Acta Scientific Otolaryngology (ISSN: 2582-5550)

Volume 5 Issue 9 September 2023

Research Article

CBCT Based Anatomic Juxtaposition of Mandibular Canal to Deeply Impacted Mandibular Third Molar: A Rationale for Coronectomy

Urvi Hiren Shah[1]*, Hiren Dharmendra Patel[2], Haren Bharat Pandya[3], Hitesh Sudarshan Dewan[3], Bijal Chetas Bhavsar[4] and Rajvi Amar Desai[5]

[1]Associate Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Dharmsinh Desai University, Nadiad, Gujarat, India

[2]Dean, Professor and Head, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Dharmsinh Desai University, Nadiad, Gujarat, India

[3]Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Dharmsinh Desai University, Nadiad, Gujarat, India

[4]Associate Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Dharmsinh Desai University, Nadiad, Gujarat, India

[5]Post Graduate Student, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Dharmsinh Desai University, Nadiad, Gujarat, India

***Corresponding Author:** Urvi Hiren Shah, Associate Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Dharmsinh Desai University, Nadiad, Gujarat, India.

DOI: 10.31080/ASOL.2023.05.0600

Received: June 29, 2023

Published: August 14, 2023

Abstract

Introduction: Accurate diagnosis and a minimally invasive surgical procedure for avoidance of injury to mandibular canal housing the inferior alveolar apparatus in relation to deeply impaced lower third molars is the need of the hour. Coronectomy, a relatively safe and novel technique, in synchronization with a Cone Beam Computarized Tomography can be evaluated further for its application towards management of the lower third molars in juxtaposition of the canal.

Aim: To evaluate clinical outcomes of coronectomy procedure performed to forestall inferior alveolar nuerosensory deficit in CBCT analyzed mandibular impacted third molars.

Patients and Methods: Patients were assessed with CBCT for impacted third molars in proximity to mandibular canal. Coronectomy was performed in 25 cases selected as per patient selection criteria. Evaluation of these patients was done in terms of possible outcomes like pain, swelling, infection and root migration and complication of neurosensory deficit at 1day, 1 week, 3 months and 6 months post operatively.

Results: Out of 25 patients only 1 patient had pain and swelling at the end of 6 months. Root migration was observed at the end of 3 months in 1 patient and at the end of 6 months in 5 cases. In 1 case, pain and swelling were still present at the end of 6 months which required root removal.

Conclusion: Coronectomy is a preferable and dependable treatment option for lower third molars in proximity of mandibular canal as in step with CBCT understanding as it is by all accounts related with less complications.

Keywords: Mandibular Third molar, mandibular canal, Cone Beam Computed Tomography, Coronectomy

Introduction

Extraction of impacted or erupted mandibular third molars (M3s) is one of the foremost frequently performed dentoalveolar surgical procedures. Oral surgeons always have to be vigilant in regards to post operative sequale such as pain, swelling, trismus and complications such as infection, hemorrhage, alveolar osteitis, paresthesia of lingual and inferior alveolar nerve [1]. Studies indicate that nerve dysfunction after mandibular third molar surgery is the third most common complication after alveolar osteitis and post operative infections which can lead to temporary or permanent anesthesia, paresthesia, and pain in the lower lip, gingival, skin over the chin, or a combination of the three [2,3].

The frequency of inferior alveolar nerve injury(IANI) after impacted third molar removal ranges from 0.41 to 8.1% (temporary) and 0.014 to 3.6% (permanent), and may increase to 20-50% when the roots make contact with the cortical bone of the inferior alveolar nerve (IAN) [4]. The relevant risk factors associated with neural injuries are the type of impaction, the proximity of the tooth to the inferior alveolar canal and the skills and experience of the operator. Anatomical factors correlated with nerve injury include the degree of intrabony impaction, root dilacerations and overly dense sclerotic bone [5].

The first step to prevention of neural injury is accurate diagnosis following the assessment. Panoramic radiographs are the state of art and mainstay of assessment of the inferior alveolar canal and third molar relationship. The major drawbacks of Orthopentomogram (OPG) are: lower image resolution, high distortion, and presence of phantom images. Therefore Cone Beam Computed Tomography (CBCT) has been accepted for its high sensitivity and as significantly superior to panoramic radiographs in predicting neurovascular bundle exposure. It is an excellent method for localizing the canal, and its relationship to the lower third molar roots as reformatted images can be generated through the mandibular body in any plane [6]. To decrease the incidence of IANI, various procedures have been proposed in high-risk cases, including staged surgical removal of IMTM, orthodontic-aided extrusion, and pericoronal ostectomy. However, these approaches might result in unpredictable complications, longer curative time, and greater damage.

Coronectomy is relatively a new procedure, gaining popularity as a means of reducing nuerosensory deficit in surgeries of impacted third molars.The method involves the removal of only the crown, in patients who are not medically compromised, leaving the roots of the impacted third molar undisturbed; thus avoiding direct or indirect damage to the IAN. However, it is not commonly practiced worldwide [7]. A number of authors have reported positive results, and a Cochrane Collaboration concluded, 'that in patients where third molar roots were close to the nerve canal, it was likely that coronectomy was associated with a reduction in nerve damage, with no increase in alveolar osteitis'.

Although coronectomy has demonstrated a reduction of IANI many clinicians are concerned about having a large section of root electively retained in the mandible, a significant common concern being that the retained root may develop a radicular cyst leading to further surgery and morbidity. As with most surgical techniques, successful coronectomy requires careful patient selection, careful operator technique, and attention to detail.

We hence undertook this prospective study to evaluate the outcome of the coronectomy in cases which is analysed by CBCT. We have focussed on success as well as failure of the treatment which Advocates guidelines that clinicians need to be aware of to avoid failure [8,9].

Material and Method

Ethical clearance was taken from the Institutional Ethical Committee in accordance with Helsinki declaration. All the diagnoses were confirmed by the maxillofacial surgeons with a clinical experience of at least 10 years in the third molar removal procedure.

A retrospective study of coronectomy procedure was conducted in 25 patients selected as per Homerton coronectomy criteria Preoperative OPG and CBCT were advised for each patient along with routine haematological investigations. Coronectomy procedure was carried out in our institute at Nadiad Gujarat between July 2019 to November 2020. Follow up was done postoperatively on day 7, 1 month, 3 months and 6 months. RadioVisioGraphy (RVG) was taken on day of procedure and on each follow up visit to determine changes in root position.

Procedure

First the patients were assessed with OPG for root proximity to IAN.OPG evaluation of impacted third molar for nerve proximity was followed by CBCT. If the patient was at significant increased risk for damage to the IAN according to CBCT (IAN classification by Liqun Gu., *et al*. 2017) [10], the option of coronectomy was discussed as an alternative to third-molar extraction provided all the rest of the criteria for coronectomy were also fulfilled. Following patients' consent, the surgical procedure was planned under LA. The standard protocol of impaction procedure and coronectomy technique given by PEDERSON was used for every case [11] [Figure 1]. IAN blocks including long buccal infiltration were accomplished with 2% lidocaine with 1:80,000 adrenaline. Classical Terrence Ward's incision was given. A full thickness mucoperiosteal flap was elevated with posterior buccal release. If necessary, a conservative buccal trough was made using a #6 round carbide bur on a surgical hand piece, allowing access to the cementoenamel junction of the tooth. Care was exercised to maintain as much crestal bone height as possible by minimizing the width of the buccal trough. After exposure was obtained, a 701 fissure bur was used and a horizontal/ transverse cut was made through the tooth at the level of the cementoenamel junction. Visualization was important to ensure adequate sectioning of the crown without perforation through the lingual bone plate. The crown was delicately fractured and separated from the residual roots of the tooth using a straight elevator. Effort was directed at minimizing any mobilization of the residual roots. On removal of the crown, any sharp fragments of retained tooth structure were smoothened down with a 2.3-mm diameter diamond round bur with simultaneous copious saline irrigation. The remaining enamel was typically reduced approximately 3 mm below the buccal crest of alveolar bone. After the coronectomy was completed, a dental curette was used for removal of any and all follicular soft tissue in the surgical bony defect. Any grossly visible exposed pulpal soft tissue was curetted. A bone file was used to smooth the bone edges along the socket defect and buccal bone trough. The incision was copiously irrigated with saline, Primary closure was desirable whenever possible, and may involve making a releasing incision distal to the second molar to facilitate closure. An immediate postoperative OPG was obtained for a baseline assessment of the retained root fragment.

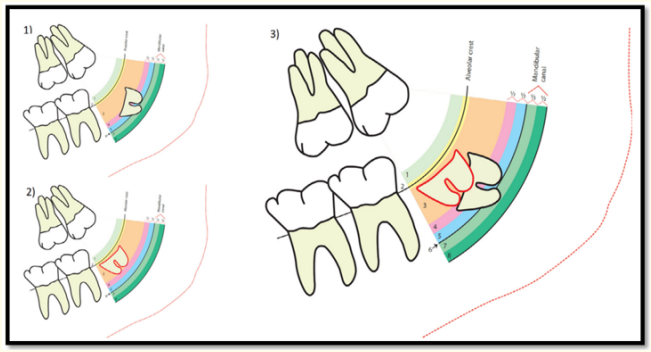

Figure 1: Measurement Of Root Migration.

Postoperatively, patients were placed on a 5 day course of antibiotic therapy. Analgesia was accomplished with hydrocodone/ acetaminophen and nonsteroidal anti-inflammatory drugs, as in patients who have had a third molar extracted. Patients were scheduled for a follow-up visit at approximately 7 days after surgery. Post operative OPG and RVG were taken after post operative 1 month, 3 months, 6 months [Figure 2(C,D,E)] During post operative followups , clinical outcomes such as root migration, pain, swelling, paresthesia were assessed. Root migration was measured from the points of interception of upper white line of inferior dental canal and long axis of root to the apex of root (technique by Pedersen., *et al*. 2019) [Figure 3].

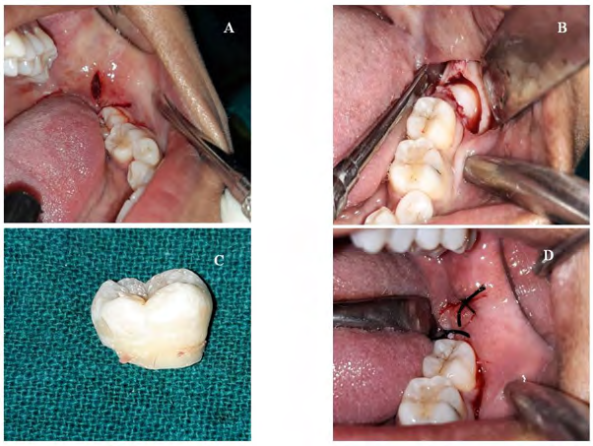

Figure 2: Surgery Procedure of Coronectomy.

A. Incision Given

B. Removal of Bone

C. Sectioning of Crown

D. Suturing done

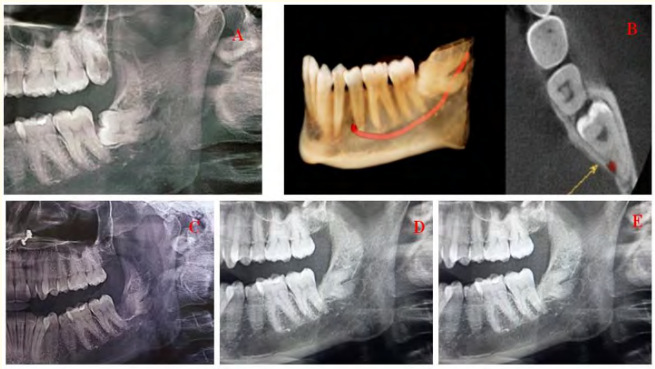

Figure 3: Radiographic Examinations.

A. Pre-Operative OPG

B. Pre-Operative CBCT

C. Immediate Postoperative OPG

D. Immediate Postoperative OPG After 3 months

E. Immediate Postoperative OPG After 6 months.

Results

The clinical study was designed to evaluate the efficacy of coronectomy in term of prevention of neurosensory deficit in the cases of CBCT analyzed mandibular third molar which is in close proximity to mandibular canal.

A sample size of 25 patients were included in this study The data was collected and statistical analysis was based upon the following criteria.

ge, eruption status, site of tooth, root form, type of IAN intervention, root migration. The data on Continuous variable is presented as Mean & Standard Deviation (SD) and Discrete variable is presented as Number and Percentage. Normality assumption was tested using the Shapiro-Wilk test. Continuous groups (age, site of teeth) were compared by Unpaired t-test and Categorical groups (eruption status, impaction pattern, root form, classification of IAN, outcome measures) were compared by Chi-square ($\chi 2$) test [Chart 1-4].

A total of 25 patients were included in the study in which there were 12 males and 13 females with a M:F ratio of 0.92:1. There was no statistically significant difference between mean age of Female and Male ($p > 0.05$). [Chart 1].

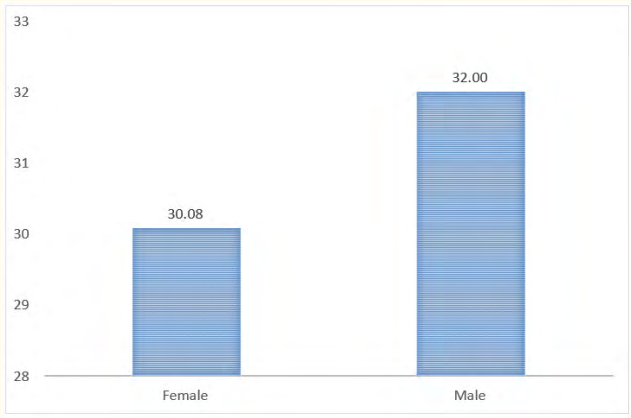

Chart 1: Bar chart showing Mean Age of Female and Male (Mean age of study group n = 25).

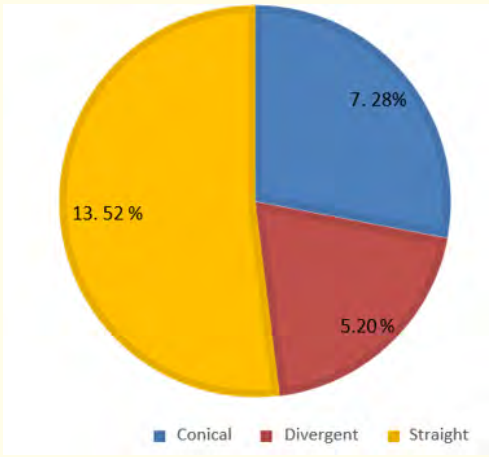

Chart 2: Pie chart showing the Root form in the patients.

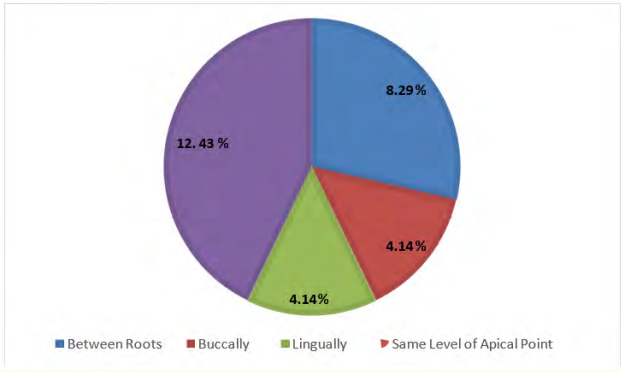

Chart 3: Pie chart showing the Ian Intervention Types in the patients.

For the site, 52% were mandibular left third molars and 48% were mandibular right third molars. Out of all the teeth, 56% were partially erupted and 44% were unerupted. 28% teeth were Distoangular, 12% were horizontal, 32% were mesioangular and 28% were vertical impactions respectively. The root forms were as follows: 28% conical, 20% were divergent and 52% were straight aligned. The inferior alveolar nerve relation with the roots of the following teeth were: 32% between the roots, in 16% cases it was buccally placed, in 4% cases lingually placed and in most of the case i.e. 48%, it was at the same level of the apical point. A thorough follow up for a period of 6 months was done for every patient and evaluated for the following criteria: pain, infection at the site, localized swelling, paresthesia and root migration. Out of all the patients, in 1 month follow up period, 11 patients had mild to moderate pain; no infection or swelling was present in any of the cases; none of the teeth showed root migration. At the 3month follow up, 6 patients presented with pain of mild degree, no patient had infection; however, in 1 patient swelling was noted locally and in 1 case evidence of root migration was also noticed. At 6-month follow up period, the number of patients with pain reduced to 1; none of them had any sort of infection; however, swelling was still present in 1 patient; migration of root was evident in 5 cases. Out of total number of cases (n = 25), in 1 patient a second surgery was required for the root stump removal in which swelling and pain were present [Table: 1].

Outcome measures	1 Month (n = 25)	3 Month (n = 25)	6 Month (n = 25)	p value
Pain	11	6	1	<0.01
Infection	0	0	0	NA
Swelling	0	1	1	>0.05
Migration of root	0	1	5	<0.05
Parasthesia	0	0	0	NA

Table 1: Distribution of outcome measures of patients over the time periods.

While evaluation, there was complete retention of sensation in all patients starting from immediate post operative period till the end of six months.

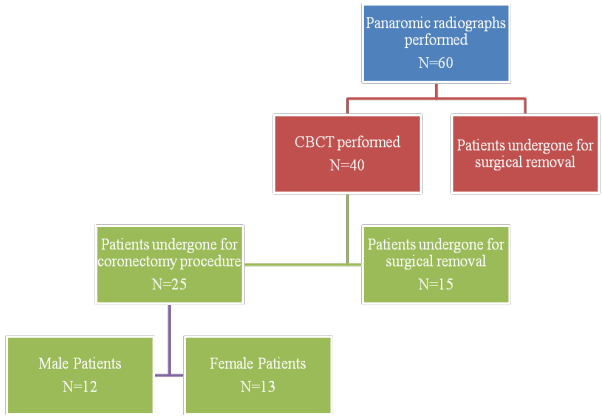

Table 2: Study Design.

Discussion

IANI not only affects the function of stomatognathic system, but also the quality of life of patients. Avoidance of neurosensory deficit following surgical management of M3s has always been of significant concern to the oral surgeons. Constant attempts are carried out to improvise on both the diagnosis as well as surgical techniques of the vulnerable third molars to minimize the incidence of neuropathy owing to iatrogenic injury to mandibular canal.

Mandibular canal, housing the inferior alveolar neurovascular bundle within the mandible, is subject to variation in its anatomic configuration, both in terms of topography as well as course, which the clinicians should be familiar with in any surgical procedures involving the posterior mandible for identification of this important landmark [12].

Other factors like age, sex, edentulism, and ethnicity which may have impact on the relative position of MC should also be considered in devising the treatment plan and procedures to minimise the chances of injury to its contents. Besides accurate assessment of this structure, surgical technique employed and surgical experience and expertise of the treating surgeon also influence the outcome of the surgical procedure of imtms, especially in terms of iatrogenic trauma to the canal.

Panaromic radiodiographs are the gold standard for assessment of impacted third molars in relation to mandibular canal. Rood's signs such as interruption of the white line of the mandibular canal

wall, darkening around the root(s), diversion of the mandibular canal, narrowing of the mandibular canal, narrowing of the root(s), and deflection of the root(s) are followed in these images to detect nerve tooth relationship in cases of close association of the two [13].

However a recent review suggests that absence of these signs don't ensure that direct contact doesn't exist between the two sturctures. Besides, in 17-54% of cases, the nerve is positioned buccal to the tooth, putting it at risk of direct trauma by surgical instruments in cases where the surgeon might remove bone or place elevator pressure in the surrounding area. Inability to evaluate the buccolingual relationship of the IAN and the third molar on a two dimensional radiograph is its major limitation.

Therefore, in our study we decided to further evaluate the canal-molar relationship with the help of CBCT in OPG diagnosed high risk cases. CBCT, the recent introduction as a diagnostic tool for assessment, is showing promising results in terms of accuracy and visibility. Several studies claim superiority of CBCT over panoramic images for display of tooth canal relation. Irrespective of type of tooth impaction and different locations of mandibular canal (MC), the visibility of the tooth – MC relation is excellent on most of the cross sectional CBCT images at impacted third molar (IMTM) sites [14].

Though it doesn't have an upper hand in reduction of nerve injury per se, it is a vital tool for prediction of the course of canal and its proximity to the third molars, thereby contributing in making a choice for accurate surgical modality of the same. Cbct 2 In one such study 12% of cases were shifted from surgical removal to coronectomy procedure post CBCT examination. As per studies CBCTs showing one of the following criteria are considered as high risk cases.

- Direct contact in combination with narrowing of the canal lumen
- Canal positioned in a bending or a groove in the root complex
- Absence of bony separation between the roots and the canal

Hence in present study we decided to undertake CBCTs for further analysis in patients with OPGs showing nerve tooth relation with a positive Rood's sign. In our study we regarded the following CBCT signs as criteria of selection for Coronectomy procedure.

- Imtms is less than or equal to 0.5 mm away from MC. (moderate risk)
- Mandibular third molar is either at contacts the mandibular canal with complete white line, defective white line or penetrates the canal (high risk) [10]

In 25 such cases which also fulfilled the homertons criteria [15] coronectomy was performed.

The concept of coronectomy evolved from the fact that broken fragments of the root of vital teeth left in place, most common heal uneventfully. Coronectomy has been defined as a method of removing the crown of a tooth but leaving the roots untouched, which may be intimately related with the IAN, so that the possibility of nerve injury is reduced [16].

Appropriate application of the coronectomy technique decreases the risk of damage to the inferior alveolar nerve. While recent studies have shown positive results after coronectomy, the technique is still not widely accepted, probably because of the lack of data on long-term outcomes or the possible requirement of a second procedure to remove the root remnant(s) [17].

In present study, we conducted immediate post operative panoramic radiographs to assess the complete removal of enamel portion of the crown and the patients with retained enamel portion eventually returned to operating room for additional planning of the anterior projecting enamel segment. Besides, we preferred panoramic images for our study to analyse root migration and healing post operatively. In multiple-rooted IMTMs, the central point of the root that extended into the IAN was chosen as reference point to decrease the error in findings.

In our study migration rate, 24%, and mean root migration distance, 1.85 mm (standard deviation, 1.34 mm), was shorter than that reported in the existing literature. The direction of migration was always away from the inferior alveolar nerve.

In the present study, retained roots after coronectomy for the mandibular third molars did not result in any complications with regard to infection, pain, and the development of a pathology within the first 6 months after surgery. Although root eruption may occur,

this phenomenon necessitated a second surgical procedure in only 4.5% patients in the present study. Synchronous with other studies no significant complications were noted after the procedure which is mainly attributed to little wound, less alveolar bone exposure and tight closure.

Not even a single case amongst 25 cases showed altered sensation of inferior alveolar nerve which shows the success of this study in terms of nerve preservation. The purpose of this study was to assess the outcomes of coronectomy and to minimize chances of IAN injury. The investigators hypothesize that coronectomy may significantly decrease the incidence of IANI with little complications after surgery of MTMs. However, the usefulness and long-term outcomes of coronectomy remain unknown. In the present study, none of the patients underwent IANI following coronectomy. This showed that coronectomy was effective in preventing the nerve injury in lower IMTMs as compared to traditional extraction.

Conclusion

As opposed to complete removal of the impacted third molar, which may cause irritation of the inferior alveolar nerve, no paresthesia or anesthesia developed after coronectomy in our study, even in the elderly. However, although no predictors were identified, second surgery may be rarely required in case of persistent postoperative complications. Our results suggest that coronectomy is a reliable surgical alternative with a low risk of complications in patients requiring impacted mandibular third molar removal who exhibit a high risk of inferior alveolar nerve injury on preoperative CBCT.

Financial Support and Sponsorship

None.

Conflict of Interest

There are no conflict of interest.

Bibliography

1. Sarikov R and Juodzbalys G. "Inferior alveolar nerve injury after mandibular third molar extraction: a literature review". *Journal of Oral and Maxillofacial Research* 5.4 (2014): e1.

2. Kouwenberg AJ., *et al*. "Coronectomy of the mandibular third molar: Respect for the inferior alveolar nerve". *Journal of Craniomaxillofacial Surgery* 44.5 (2016): 616-21.

3. Kang F., *et al*. "Coronectomy: A Useful Approach in Minimizing Nerve Injury Compared With Traditional Extraction of Deeply Impacted Mandibular Third Molars". *Journal of Oral and Maxillofacial Surgery* 77.11 (2019): 2221.e1-2221.e14.

4. Petia F Pechalova and Nikolai V Pavlov. "Coronectomy of Impacted Mandibular Third Molars - Method for Prevention of Inferior Alveolar Nerve Injury". *SMGroup Journals* 53.9 (2015): 1278-1276.

5. Valenzuela-Fuezalida JJ., *et al*. "Anatomical Variation of mandibular canal and their clinical implication in dental practice". *Surgical and Radiologic Anatomy* 43.8 (2021): 1259-1272.

6. Patel PS., *et al*. "Comparison of panoramic radiograph and cone beam computed tomography findings for impacted mandibular third molar root and inferior alveolar nerve canal relation". *Indian Journal of Dental Research* 31 (2020): 91-102.

7. Ecuyer J and Debien J. "Deductions operatoires". *Actualités Odonto-Stomatologiques* 38.148 (1984): 695-702.

8. Khawaja N and Renton T. "Case studies on implant removal influencing the resolution of inferior alveolar nerve injury". *British Dental Journal* 206.7 (2009): 365-370.

9. Williams M and Tollervey D. "Lower third molar surgery - consent and coronectomy". *British Dental Journal* 220.6 (2016): 287-288.

10. Gu L., *et al*. "Anatomic study of the position of the mandibular canal and corresponding mandibular third molar on cone-beam computed tomography images". *Surgical and Radiologic Anatomy* 40.6 (2018): 609-614.

11. Pedersen MH., *et al*. "Coronectomy of mandibular third molars: a clinical and radiological study of 231 cases with a mean follow-up period of 5.7years". *International Journal of Oral and Maxillofacial Surgery* 47.12 (2018): 1596-1603.

12. Dolanmaz D., *et al*. "A preferable technique for protecting the inferior alveolar nerve: coronectomy". *Journal of Oral and Maxillofacial Surgery* 67.6 (2009): 1234-1238.

13. Rood JP and Shehab BA. "The radiological prediction of inferior alveolar nerve injury during third molar surgery". *British Journal of Oral and Maxillofacial Surgery* 28.1 (1990): 20-25.

14. Alkhader M., *et al*. "The visibility of mandibular canal on orthoradial and oblique CBCT slices at molar implant sites". *Biotechnology and Biotechnological Equipment* (2016).

15. Ghaeminia H., *et al*. "Clinical relevance of cone beam computed tomography in mandibular third molar removal: A multicentre, randomised, controlled trial". *Journal of Craniomaxillofacial Surgery* 43.10 (2015): 2158-2167.

16. Pogrel MA., *et al*. "Coronectomy: a technique to protect the inferior alveolar nerve". *Journal of Oral and Maxillofacial Surgery* 62.12 (2004): 1447-1452.

17. Renton T., *et al*. "A randomised controlled clinical trial to compare the incidence of injury to the inferior alveolar nerve as a result of coronectomy and removal of mandibular third molars". *British Journal of Oral and Maxillofacial Surgery* 43.1 (2005): 7-12.