experimental dentistry*, *16*(2), e198–e222. https://doi.org/ 10.4317/jced.61285
27. Montanha-Andrade, K., Ferreira, P. P., DE Sena, A. C. V. P., Cury, P. R., & Crusoé-Rebello, I. M. (2024). Tomographic diagnosis of alveolar bone coverage impact in orthodontic planning: cross-sectional study. *Dental press journal of orthodontics*, *29*(5), e242446. https://doi.org/10.1590/2177-6709.29.5.e242446.oar
28. Cooke, J., & Wang, H. L. (2006). Canine impactions: incidence and management. *The International journal of periodontics & restorative dentistry*, *26*(5), 483–491.
29. Harris, E. F., & Glassell, B. E. (2011). Sex differences in the uptake of orthodontic services among adolescents in the United States. *American journal of orthodontics and dentofacial orthopedics : official*

publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics, *140*(4), 543–549. https://doi.org/10.1016/j.ajodo.2010.11.023

30. Manne, R., Gandikota, C., Juvvadi, S. R., Rama, H. R., & Anche, S. (2012). Impacted canines: Etiology, diagnosis, and orthodontic management. *Journal of pharmacy & bioallied sciences*, *4*(Suppl 2), S234–S238. https://doi.org/10.4103/0975-7406.100216
31. Camilleri S. (2021). Canine exposure: open or closed?. *European journal of orthodontics*, *43*(5), 506–507. https://doi.org/10.1093/ejo/cjab028
32. Ericson, S., & Kurol, J. (1986). Longitudinal study and analysis of clinical supervision of maxillary canine eruption. *Community dentistry and oral epidemiology*, *14*(3), 172–176. https://doi.org/10.1111/j.1600-0528.1986.tb01526.x
33. Shafer, W. G., & Hine, M. K. (1983). Levy BM: A textbook of oral pathology.
34. Narmada, I. B., & Putri, A. R. (2024). The Effect of Maxilla Impacted Canine Positions on Root Resorption of Adjacent Teeth Using Cone-Beam Computed Tomography Imaging. *Acta medica Philippina*, *58*(1), 90–97. https://doi.org/10.47895/amp.vi0.4321
35. Litsas, G., & Acar, A. (2011). A review of early displaced maxillary canines: etiology, diagnosis and interceptive treatment. *The open dentistry journal*, *5*, 39–47. https://doi.org/10.2174/1874210601105010039
36. Shapira Y, Kuftinec MM. Early diagnosis and interception of potential maxillary canine impaction. J Am Dent Assoc 1998;129:1450-4
37. Farias JG, Santos FA, Campos PS. Prevalência de dentes inclusos em pacientes atendidos na disciplina de cirurgia do curso de odontologia da universidade estadual de Feira de Santana. Rev Pesq Bras Odontoped Clin Integr 2003;3:15-9
38. Willems, G., Butaye, C., Raes, M., Zong, C., Begnoni, G. & Cadenas de Llano-Pérula, M. (2023). Early prevention of maxillary canine impaction: a randomized clinical trial.