ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Can the Distance Between the Incisors and the Canine Teeth be a Safe Marker for Conventional Adenoidectomy?

Kesici ve Kanin Dişler Arası Mesafe Geleneksel Adenoidektomi İçin Güvenli Bir Belirteç Olabilir mi?

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ABSTRACT Objective: This study aims to determine 1) the correlation between the distance of the incisors and the medial edges of the torus tubarius, 2) the correlation between the distance of the canines and the eustachian orifices; and also the effects of these correlations on the size preference of the adenoid curet used in adenoid surgery. **Material and Methods:** Head-neck (brain, paranasal sinuses, temporal bone and neck) computed tomography of 198 patients (130 males, 68 females), examined for various indications were retrospectively evaluated, and the reciprocal distances between the medial and lateral sides of the incisors, canine teeth and eustachian orifices and the medial sides of the tori tubarius were determined. **Results:** The medial sides' mean distances of the eustachian orifices and the tori tubarius were 2.84±0.27 mm and 1.61±0.28 mm, respectively.The distance between the medial sides of the eustachian orifices was smaller than the distance between the lateral sides of the upper canine teeth, and it was larger than the distance between the medial sides of the upper canine teeth in all patients (100%). In most patients (93.4%), the distance between the medial sides of the torus tubarius was larger than the distance between the medial sides of the lower lateral incisor teeth. **Conclusion:** The reciprocal distance between the upper canine and the lower lateral incisor teeth can be used to determine the size of the adenoid curette used during adenoid surgery to avoid damage to the eustachian orifice and the torus tubarius.

Keywords: Adenoidectomy; incisors; adenoid hypertrophy; CT; eustachian tube

ÖZET Amaç: Bu çalışmanın amacı; 1) Kesici dişlerin karşılıklı mesafeleri ile torus tubaris mediyal kenarlarının karşılıklı mesafeleri arasındaki ilişkiyi, 2) Kanin dişlerin karşılıklı mesafeleri ile östaki orifis mediyal kenarlarının karşılıklı mesafeleri arasındaki ilişkiyi, ayrıca bu ilişkilerin adenoid cerrahisinde kullanılan adenotom küret boyutlarına olabilecek etkilerini araştırmaktır. **Gereç ve Yöntemler:** Çeşitli endikasyonlar ile çalışılan 198 (130 erkek, 68 kız) hastanın baş boyun (beyin, paranasal sinüs, temporal kemik ve boyun) bilgisayarlı tomografileri (BT) retrospektif olarak incelenerek, yan kesici ve kanin dişlerin karşılıklı mediyal ve lateral kenarları arasındaki mesafeler ile östaki orifis ve torus tubaris mediyal kenarlarının arasındaki karşılıklı mesafeleri değerlendirildi. **Bulgular:** Östaki orifis mediyal kenarları arası mesafe ortalama 2,84±0,27 mm, torus tubaris mediyal kenarları arası mesafe ortalama 1,61±0,28 mm olarak ölçüldü. Östaki orifis mediyal kenarlar arası mesafe, tüm hastalarda üst kanin lateral kenarlarından küçük, üst kanin mediyal kenarlar arası mesafeden büyük bulunmuştur (%100). Hastaların büyük çoğunluğunda (%93,4) torus tubaris mediyal kenarları arası mesafe, alt yan insizör mediyal kenarlar arası mesafeden büyük bulunmuştur. **Sonuç:** Adenoid cerrahisinde, östaki orifis ve torus tubaris hasarını azaltmak için tercih edilecek adenotom büyüklüğünün belirlenmesinde, üst kanin ve alt yan kesici dişlerin karşılıklı mesafelerinden yararlanılabilir.

Anahtar Kelimeler: Adenoidektomi; kesici diş; adenoid hipertrofi; BT; östaki tüpü

Adenoidectomy is one of the most commonly performed surgical interventions in the pediatric population.[1,2] Adenoid curettes, laser ablation, electrocauterization and endoscopic microdebridement are some of the techniques suggested for the excision of adenoid tissue.[3] Adenoid curettes are used under sufficient visibility with mirrors or an endoscopy guide. Additionally, the conventional technique, which is to

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use instruments without any guide, is currently employed by many surgeons.[2]

Complications related to the application technique are rarely monitored. Velopharyngeal deficiency, nasopharyngeal stenosis, atlantoaxial subluxation and hypernasal speech are some of the more common complications. Eustachian tube lacerations are encountered very rarely and are generally related to the excision of adenoid tissue and the control of hemorrhage by electrocauterization.[4,5] Damage to the torus tubarius and persistent eustachian tube defects may develop after nasopharyngeal surgery interventions performed without the use of appropriate guide instruments, depending on the choice of the appropriate adenotome size.

Although it is recommended in most operative papers that adenoid curettage be done under vision using a postnasal mirror or endoscope, in practice this is not always possible because the eustachian tubes are concealed from view by the mass of the adenoids.[6,7] Thus, standardization of the size of the adenoid curette according to the patient may be necessary for a safe surgery and for preventing complications. The right curette size is expected to improve the outcome by reducing the incidence of adenoid remnants and adenoidectomy sequelae, as well as by reducing the risk of eustachian tube injury.[8]

In the present study, correlation between the distance of incisors and the medial sides of the torus tubarius, and correlation between the distance of canine teeth and the eustachian orifices were evaluated. We believe this correlation might be helpful in determining the preferred size of an adenoid curette in order to reduce the risk of complications from conventional adenoidectomy surgery performed without using any guide instrument.

MATERIAL AND METHODS

STUDY POPULATION

Approval for the study was received from the Ethical Review Board of Samsun Research and Training Hospital (191-2018GOKAEK/13-109). The head–neck computed tomography (CT) results of 198 pediatric patients examined for various indications at a hospital between January 2017 and December 2018 were retrospectively evaluated. Demographic information, such as age and gender, was recorded for all patients. Patients with deciduous teeth, occlusion dysfunction, absent teeth, and nasopharynx pathology were excluded from the study.

COMPUTED TOMOGRAPHY IMAGING AND MEASUREMENTS

Computed tomography imaging was performed using the Brilliance 64 (Philips Medical Systems, Cleveland, Ohio, USA) multidetector CT device with 0.9 mm section thickness and 120 kV 300 mA imaging parameters in the axial plane. Osirix MD v.8.0.2 (Geneva, Switzerland) software was used to evaluate the images.

1. The distances between the determined anatomical points were recorded as follows:

2. The distance between the reciprocal medial and lateral sides of the lower and upper lateral incisors (Figure 1,2);

3. The distance between the reciprocal medial and lateral sides of the lower and upper canine teeth (Figure 3,4);

4. The distance between the medial sides of the eustachian orifices (Figure 5);

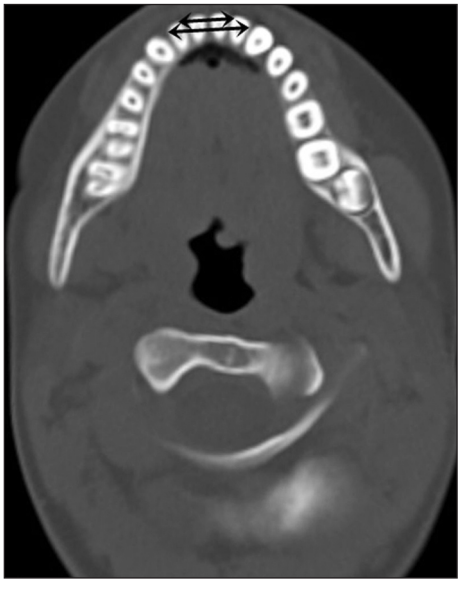


FIGURE 1: The distance between the reciprocal medial and lateral sides of the lower lateral incisors.

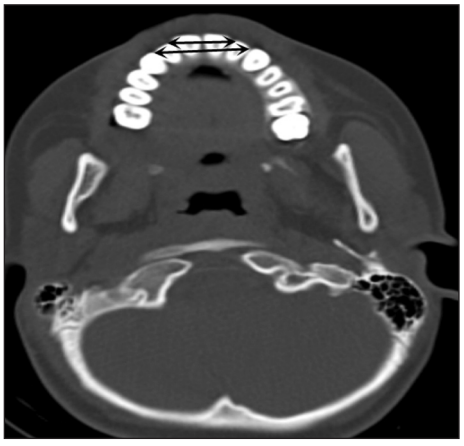


FIGURE 2: The distance between the reciprocal medial and lateral sides of the upper lateral incisors.

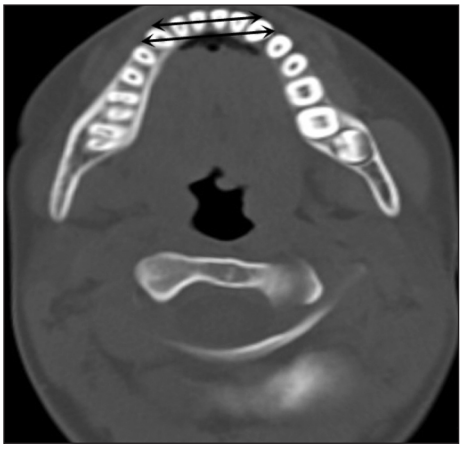


FIGURE 3: The distance between the reciprocal medial and lateral sides of the lower canine teeth.

5. The distance between the medial sides of the tori tubarius (Figure 5).

The measurements were recorded using the narrowest distance between two anatomical points.

STATISTICAL ANALYSIS

Data were analyzed with the software SPSS version 15 for Windows (SPSS Inc., Chicago, IL, US). The distribution of the results was analyzed using the Shapiro-Wilk test. Normal distribution was observed, and groups were compared using analysis of variance (ANOVA); α=0.05. When the ANOVA tests resulted in a statistical significance, groups were compared using a paired t-test; α=0.017. The results were analyzed using a paired t-test (right ears were paired with left ears); $p<0.05$ was considered statistically significant.

RESULTS

Of the 198 patients, 130 (65.7%) were male and 68 (34.3%) were female. The mean age of the patients was 9±2.18 years (age range: 6 to 12). The average measured distances between the given anatomical points are presented in Table 1.

The distance between the medial sides of the eustachian orifices was smaller than the distance between the lateral sides of the upper canine teeth; the distance was larger than the distance between the medial sides of the upper canine teeth in all patients (100%). In the majority of the patients, the distance between the medial sides of the torus tubarius was larger than the distance between the medial sides of

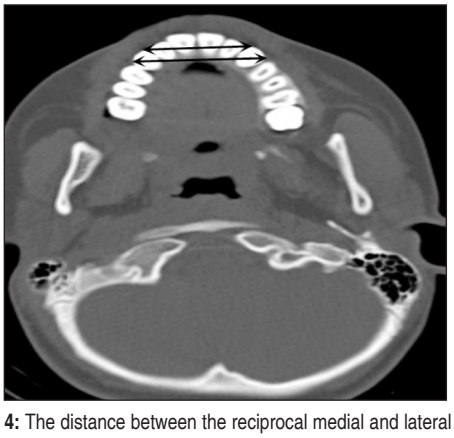


FIGURE 4: The distance between the reciprocal medial and lateral sides of the upper canine teeth.

FIGURE 5: The distance between the medial sides of the eustachian orifices.

TABLE 1: The investigated anatomical points.

Anatomical point	Distances between the points mean (min-max) (mm)
Eustachian tube orifice (medial sides)	2.84 (2.10–3.61)
Torus tubarius(medial sides)	1.61 (0.92–2.50)
Lower incisor (lateral sides)	2.08 (1.58–2.95)
Lower incisor (medial sides)	1.12 (0.74–2.03)
Lower canine (medial sides)	2.21 (1.75–3.02)
Lower canine (lateral sides)	3.01 (2.22–3.82)
Upper incisor (lateral sides)	2.57 (1.75–3.30)
Upper incisor (medial sides)	1.71 (1.14–2.29)
Upper canine (lateral sides)	3.46 (2.71–4.35)
Upper canine (medial sides)	2.72 (1.89–3.35)

the lower lateral incisors (93.4%); the distance was smaller than the distance between the lateral sides of the lower lateral incisors (95.5%).

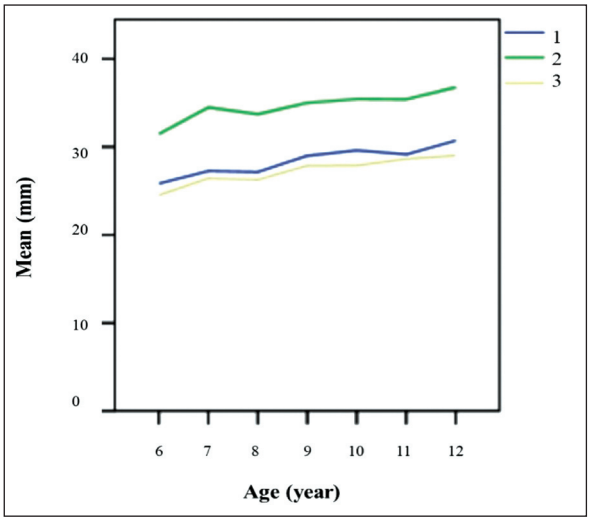
When the genders of the patients showing differences were examined, it was found that the distance between the medial sides of lower incisors was larger than the distance between the medial sides of the torus tubarius in 10 males and 3 females, and the distance between the lateral sides of incisors was smaller than the distance between the medial sides of the torus tubarius in 5 males and 4 females. However, this was not statistically significant. (p> 0.05).

In all age groups, the distribution of the distance between eustachian orifices was given in Graphic 1 and additionally the distribution of the distance between torus tubarius in Graphic 2.

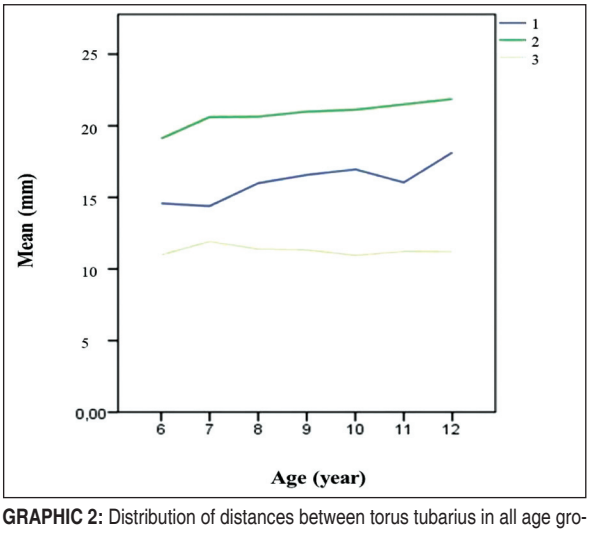
DISCUSSION

Many different surgical techniques are defined for adenoidectomy. Recently, a preference shift from cold surgical techniques to electrosurgery, such as electrocauterization, has been observed. Additionally, newer instruments, such as microdebriders and coblators, can be used for adenoidectomy.[3] However, cold surgery is still the most commonly used technique worldwide. [9] Inappropriate curette choice for adenoid tissue excision in cold surgery technique frequently causes eustachian tube laceration.[5,10] In some cases, the size of adenoid tissue may restrict the visibility of the fossa of Rosenmüller and the torus tubarius.[11] Therefore, determination of the optimal adenoid curette size is important in order to avoid complications. The aim of this study to determine 1) the correlation between the distance of incisors and the medial sides of the torus tubarius, and 2) the correlation between the distance of canine teeth and the eustachian orifices. Additionally to investigate the effects of this correlation on the size preference of the adenoid curette used in adenoid surgery.

In a study that compared the conventional curette method and the microdebrider technique in 50 patients, Juneja et al. reported that the surgery time was signifi-



GRAPHIC 1: Distribution of distances between eustachian orifices in all age groups. 1. The distance between the medial sides of the eustachian orifices (mm), 2. The distance between the lateral sides of the upper canine (mm), 3. The distance between the medial sides of the upper canine (mm).



GRAPHIC 2: Distribution of distances between torus tubarius in all age groups. 1. The distance between the medial sides of the torus tubarius (mm), 2. The distance between the lateral sides of the lower lateral incisor (mm), 3. The distance between the medial sides of the lower lateral Incisor (mm).

cantly shorter and less hemorrhage was observed using the conventional surgical technique, although the data were not statistically significant.[12] Datta et al. and Businco et al. similarly reported that surgery time was shorter using the conventional technique.[13,14] However, Stanislaw et al. suggested that the surgery time in the microdebrider technique accompanied with endoscopy was shorter.[15]

Sjogren et al. evaluated 1065 adenoidectomy cases and showed that the cost for microdebrider and coblator techniques was significantly higher. They also observed that the surgery time was longer using these techniques, although there was no statistical significance.[3]

Various studies have discussed the advantages and disadvantages of different techniques for adenoidectomy. Many newly developed technologies aim to decrease complication frequency and surgery time. However, when the surgery cost is taken into consideration, the situation becomes complicated. In the USA, 132,000 adenoidectomy operations are performed every year, and this number does not include operations performed together with tonsillectomy.[16] In the USA, Compared to electrocauterization, microdebrider use costs an additional 31.2 million dollars per year, while coblator use costs an additional 26.3 million dollars per year.[3] When high cost and surgery time are considered, conventional surgery using adenoid curette is still the most commonly preferred technique.

In the study of Shaalan's aiming to determine the right size of adenoid curette at the end of the surgery, the distance of the intertubal space was measured in patients who underwent adenoidectomy and in the light of the measurements, usage of some different adenoid curette size in various ages was recommended.[8]

Hohn et al. inspected 101 adenoidectomy cases of pediatric patients and evaluated the correlation between the distances of the lateral sides of upper incisors and the distances between the tori tubarius using adenotome blades of different sizes. They suggested that the distance between the lateral sides of the upper incisors could be used as a guide for the adenotome size for safe surgery.[11] The data we obtained from the CT results of 198 pediatric patients suggest that the optimal adenoid curette size should be smaller than the distance between the medial sides of the upper canine teeth in order to prevent damage to the eustachian orifices. Additionally, it is suggested that the size of the adenoid curette be smaller than the distance between the medial sides of the lower lateral incisors in order to prevent damage to the torus tubarius.

We believe that this correlation of the distance between the lateral incisors, canine teeth, eustachian orifices, and torus tubarius might be helpful in determining the ideal adenoid curette size. The most important disadvantage of our study is that it is constructed as a radiological anatomy study and its results are not supported by the findings of patients who underwent clinical adenoidectomy. However, in patients with adenoid hypertrophy, it is not possible to distinguish the boundaries between adenoid tissue and the surrounding soft tissue using computed tomography, therefore the distance between the eustachian orifice and the torus tubarius cannot be measured. For this reason, studies with large series that check for torus tubarius and eustachian orifice injury after adenoidectomy surgeries that utilize the distance between lateral incisor and canine teeth to determine adenotome size are needed. We believe that the data obtained by this study will shed light on the findings of such studies.

CONCLUSION

We suggest that a simple measurement of the distance between the lower lateral incisive teeth would be very helpful to surgeons in order to avoid eustachian tube damage during conventional adenoidectomy surgery performed without using any guide instrument.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Gökhan Akgül;* ***Design:*** *Abdülkadir Özgür, Doğukan Özdemir;* ***Control/Supervision:*** *Abdülkadir Özgür;* ***Data Collection and/or Processing:*** *Nesrettin Fatih Turgut;* ***Analysis and/or Interpretation:*** *Abdullah Taylan, Nesrettin Fatih Turgut;* ***Literature Review:*** *Dursun Mehmet Mehel;* ***Writing the Article:*** *Nesrettin Fatih Turgut, Gökhan Akgül, Abdülkadir Özgür;* ***Critical Review:*** *Abdülkadir Özgür;* ***References and Fundings:*** *Abdülkadir Özgür.*

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