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Načini prikazivanja nepčanog torusa uporabom *Cone Beam* kompjutorizirane tomografije i magnetske rezonancije: Prikaz slučaja

Imaging Aspects of Palatal Torus in Cone Beam Computed Tomography and Magnetic Resonance: Case Report

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Sažetak

Torus palatinus jednostruka je ili višestruka egzostoza koja se pojavljuje u srednjoj liniji tvrdoga nepca. Smatra se uobičajenim kliničkim nalazom. Kako se magnetska rezonancija (MR) u dentalnoj medicini ne upotrebljava često, rijetki su opisi te koštane izrasline na temelju takve metode. U ovom istraživanju opisan je slučaj pacijentice koja je upućena doktoru dentalne medicine da ispita koštano zadebljanje otkriveno magnetskom rezonancijom učinjenom radi dijagnostike migrene. Obavljeni su i dodatni dentalno-medicinski pregledi radi planiranja različitih terapijskih zahvata pa oni, uz MR, upotpunjuju opis torusa palatinusa sa svrhom dobivanja cjelovite slike kliničkog nalaza.

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Uvod

Torus palatinus (TP) obično je asimptomatska egzostoza koja se uglavnom pojavljuje u sredini tvrdog nepca. Njezova etiologija još nije potpuno razjašnjena (1, 2). Teorije o razvoju torusa palatinusa uključuju genetsku podlogu, okolišne čimbenike, pa čak i multifaktorijsku teoriju (2,3) koja se temelji na spoju čimbenika vezanih za okluzalni stres (4). Cantin i suradnici (5) ističu da TP nastaje od tkiva u palatinalnoj suturi, a tijekom trudnoće može se pojaviti i u fetusu.

Najčešće pogađa žene u četrdesetim i pedesetim godina (6). Klinički se TP pojavljuje na srednjoj liniji stražnjeg

Introduction

The *torus palatinus* (TP) is a generally asymptomatic exostosis that commonly occurs in the midline of the hard palate. Its etiology is still not fully established (1,2). Theories of the development of TP include genetic traits, environmental factors, or even a multifactorial theory (2,3) that comprises factors related to occlusal stress (4). Cantin et al. (5) emphasize that TP arises from tissues present in the palatine suture and can still occur in the maternal uterus.

Female patients during their fourth and fifth decades of life are most commonly affected (6). Clinically, TP is found

dijela tvrdog nepca i manifestira se kao okrugao i simetričan čvor, katkad i multilobularan (7). Obično se otkriva rutinskim kliničkim pregledom (4).

Torus palatinus i *torus mandibularis* mikroskopski karakteriziraju lamele kompaktne kosti prekrivene tankom i slabo prokrvljuenom sluznicom (6, 7). Ako su veći, mogu imati srednji dio od spongiozne kosti, a razlikuju se od ostalih egzostoza po tome što asimetrično nastaju u karakterističnim područjima (7). Sporo rastu, ali kad postanu veći, nužno ih je kirurški ukloniti, primjerice ako čine poteškoće u protetičkoj terapiji (2, 7).

Zabilježene su i komplikacije u vezi s TP-om, kao što su spontana izloženost torusa i osteonekroza zbog uporabe bisfosfonata, što zahtijeva kiruršku i farmakološku terapiju (8). S druge strane, pojava torusa ima i određene prednosti jer to mogu biti mjesta prikupljanja koštanoga tkiva za autogene transplantate u implantatima i u parodontnoj terapiji (8, 9).

Torus palatinus često se identificira na prikazima kompjutorske tomografije (CT) na kojima se vidi kao koštana izbočina s gustoćom sličnoj kompaktnoj kosti (10). Kako navode Godinho i suradnici (8), u nekim slučajevima ova je dodatna pretraga potrebna.

Magnetska rezonancija (MR) nije metoda izbora u ovim slučajevima niti se njome liječnici koriste za dentalno planiranje. To je razlog da su u literaturi rijetki izvještaji o nalazima TP-a dobiveni MR-om. Ipak, opis TP-a na temelju MR-a itekako je važan za medicinsku i dentalnu praksu jer se povezuje s potvrdom metode koja je doktoru dentalne medicine mnogo poznatija – s CT-om. Takav pristup omogućuje diferencijalnu dijagnostiku ovog entiteta koja najčešće ne zahtjeva intenzivnu intervenciju u odnosu na druga stanja koja ga mogu oponašati. U tom smislu, ovo istraživanje pruža detaljan opis TP-a većih dimenzija i nalaze dobivene na CT-u ničnom zrakom i MR prikazima.

Prikaz slučaja

Zbog čestih migrena 44-godišnja pacijentica zatražila je medicinsku pomoć. U sklopu liječenja bio je predložen i MR lubanje koji je otkrio hipohogeni signal u području mekog nepca. Liječnik, koji nije bio obaviješten o ovoj promjeni, poslao ju je radi dijagnoze doktoru dentalne medicine.

Pri uzimanju anamneze pacijentica je potvrdila da boluje od dijabetesa, da je hipertenzivna i da noću glasno hrče. Klinička obrada pokazala je tvrd i nepomičan čvorčić u boji okolne sluznice (slika 1. a). Tomografski i radiološki pregledi otkrili su koncentrične radioopake strukture u području tvrdog nepca promjera dva centimetra.

T-2 MR snimke lubanje pokazale su hipersignal kroz obložnu sluznicu lijevoga maksilarnog sinusa u skladu sa zadebljanjem njegove sluznice i, što je iznenadilo liječnike, uočljiv hiposignal koji odgovara izraženom izbočenju cijeloga tvrdog nepca (slike 2.a i 2.b).

Napravljane su radiološke slike za planiranje dentalne terapije. Na njima su bili vidljivi koštani prikazi s nepreciznim rubovima na periapikalnom dijelu gornjih prednjih zuba koji su zauzimali područje nosne šupljine (slike 1.b i 1.c).

in the midline of the posterior hard palate and manifests as a round and symmetrical, sometimes multilobulated, nodule (7), generally discovered on routine clinical examination (4).

Palatal and mandibular tori are microscopically characterized by *lamellae* of compact bone covered with a thin and poorly vascularized mucosa (6, 7). Larger specimens can have a center of cancellous bone and the only difference between the palatal torus and other exostoses is in its being developed at characteristic sites and in a symmetrical manner (7). Palatal tori are characterized by slow growth and the torus can reach a large size that requires surgical removal, for example, when representing an obstacle to prosthetic treatment (2, 7).

There are reports on complications related to TP, such as spontaneous exposure of a torus and osteonecrosis of a torus associated with the use of bisphosphonates, which require surgical or pharmacological treatment (8). On the other hand, the presence of tori can be advantageous since they can be sites of bone tissue collection for autogenous grafts in implant and periodontal surgery (8,9).

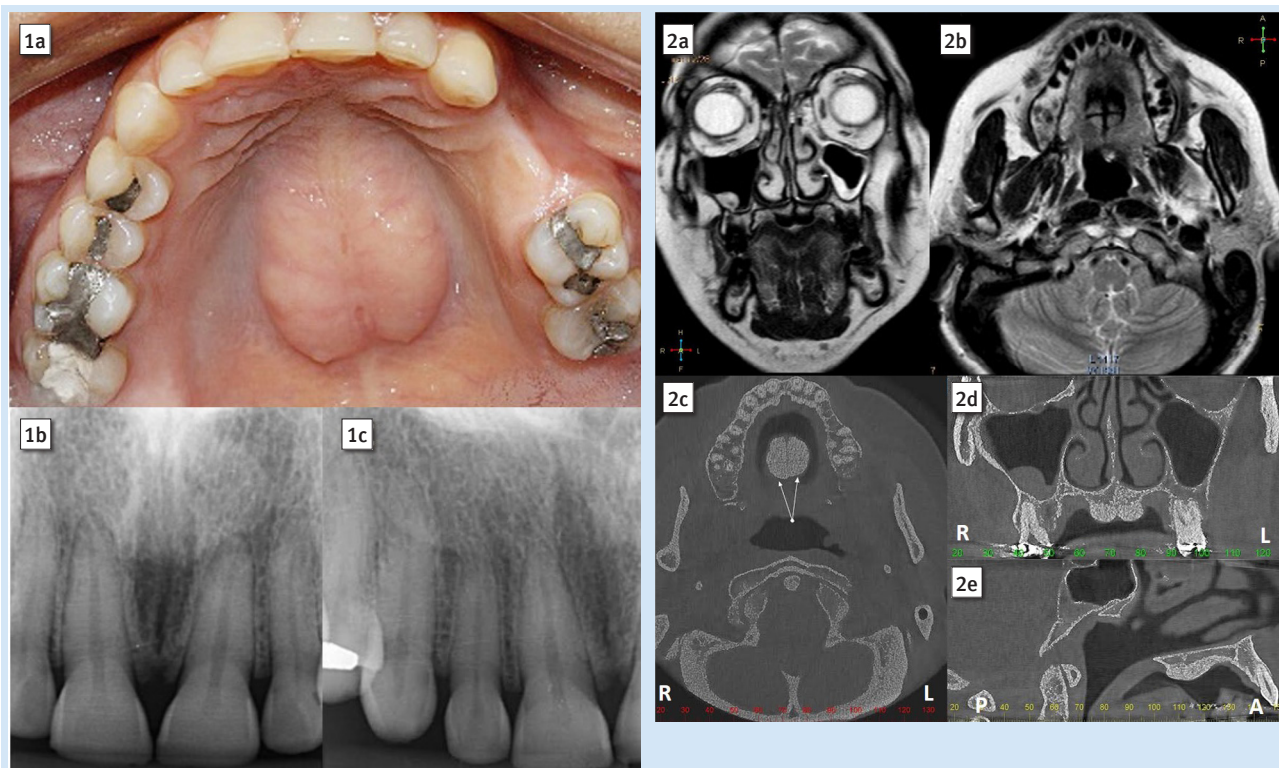
Torus palatinus is frequently identified on computed tomography (CT) scans, where it appears as a bone protuberance with a density similar to that of compact bone (10). This complementary exam is needed in some cases, as stated in the report of Godinho et al. (8).

Magnetic resonance imaging (MRI) is not an imaging method of choice in these cases nor is it used for diverse dental planning. Reports of MRI of TP are therefore sparse in the literature. However, the description of MRI features of TP, in conjunction with its confirmation by an imaging method that is more familiar to the dentist such as CT, is important for dental and medical practice. This approach permits the differential diagnosis of this entity, which generally does not require intensive interventions, from other conditions that can mimic it. Within this context, this study provides a detailed description of the presence of TP of exacerbated dimensions on cone beam CT and MRI images.

Case report

A 44-year-old woman sought medical care because of recurrent episodes of migraine. An MRI scan of the skull was requested to help diagnose the case, which revealed a hyposignal in the region of the soft palate. The physician, who was unaware of this alteration, referred the patient to a dentist for diagnosis.

During anamnesis, the patient confirmed to be diabetic and hypertensive and reported significant nocturnal snoring. The patient was diagnosed with obstructive sleep apnea by an otorhinolaryngologist. Clinical examination showed a sessile nodule of firm consistency, which had the color of the adjacent mucosa (Figure 1a). Radiographic and tomographic examination revealed a concentric radiopaque image in the region of the hard palate, which measured approximately 2 cm in diameter. The T2-weighted MRI images of the skull showed a hypersignal throughout the lining of the left maxillary sinus compatible with mucosal thickening of the sinus and, surprisingly, an eminent hyposignal corresponding to pronounced bulging of the entire hard palate (Figure 2a and 2b).



Slika 1. a) Inicijalna klinička fotografija čeljusti koja prikazuje ispuščen *torus palatinus*; b) periapikalni radiogram središnjeg sjekutića; uočljiva radioopakna struktura u apikalnom području zuba 11 i 21.; c) periapikalni radiogram gornjeg desnog očnjaka

Figure 1 A) Initial clinical photograph of the jaw showing an exuberant *torus palatinus*. B) Periapical radiograph of the central incisors. Note the radiopaque image in the apical region of teeth 11 and 21. C) Periapical radiograph of the upper right canine.

Slika 2. a) Prikaz magnetske rezonancije u frontalnoj ravnini; b) prikaz magnetske rezonancije u aksijalnoj ravnini; c) aksijalni tomografski presjek; d) koronalni tomografski presjek; e) sagitalni tomografski presjek

Figure 2 A) Magnetic resonance imaging in the frontal plane. B) Magnetic resonance imaging in the axial plane. C) Axial tomographic section. D) Coronal tomographic section. E) Sagittal tomographic section.

Panoramska radiološka slika pokazala je značajan radioopaktan konveksitet tvrdoga nepca koji se širio obostrano na područje kutnjaka, a izgledao je poput spongioznog koštanog tkiva. Zato je odlučeno poslati pacijenticu na CT s koničnom zrakom. Pregled je obavljen tomografom ICAT Next Generation (Imaging Science International, Hatfield, PA, SAD) s poljem pregleda od 16 x 13 centimetara koji zahvaća srednju trećinu lica. Dobiveni su aksijalni, koronalni i sagitalni pre-rezi, te je otkrivena znatna hiperopakna lobularna obostrana masa gustoće koštanoga tkiva koja je uzrokovala izbočenje cijelog tvrdog nepca (slike 2. c, 2. d i 2. e).

Konačna dijagnoza bila je TP. Pacijentica je potanko obaviještena o anatomskoj varijaciji te se vratila medicinskom liječenju migrene.

Imaging scans were performed for dental treatment planning. Imprecise areas of opacity with ill-defined borders and a bony aspect were observed on periapical radiographs of the upper anterior teeth, which occupied the region corresponding to the *nasal fossae* (Figure 1b and 1c). Panoramic radiography showed an extensive radiopaque convexity area in the region of the hard palate, which extended bilaterally to the molar area and had the appearance of cancellous bone tissue. Cone beam CT was performed using an ICAT Next Generation dental scanner (Imaging Science International, Hatfield, PA, USA), with a field of view of 16 x 13 cm comprising the middle third of the face. Axial, coronal and sagittal sections were obtained, which revealed an extensive hyperdense lobulated bilateral mass with the density of bone tissue that caused bulging of the entire hard palate (Figure 2c, 2d and 2e).

The final diagnosis was TP. The patient received detailed information about the anatomical variation and returned to medical treatment for her migraine.

Rasprava

Gorsky i suradnici (2) istraživali su prevalenciju TP-a u populaciji od 1002 Izraelca. Iznosila je 21 posto u cjelokupnom uzorku, a veća je uočena kod žena (24,9 %) u usporedbi s muškarcima (16,45 %), bez veće razlike u odnosu na dob

Discussion

Gorsky et al. (2) studied the prevalence of TP in a population of 1,002 Israeli Jews. The prevalence of TP was 21% in the entire sample and a higher prevalence was observed among women (24.9%) compared to men (16.45%), with-

(≤ 21 godina i > 21 godina). Najčešća lokacija bila je u blizini kutnjaka. Prevalencija torusa većeg od dva centimetra bila je češća među starijom populacijom. Al-Bayaty i njegovi kolege (3) ističu da se TP pojavljuje u prosječnoj dobi od 30,7 godina. Ipak, Beena (11) izvješćuje o slučaju 18-mjesečnog dječaka s TP-om i dodaje da torus može utjecati na neke oralne funkcije kao što je govor, posebno u dječjoj dobi.

U jednom istraživanju uočena je visoka incidencija torusa unutar obitelji te se sugerira da se nasljeđuje dominantno autosomno (12). Pechenkina i suradnici (13) proučavali su egzostozne formacije lubanje neolitičkoga Kineza i smatraju da je njihov nastanak složen proces čija etiologija može potjecati od bilo kakve traume ili upale gingivnoga tkiva. Teški okluzalni stres najčešći je okolišni čimbenik koji rezultira formiranjem egzostozna ako pojedinac ima genetsku predispoziciju. Ipak, ta hipoteza nije čvrsto utemeljena jer torusi nastaju i daleko od dentalnih struktura, kako je uočeno u opisanom slučaju.

Morrison i Tamimi (14) analizirali su pacijente s oralnim torusom i bez tih koštanih izraslina, te su otkrili da su zubi povezani s parafunkcionalnim navikama pacijenata s torusom. Uočena je korelacija između torusa i hipotiroidizma. Dob, spol, pušenje, hipertenzija, parodontna bolest, dijabetes ili depresija nisu se razlikovali među grupama. Problemi s disanjem istaknuti tijekom anamneze opisanog slučaja, uključujući i apneju, također su povezani s torusom. Palm i suradnici (15) procijenili su povezanost između mandibularnog torusa i opstruktivne apneje, no nisu pronašli povezanost između prevalencije torusa i hrkanja ili drugih stupnjeva apneje. Premda su mali torusi uočeni kod težih stupnjeva apneje, to se ne slaže s hipotezom autora da veliki torusi interferiraju s poremećajima spavanja jer sprječavaju ulazak zraka. Nadalje, veći torusi tretirani uređajima za mandibularno pomicanje uspješnije se liječe negoli oni mali. Hipoteza je bila da veći torusi pridonose pozicioniranju jezika i posljedično smanjuju simptome apneje. U našem slučaju prisutnost nije korelirala s hrkanjem ili apnejom pacijentice. Istaknimo da su rijetka istraživanja koja povezuju TP s poremećajima spavanja.

Diferencijalna dijagnoza torusa uključuje i osteome ako pacijent pati od Gardnerova sindroma. Oni su obično mnogobrojni i asimetrični, češći su u mandibuli te su povezani s impaktiranim zubima i odontomima vezanima za sindrom (1). Ta hipoteza isključena je u našem slučaju jer pacijentica nije pokazivala druge promjene. *Torus palatinus* mogu imati i oboljeli od Worthova sindroma, rijetke dominantno autosomne bolesti poznate kao *hyperostosis corticalis generalized congenita*. Za taj poremećaj svojstvena je povećana gustoća kostiju, koštana protuberancija ili prominencija, tj. izbočina (TP) na nepcu i zadebljanje ostalih dugih kostiju (16).

Važno je postaviti točnu dijagnozu jer je povezana s izborom terapije. Torusi mogu postojati dugo prije nego što ih je potrebno kirurški ukloniti. U tom slučaju razmatraju se različiti oblici sigurnih zahvata. U istraživanju u kojem je opisano korištenje lasera Er:Yag istaknuto je da je, unatoč dugotrajnosti zahvata, instrument omogućio dobro remodeliranje rane, dekontaminaciju i biostimulaciju (17). Kompjutorizirana tomografija često se koristi u dijagnostici specifičnih patoloških stanja ili za promatranje anatomskih struktura za-

out significant differences between age groups (≤ 21 years and > 21 years). The most common location was near the molar area. The prevalence of tori larger than 2.0 cm was higher among older subjects. Al-Bayaty et al. (3) reported an average age at the onset of TP of 30.7 years. However, Beena (11) reported the case of an 18-month-old boy with TP, in which he concluded that torus can adversely affect some oral functions such as speech, especially during childhood.

One study demonstrated a high incidence of tori among families, suggesting a dominant autosomal inheritance (12). Pechenkina et al. (13) studied exostosis formation and found out that exostosis was unusually common on the Neolithic skulls from China. They concluded that the formation of exostoses is a complex process the etiology of which can be any trauma or inflammation of gingival tissue. Severe occlusal stress is the most common environmental factor, which can lead to the development of exostosis when the individual has a genetic predisposition. However, this hypothesis is not well founded since tori are located distant from dental structures, as observed in the present case.

Morrison and Tamimi (14) studied the patients with tori and those without oral tori and found out that tooth wear is related to parafunctional habits in patients with tori. A correlation was also observed between the presence of a torus and hypothyroidism. Age, gender, smoking, hypertension, periodontal disease, diabetes or depression did not differ between groups. Respiratory problems, including apnea as reported during medical history taking for the present case, were also correlated with the presence of tori. Palm et al. (15) evaluated the relationship between the presence of *torus mandibularis* and obstructive sleep apnea and found no association between the prevalence of tori and snoring or different degrees of apnea. However, smaller tori tended to be present in more severe degrees of apnea, disagreeing with the hypothesis of the authors who have stated that larger tori interfere with sleep disorders when air is blocked from entering into the lungs. Furthermore, the patients with larger tori treated with a mandibular advancement device had significantly better success rates than those with smaller tori. The hypothesis was that larger tori contribute to tongue positioning and subsequently reduce sleep apnea symptoms. In our case, the presence of the torus was not correlated with snoring or apnea of the patient. Studies associating TP with sleep disorders are sparse.

The differential diagnosis of tori includes osteomas found in patients with Gardner syndrome. However, these osteomas are generally numerous and asymmetrical, are more common in the mandible, and are associated with dental impaction and syndrome-related odontoma (1). This hypothesis was ruled out in the present case, since the patient did not exhibit any other alteration. *Torus palatinus* can also be found in patients with Worth syndrome, a rare dominant autosomal disease, known as *hyperostosis corticalis generalized congenita*. This rare disease is characterized by increased bone density, the presence of bone protuberances in the palate, and thickening of various long bones (16).

The importance of a correct diagnosis is related to the choice of treatment. Tori can persist for a long period and their surgical excision may become necessary. Different types of safe

to što omogućuje trodimenzionalni pogled i razne presjeke te vizualizaciju detalja u usporedbi s periapikalnim i panoramskim radiogramima (10). Tomografski prikazi omogućuju bolju procjenu anatomskih varijacija i točnije prikazivanje njihova odnosa s okolnim strukturama te sastav medularne ili kortikalne kosti (12). Premda je u većini slučajeva TP slučajan nalaz na CT-u, Ruprecht i suradnici (18) istraživali su mandibularne toruse i uspoređivali njihov radiografski izgled s njihovim izgledom na diseciranim lubanjama te su pronašli da su oni manji od tri milimetra vrlo teško uočljivi i gotovo ih je nemoguće pronaći radiološki.

Opis torusa pronađen MR-om rijedak je u literaturi. Platzek i suradnici (19) opisali su MR prikaze mandibularnog torusa, uključujući i signal slabog intenziteta, kao što postoji u kompaktnoj kosti. Manji torusi teško se pronalaze na MR prikazima jer njihovo otkrivanje sprječavaju metalni artefakti. U ovom istraživanju to nije bilo tako, jer su torus i njegovi odnosi s okolnim strukturama brzo pronađeni. Ipak, u većini slučajeva, ova anatomska varijacija ne zahtijeva dodatne dijagnostičke postupke. No, ako se u torusu događaju kliničke promjene, CT je potreban radi dentalnog planiranja, a MR radi medicinske dijagnoze. Općenito, njegov klinički prikaz dovoljan je za dijagnozu, a pronalasci na prikazima specifični su i trebali bi biti dio medicinskog i dentalnog znanja. Zato su opisi slučajeva vrlo važni, posebno za profesionalce uključene u dijagnostiku lezija glave i vrata ako nisu upoznati s ovom strukturom, kako bi se izbjegle nepotrebne procedure.

surgery are being investigated for these cases. In a study using an Er:Yag laser, the instrument promoted good remodeling of the surgical wound, decontamination and biostimulation despite an increased length of surgery (17). Computed tomography is widely used for the diagnosis of specific pathological conditions or observation of anatomical structures, since it provides a three-dimensional view and transverse images and permits to visualize details when compared to panoramic or periapical radiography (10). Tomography scans permit better evaluation of these anatomical variations and demonstrate their relationship with adjacent structures and the composition of medullary and cortical bone (12). However, in most cases, TP is also an incidental finding on CT. Ruprecht et al. (18) investigated mandibular tori by relating their intraoral radiographic appearance to their corresponding appearance in dissected skulls and found that tori smaller than 3 mm are very difficult or impossible to detect radiographically.

The description of tori by MRI is rare in the literature. Platzek et al. (19) described the MRI features of a case of mandibular torus, including low signal intensity as it consists of compact bone. Smaller tori are difficult to identify on MRI scans and their detection is impaired in the presence of metallic artifacts. This was not the case in the present study, in which the torus and its relationship with adjacent structures were easily identified. However, in most cases, this anatomical variation does not require additional diagnostic methods. Computer tomography is needed for dental planning and to make a correct diagnosis. Also, MRI is used for medical diagnostic purposes, apart from situations in which clinical alterations occur in the torus. Generally, its clinical features are sufficient for the diagnosis and imaging findings are specific and should be part of medical and dental knowledge. Case reports are therefore important, especially for professionals involved in the diagnosis of head and neck lesions who are not familiar with this entity, in order to avoid unnecessary procedures.

Abstract

The *torus palatinus* is a unilocular or multilocular exostosis that occurs in the midline of the hard palate. It is considered a common clinical finding. Magnetic resonance imaging (MRI) is not commonly used in dentistry and descriptions of the *torus* by this imaging method are therefore rare in the literature. This case study reports on a female patient referred to the dentist to elucidate a bone enlargement detected by MRI, which was requested by the physician who accompanied the patient for migraine treatment. Additional routine dental imaging exams were performed for the planning of different treatments. Here is a description of the *torus palatinus* along with MRI in order to provide a complete representation of the clinical finding.

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Key words

Torus Palatinus; Exostoses; Hard Palate; Magnetic Resonance Imaging; Cone-Beam Computed Tomography

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