ABSTRACT

Background: There is increasing frequency of dentoalveolar and palatal implants placed in the posterior maxilla for prosthodontic and orthodontic purposes. The purpose of this study is to provide information on the location and morphology of the greater palatine grooves (GPG) in the hard palate and to promote awareness of this structure.
Materials and methods: Eighty-nine Cone Beam CT (CBCT) scans were analysed for the presence of a groove, crest or bridging.

Results: This study on the morphology of the GPG in the maxillary first and second molar regions showed three distinct appearances: i, no palatal groove, ii, one palatal groove, iii, two palatal grooves. The detection frequency of no palatal groove in the first molar region was 60%, 34% had one groove and 6% having two grooves. The detection frequency of no palatal groove in the second molar region was 72%, 26% had one groove and 2% had two grooves. The number of crests in the first and second molar regions ranged from 0-3.

Conclusion: The present study demonstrates a great variation in morphology of the GPG of the hard palate. Knowledge of the GPG will decrease possible complications of implant surgery, particularly palatal implant surgery and to not confuse the GPG with pathology.

INTRODUCTION

Cone beam computed tomography (CBCT) is now used extensively for pre-implant assessment of the jaws. One of the most important functions of CBCT is the identification of vital structures prior to implant placement. There is now a growing use of palatal implants (temporary anchorage devices) for orthodontic purposes. The GPG is a significant structure in the hard palate that should be considered when placing implants in the upper molar regions, but there is very little in the literature regarding this structure. The greater palatine nerve and vessels pass inferiorly in the pterygopalatine fossa and exit via the greater palatine foramen onto the hard palate. They pass in a groove in the hard palate to supply the mucous membrane of the hard palate, including the palatal glands and the palatal gingiva. The greater palatine nerve supplies the mucosa of the hard palate as far anteriorly as the maxillary canines.
Frequently, there are bony ridges and protuberances forming grooves in the hard palate in the second and first molar regions adjacent to the course of the greater palatine neurovascular bundle. A study by Hassanali and Mwaniki identified the presence of crests and bridges along the borders of the palatine grooves. These features were also studied by Zivanovic and were found to be present in ancient skulls. The morphological variation of the greater palatine foramen and groove may be significant when administering local anaesthesia or performing palatal surgery. These grooves and crests should also not be mistaken for the presence of disease.

The purpose of this study is to provide information on the location and morphology of the GPGs in the hard palate and to promote awareness of this structure, particularly with more implant surgery occurring in this region.

MATERIAL AND METHODS

The study group comprised of 89 scans which included the maxilla (55 female and 34 male) with an average age of 31.5 years (range 6-78 years). The scans which included the maxilla, were selected randomly from a database from a private maxillofacial radiology practice and ethics approval was obtained for this study. Cone beam scans where the first molar and second maxillary molars were missing were excluded. Patients with local pathology and exostoses in the first and second maxillary molar regions were also excluded.

The CBCT studies were acquired with an i-CAT cone beam CT (Imaging Sciences International) using 120 kV and 3-7 mA. The software Xoran-CAT was used for the analysis of the datasets. Orientation of the three planes was achieved by lining up the infraorbital margins, anterior and posterior nasal spines, and orientating the hard palate parallel to the axial plane.
The scans were reviewed by a registered oral and maxillofacial radiologist. The second and first molar regions bilaterally were analysed for the presence of a groove, crest or bridging. The distance of the groove from the greater palatine foramen in the first and second molar positions were also measured. The presence or absence of torus palatinus was also recorded.

RESULTS

The assessed patient pool of 89 cases provided 178 sites. This study on the morphology of the GPG in the maxillary first and second molar regions showed three distinct morphologies (Fig 1-3). In the first molar region, 107 sites had no signs of a groove, 61 sites had one groove while 10 sites had two grooves. In 29 cases, the grooves in the first molar region were bilateral while in 20 cases, the groove was unilateral. In the second molar region, 128 sites had no signs of a groove, 46 sites had one groove and 4 sites had two grooves. In 13 cases, the grooves in the second molar region were bilateral while in 10 cases, the groove was unilateral.

The number of crests at each site varied from 0 to 3. In the first molar region, 84 sites had no crests, 82 had one crest, 11 had two crests and 1 had three crests. In the second molar region, 113 sites had no crests, 50 sites had one crest, 14 sites had two crests and 1 site had three crests.

The average distance of the groove in the first molar region from the greater palatine foramen is 11.8 mm (range 6-18.5mm). The average distance of the groove in the second molar region from the greater palatine foramen is 9.6 mm (range 5-14.5mm). Torus palatinus was present in 8 cases (9%).
DISCUSSION

As there is a close relationship between the greater palatine neurovascular bundle and the roots of the maxillary molars, careful radiologic analysis is needed before insertion of implants. However, there is scarce data in the literature describing the anatomical variations of the grooves and crests in the palate housing the greater palatine neurovascular bundle. Furthermore, the normal variations in the grooves and crests in the palate should not be confused with pathology.

This study on the morphology of the GPG in the maxillary first and second molar regions showed three distinct appearances (Fig. 1-3) i, no palatal groove, ii, one palatal groove, iii, two palatal grooves. The detection frequency of no palatal groove (60%) in the first molar region was significantly higher than the presence of either one (34%) or two grooves (6%). Similarly, the detection frequency of no palatal groove (72%) in the second molar region was significantly higher than the presence of either one (26%) or two grooves (2%). In cases where no groove was evident, it might be expected that the neurovascular elements would lie in the overlying soft tissues of the palate.

Unlike the study by Hassanali and Mwaniki, no bridging of the greater palatal groove was noted and this may reflect the difference in the population samples. The incidence of torus palatinus was 9% in this present study compared to 4.8% in the study by Hassanali and Mwaniki. The presence of torus palatinus can alter the appearance of the GPG, resulting in the false impression of two grooves.

The greater palatine neurovascular bundle is an important structure in the posterior maxilla but the risks and clinical implications of damaging the neurovascular structures during implant procedures have not been addressed in the literature (Fig. 4). In contrast, one study found that some sensory changes can occur after graft harvesting from the palate. A study into complications following palatal implant placement for orthodontic purposes, found prolonged bleeding as one of the
complications. Although the site of the implant was not reported, impingement of the greater palatine artery would certainly increase the chance of bleeding.\textsuperscript{6}

CONCLUSION

The present study demonstrates a great variation in morphology of the GPG of the hard palate. The number of grooves range from none to two, while the number of crests range from none to three. Knowledge of this may help to decrease possible complications of implant surgery, particularly palatal implant surgery and prevent the GPG being confused with pathology. Based on these findings, CBCT is of great value in assessing the morphology of the posterior maxilla prior to dento-alveolar or palatal implant placement.

REFERENCES


This article is protected by copyright. All rights reserved.

Fig 1. No distinct greater palatine groove is present.
Fig. 2a. One greater palatine groove is demonstrated with one crest (arrow) on the palatal aspect of the groove.

Fig. 2b. One greater palatine groove is demonstrated with two crests (arrow).

Fig 3a. Two greater palatine grooves are demonstrated with two crests (arrows).
Fig 3b. Two greater palatine grooves are demonstrated with three crests (arrows).

Fig 4. Palatally positioned implant in the vicinity of the greater palatine neurovascular bundle.