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ORIGINAL ARTICLE

Analyses of anatomical relationship between mandibular third molar roots and variations in lingual undercut of mandible using cone-beam computed tomography

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Abstract *Background/purpose:* Anatomical features of the lingual undercut region is a potential factor that might increase the risk of displacement of a tooth or fragment. The aim of this study was to report the normal anatomical relationship of impacted lower third molar roots to the lingual cortex and soft tissues of mandible and anatomical variations of lingual balcony in the impacted third molar region.
Materials and methods: One hundred impacted third molars (54 males, 46 females) from 65 (31 men, 34 women) patients were evaluated for this study using cone-beam computed tomography. Three measurements [bone thickness, angle (Ang) 1 and Ang 2] were recorded on the coronal section slices of cone-beam computed tomography images; in these images, the impacted third molar root was closest to the lingual soft tissues.
Results: The average distance between the tooth root and the lingual outer cortical bone layer (bone thickness) was 1.03 mm. The averages of Ang 1 and Ang 2 were 140.61° and 153.44°. Ang 1 and Ang 2 of female patients were larger than those of male patients.
Conclusion: The narrow angulation of the lingual balcony region and the relationship between roots and lingual soft tissues should be noted to avoid undesirable complication of

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displacement of a tooth or fragment into sublingual, submandibular, and pterygomandibular spaces. There was no relation in the floor of the mouth between the position of the impacted third molar roots and different lingual undercut angulation variations.

Introduction

Third molar extraction, a common procedure in oral and maxillofacial surgery, is rarely associated with complications.[1] However, the complications of mandibular third molar surgery include alveolar osteitis, secondary infection, nerve dysfunction, hemorrhage, and displacement of the tooth into adjacent structures.[2] The most common sites of dislodgement of an impacted mandibular third molar fragment are the sublingual, submandibular, and pterygomandibular spaces.[3] Distal version and curved roots may increase the risk of displacement of a tooth or fragment.[4]

In this study, anatomical features of the lingual undercut region was questioned as a potential factor that might increase the risk of displacement of a tooth or fragment. Cone-beam computed tomography (CBCT) was used to evaluate the proximity of impacted mandibular third molar roots to lingual soft tissues and to determine the anatomical features of the lingual undercut region related to impacted mandibular third molars.

The main purpose of this study was to report the normal anatomical relationship of impacted lower third molar roots to the lingual cortex and soft tissues of mandible and anatomical variations of lingual balcony in the impacted third molar region.

Materials and methods

This study followed the Declaration of Helsinki on medical protocol and ethics and the regional Ethical Review Board of Medipol University Non-invasive Clinical Research Ethics Committee (no:2015/328) approved the study.

Until reaching the number of 100 impacted mandibular third molar teeth in inclusion criteria assessed in this study, 185 archived CBCT images that had been taken for various needs (indication, preoperative or postoperative control, follow-up, treatment planning) were reanalyzed. Patients with a history of trauma and/or surgery involving the maxillofacial region, systemic diseases affecting growth and development, or clinical and/or radiographic evidence of developmental anomalies/ pathologies affecting the maxillofacial region were excluded from the study. After also excluding third molars with pathology, incomplete root formation, and lingual version, 100 impacted third molars (54 males, 46 females) from 65 patients (31 men, 34 women) were evaluated. The evaluation was performed independently by one trained oral and maxillofacial surgeon and one trained oral and maxillofacial radiologist who were experienced in the radiographic evaluation of maxillofacial anatomy. Then, the average of the two measurements was calculated and evaluated.

The CBCT examinations were performed using a ProMax 3D Mid machine (Planmeca Oy, Helsinki, Finland). The ProMax 3D Mid was operated at 90 kVp and 10 mA with a 16 cm $\times$ 16 cm field of view. Assessment of CBCT scans was performed directly on a monitor screen (58-cm Acer, 1920 $\times$ 1080 pixels, HP Reconstruction PC). The MIMICS software (ver. 14.0; Materialise Europe, Leuven, Belgium) was used to measure the distance and angulation parameters. Measurements were recorded on 2$\times$ zoomed-in images to provide more accurate and detailed data. Collected data were categorized under classes of right—left sides, vertical—mesioangular—horizontal—distoangular versions, Emes[5] A—B—C relation types (Figure 1), and Chan[6] U—P—C morphology types (Figure 2).

In addition, three measurements were recorded on the coronal section slices of CBCT images; in these images, the impacted third molar root was closest to the lingual soft tissues. If there were multiple roots, the root closest to the lingual soft tissues was selected for evaluation.

1) Bone thickness (BT): lingual BT between the tooth root and the lingual outer cortical bone layer (Figure 3). Relationship type C values, in which the root does protrude into the soft tissues, by the Emes classification,[5] were entered with the data as negative rational values.
2) Angle 1 (Ang 1): the angle between (1) the most superior point of the lingual alveolar bone; (2) the most prominent point of the lingual alveolar bone; and (3) the deepest point of the lingual balcony (Figure 4).
3) Angle 2 (Ang 2): the angle between (1) the most prominent point of the lingual alveolar bone; (2) the deepest point of the lingual balcony; and (3) the most inferior point of the mandibular basis (Figure 5).

Statistical analysis

All statistical analyses were performed using SPSS software (version 22.0; SPSS, Chicago, IL, USA). Results were evaluated with the Shapiro—Wilk test, and a normal distribution of the parameters was detected. Results are expressed as means $\pm$ standard deviation. Differences between groups were evaluated using a one-way ANOVA test or Student *t* test, as appropriate. Student t test was used for the comparison of the quantitative data that does achieve two independent group's parametric test possibilities. One-way ANOVA test was used for the comparison of the quantitative data that does achieve three or more independent group's parametric test possibilities. A P value $<$ 0.05 was considered to indicate statistical significance.

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