Case Report

http://dergipark.org.tr/en/pub/anatomy
Received: September 8, 2022; Accepted: November 12, 2022
doi:10.2399/ana.22.3383890

anatomy
An International Journal of Experimental and Clinical Anatomy

Occipital spur: an incidental finding on a diagnostic cone-beam computed tomography – a case report

Shakeel Ahmed Valai Kasim[1], Mehboob Mohammed Mustafa Shariff[2], Sonu Danish[3], Naveed Ahmed Valai Kasim[4]

[1]*Department of Orthodontics and Dentofacial Orthopaedics, Ragas Dental College and Hospital, The Tamil Nadu Dr. M.G. R. Medical University, Uthandi, Tamil Nadu, India*
[2]*SRM Dental College, Bharathi Salai, Ramapuram, Chennai, Tamil Nadu, India*
[3]*Private Practitioner, Chennai, Tamil Nadu, India*
[4]*Private Practitioner, NK Dental Clinic Orthodontic Center, Chennai, Tamil Nadu, India*

Abstract

Exaggerated bony outgrowth of the external occipital protuberance is called occipital spur. The current report presents a case of a 20-year-old male patient seeking orthodontic treatment. The patient was referred for a cone-beam computed tomography scan to determine the position of impacted maxillary canines. An incidental finding on the scan was the existence of a focal spine-like hyperostosis in the occipital protuberance, and confirmed to be an occipital spur (Type III spine form). Clinical examination showed a palpable bone swelling without any tenderness, infection or discharge. He was referred to an orthopaedic surgeon should any symptoms get aggravated in the future. This case supports the essential role of cone-beam computed tomography to detect, analyse and identify the lesion as an occipital spur. This is the first such case report of its kind, which measures the size of occipital spur using cone-beam computed tomography and 3D imaging software. Usually asymptomatic, awareness of this uncommon presentation can expedite emergency medical care in the event of pain, or trauma leading to fracture or avulsion of the spur fragment. In such an event, the readily available CBCT data will be indispensable to surgeons for planning surgery with precise linear and volumetric measurements. Knowledge of these bony spurs is of untold value to anatomists, who will benefit greatly from being able to study the variants in vivo, in addition to studies on dry skulls or preserved cadavers. It is also of interest to clinicians and radiologists for diagnostic purposes, and sports physicians.

Keywords: Cone-beam computed tomography (CBCT); external occipital protuberance; inion hook; occipital spur

Anatomy 2022;16(3):189–192 ©2022 Turkish Society of Anatomy and Clinical Anatomy (TSACA)

Introduction

External occipital protuberance (EOP) is a normal anatomical structure located on the posterior surface of the occipital bone, and the highest point of this structure is called inion. It is the insertion site of the ligamentum nuchae and trapezius muscle. Prominence of EOP has been used in the determination of sex in forensic investigations, and it is often more prominent in males than females. Based on its shape, Broca et al. classified EOP into six anatomical types using radiographs of dry skulls, which was later simplified by Gülekon and Turgut[1] into three subtypes: Type I, smooth; Type II, crest form; Type III, spine form.

While the EOP is widely reported in anthropological literature, there is a dearth of information regarding it within medical publications. Recently, this anatomical structure has been mired in controversy. The term enthesis describes the site of insertion of a tendon, ligament, fascia or articular capsule into bone. An enthesophyte is a bony projection arising at an enthesis. Exaggerated bony outgrowth of the external occipital protuberance is called Occipital spur or Inion hook. They are seen rarely in radiographic findings in young adults, as these bony adaptations are assumed to develop slowly over time.[2] However, in recent years, the presence of an enlarged external occipital protuberance

(EEOP) has been observed frequently in radiographs of relatively young patients.[3]

There are studies being conducted to investigate whether EEOP is linked to excessive use of smartphones and associated posture-related health issues in young adults. This article presents an incidental finding of this exaggerated anomaly in an orthodontic patient using cone-beam computed tomography.

Case Report

A 20-year-old male patient reported with the chief complaint of malalignment and irregularity of his upper anterior teeth. On clinical and oral examination, he had an anterior crossbite, bilateral class III molar relationship, constricted maxillary arch and class III skeletal pattern. Interestingly, the patient was unaware of the absence of the maxillary canines from the dental arch. Patient's medical history showed no systemic diseases. Routine records were taken to assist in diagnosis and treatment planning, which included intra-oral and extra-oral photographs, plaster study models, cephalometric and panoramic radiographs.

The patient was referred for a cone-beam computed tomography (CBCT) scan to determine the position of the impacted maxillary canines and evaluate possible root resorption of the adjacent teeth. The scan was carried out on a CBCT (CS 9000 3D Imaging system Kodak, Rochester, NY, USA) and data processing was done using 3D imaging software version 11.95 (Dolphin imaging and management solutions, Chatsworth, CA, USA). The resultant images identified the exact position of the impacted canines in the maxilla and confirmed that there was no root resorption of the maxillary lateral incisors or the maxillary first bicuspids (**Figure 1**).

An incidental finding on the CBCT was the existence of a focal spine-like hyperostosis which was seen in the occipital protuberance extending in a craniocaudal direction (**Figure 2**). The measurements of the spur done on the CBCT at the level of EOP showed the spur width at the base was 13.2 mm and 3.5 mm at the apex (**Figure 3**). The length of the spur was 17.4 mm, measured at the base of EOP to the apex of the spur. The distance of the spur from the base of the skull was 6.5 mm (**Figure 2**). This incidental CBCT finding was confirmed to be an occipital spur (Type III spine form).

Clinical examination showed a palpable bone swelling without any tenderness, infection or discharge. Though asymptomatic, the patient gave a history of mild discomfort while sleeping on a hard pillow.

Figure 1. Three-dimensional reconstruction in coronal view shows the exact position of the impacted canines in the maxilla.

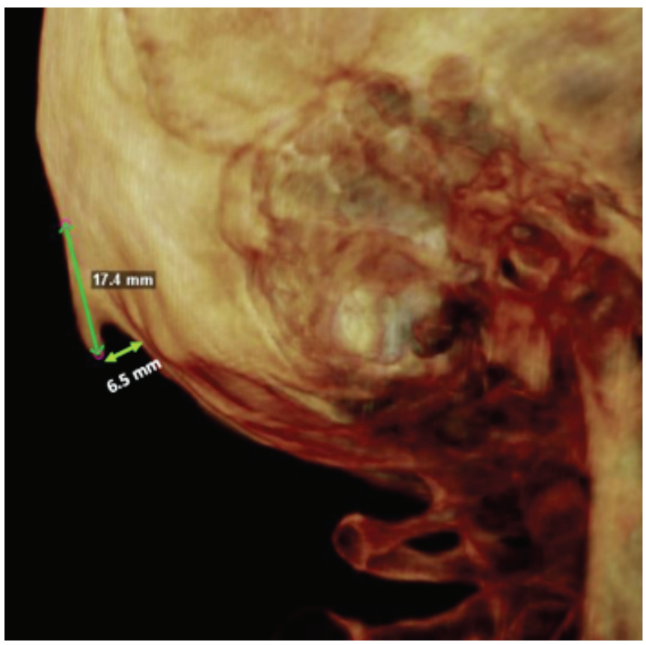

Figure 2. Three-dimensional reconstruction in lateral view shows a focal spine-like hyperostosis in the occipital protuberance extending in a craniocaudal direction. The length of the spur is 17.4 mm, measured at the base of external occipital protuberance to the apex of the spur. The distance of the spur from the base of the skull is 6.5 mm.

He was managed conservatively and advised to use a soft pillow. He was referred for an opinion from an orthopaedic surgeon should any symptoms get aggravated in future. He is currently undergoing orthodontic treatment for malalignment of teeth and class III skeletal malocclusion.

Discussion

The diagnostic value of CBCT has risen in regular orthodontic practice, with benefits which cannot be achieved with conventional 2D radiographs. Based on these advantages, CBCT has been utilized in orthodontics, and several pathological findings and abnormalities in the oral and maxillofacial region have been incidentally reported on CBCT scans.[4,5]

In the present case report of a 20-year-old male patient seeking orthodontic treatment for malalignment of teeth, the occipital spur was an incidental finding in the CBCT. It was missed in the diagnostic cephalometric records, since the suboccipital area is routinely cropped out of the field of view in conventional lateral cephalograms. Hence, incidental findings detected in CBCT images can contribute significantly to the identification of subclinical pathologic abnormalities. It is of major importance that the ALARA principle (radiation dose "as low as reasonably achievable") is respected. In such cases, however, the benefits outweigh the expected risk from radiation.

Previous studies have quantified occipital spurs conventionally using either dry skulls,[6] two-dimensional radiographs,[7] ultrasonography[8] or CT studies.[9] The disadvantage of studies on dry skulls is that the dimensional changes due to the effects of prolonged cadaver preservation have not been researched extensively. Two-dimensional radiographs cannot ensure the same degree of accuracy that are obtained through three-dimensional reconstruction in CBCT.[10] Helical CT studies have a much higher risk from radiation compared with CBCT,[11] which has the specific advantage of choosing the field of view according to convenience and requirement.

In this case report, the patient primarily sought treatment for malocclusion and had no history of pain, with only mild discomfort while using a hard pillow in spite of the increased size of the occipital spur. In the normal course of events, the possibility of detecting and identifying the lesion would have been low, putting the patient at risk of injury from trauma to the occipital spur. The incidental discovery of the occipital spur in the CBCT and its immediate identification by the clinician enabled the patient to be apprised of the condition. The patient was advised to take necessary caution in case of accidents or trauma to the back of the head, and referred to an orthopaedic surgeon should his symptoms get aggravated in future. Though occipital spurs are usually asymptomatic, awareness of this uncommon presentation can expedite emergency medical care and management in a cost-effective manner in the event of any pain or trauma leading to fracture or avulsion of the spur fragment.[12] In such a scenario, the readily available CBCT data will prove to be indispensable to the surgeon for planning and executing surgery. This is the first such report of its kind, which measures the size of occipital spur using cone-beam computed tomography and 3D imaging software. This imag-

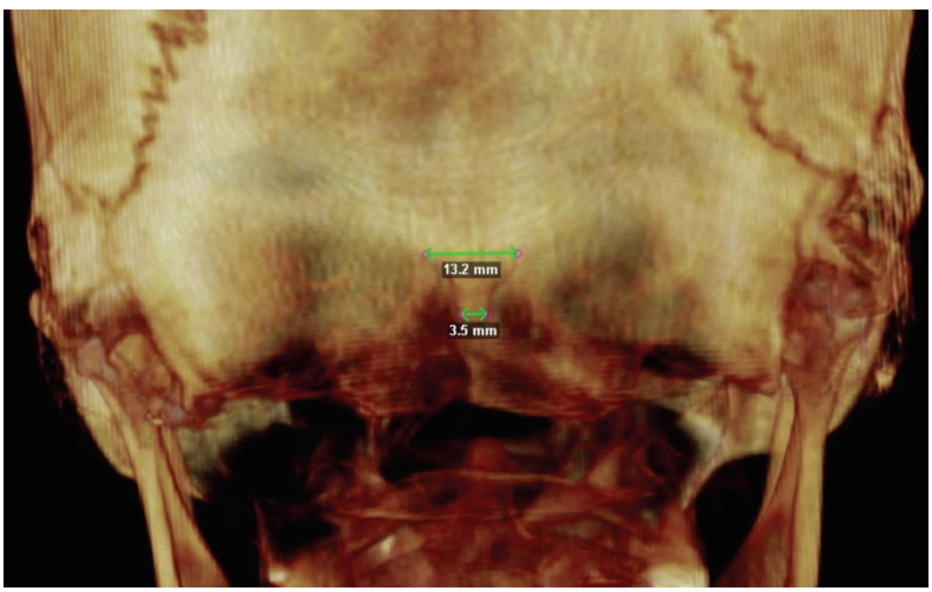

Figure 3. Three-dimensional reconstruction in posteroanterior view shows the width of the spur at the base is 13.2 mm and 3.5 mm at the apex, measured at the level of external occipital protuberance.

ing modality is more sensitive than conventional radiography for precise linear and volumetric measurements, and the depiction of changes in bone spur. Knowledge of these bony spurs is of untold value to clinicians and radiologists for diagnostic purposes. Anatomists and anthropologists will benefit greatly from being able to study the variants in vivo, in addition to studies on dry skulls or preserved cadavers. Also, sports physicians cognizant of such an anomaly will be better able to provide adequate protection to the athletes in their care.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

SAVK: protocol/project development, data analysis; MMMS: protocol/project development, data analysis; SD: data analysis, manuscript writing/editing; NAVK: protocol/project development, data analysis.

Ethics Approval

This case report has been prepared in accordance with the Helsinki Declaration and does not require any kind of approval of the Ethical committee. However, informed consent obtained from the patient for the report to be published.

Funding

There has been no financial support for this work that could have influenced its outcome.

References

1. Gülekon IN, Turgut HB. The external occipital protuberance: can it be used as a criterion in the determination of sex? J Forensic Sci 2003;48:513–6.
2. Matsumoto M, Okada E, Ichihara D, Watanabe K, Chiba K, Toyama Y, Fujiwara H, Momoshima S, Nishiwaki Y, Hashimoto T, Takahata T. Age-related changes of thoracic and cervical intervertebral discs in asymptomatic subjects. Spine (Phila Pa 1976) 2010;35:1359–64.
3. Shahar D, Sayers MGL. A morphological adaptation? The prevalence of enlarged external occipital protuberance in young adults. J Anat 2016;229:286–91.
4. Rogers SA, Drage N, Durning P. Incidental findings arising with cone-beam computed tomography imaging of the orthodontic patient. Angle Orthod 2011;81:350–5.
5. Cha JY, Mah J, Sinclair P. Incidental findings in the maxillofacial area with 3-dimensional cone-beam imaging. Am J Orthod Dentofacial Orthop 2007;132:7–14.
6. Srivastava M, Asghar A, Srivastava NN, Gupta N, Jain A, Verma J. An anatomic morphological study of occipital spurs in human skulls. J Craniofac Surg 2018;29:217–9.
7. Varghese E, Samson RS, Kumbargere SN, Pothen M. Occipital spur: understanding a normal yet symptomatic variant from orthodontic diagnostic lateral cephalogram. BMJ Case Rep 2017; bcr2017220506.
8. Gómez Zubiaur A, Alfageme F, López-Negrete E, Roustan G. Type 3 external occipital protuberance (spine type): ultrasonographic diagnosis of an uncommon cause of subcutaneous scalp pseudotumor in adolescents. Actas Dermosifiliogr (Engl Ed) 2019;110:774–5.
9. Jacques T, Jaouen A, Kuchcinski G, Badr S, Demondion X, Cotten A. Enlarged external occipital protuberance in young French individuals' head CT: stability in prevalence, size and type between 2011 and 2019. Sci Rep 2020;10:6518.
10. Jung PK, Lee GC, Moon CH. Comparison of cone-beam computed tomography cephalometric measurements using a midsagittal projection and conventional two-dimensional cephalometric measurements. Korean J Orthod 2015;45:282–8.
11. Li G. Patient radiation dose and protection from cone-beam computed tomography. Imaging Sci Dent 2013;43:63–9.
12. Sattur M, Korson C, Henderson F Jr, Kalhorn S. Presentation and management of traumatic occipital spur fracture. Am J Emerg Med 2019;37:1005.e1-1005.e2.

ORCID ID:
S. A. Valai Kasim 0000-0001-8642-4776;
M. M. Mustafa Shariff 0000-0003-2759-5860;
S. Danish 0000-0002-0715-4016;
N. A. Valai Kasim 0000-0003-0502-926X

deomed

Correspondence to: Shakeel Ahmed Valai Kasim, MDS, MOrth RCPS, Prof.
Department of Orthodontics and Dentofacial Orthopaedics, Ragas Dental College and Hospital, Tamil Nadu Dr. M.G. R. Medical University, Uthandi, India
Phone: +91 9840862274
e-mail: drshakeelahmed_vk@yahoo.com

Conflict of interest statement: No conflicts declared.