EDITORIAL OPEN ACCESS

Inferior alveolar nerve injuries and impacted lower third molars: The importance of third dimension

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One of the most frequent oral surgical intervention is the removal of impacted wisdom-teeth. Inferior alveolar nerve (IAN) injury is a possible and unpleasing complication of surgical removal of impacted lower third molars. The incidence of irreversible injuries according to literature is usually below 1%, but reversible injuries are reported between 0.4–8.4% [1].

Anesthesia or paresthesia of the lower lip (consequent mental nerve sensory function disturbance) can significantly change patients' quality of life. Missing or reduced sensory innervation of the lower lip causes difficulties during eating and drinking, and uncontrolled bite trauma of the soft tissues is more frequent.

To predict "high-risk" cases more accurately or to try to avoid nerve injuries, several diagnostic and surgical efforts are introduced and usually performed, such as coronectomy (only the crown of the third molar tooth is removed), orthodontically assisted extraction (the third molar tooth is extracted slowly with the help of orthodontic forces using different appliances, e.g., springs, wires after some retention is attached on tooth's surface), spontaneous migration (only small portions of the impacted part of the third molar's crown are removed with burs and the tooth can begin to migrate away from the dental canal, so later it could be extracted), pericoronal ostectomy (the surrounding bone is removed, which caused impaction) and the so called inward fragmentation method (with the visual aid of an endoscope the tooth is sectioned to many tiny parts without damaging the alveolar bone or hopefully the nerve) [2–8]. The usage of piezoelectric bone preparing devices also give the possibility to reduce nerve injuries (soft tissues, such as the neurovascular bundle can "vibrate together" with piezoelectric-tips avoiding irreversible injury) when bone removal is necessary near to the IAN at the apical region of third molars.

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Diagnostic efforts include the analysis of two dimensional (panoramic radiography, periapical-, occlusal radiographs, vertical tube shifting technique) and three dimensional imaging methods such as computed tomography (CT) scan, cone beam CT (CBCT) scan or magnetic resonance imaging (MRI) scan. The benefits and limitations of specific and non-specific "high-risk" signs indicating intimate connections between third molar and the IAN are well investigated according to panoramic radiography, however the third dimension can carry several times important additional information, including the exact buccolingual localization of the IAN, or the exact root anatomy of the tooth [9–15]. One of the biggest challenge during third molar's presurgical workup is to keep patients' radiation as low as possible (ALARA) but to get least as many information which is mandatory to avoid intraoperative nerve injury complications or to make the best decision in the "to remove or not to remove" question or considering alternative removal possibilities (mentioned above). The routine usage of three dimensional diagnostics is not acceptable in this field of oral surgery yet.

In the following cases the possibility of IAN damage could be more or less predicted according to panoramic radiography, but the patient's strict rejection, even though excessive information about possible neurological complications were detailed, of further three dimensional diagnostic methods led to "nerve endangered" situations.

In the first representative case (Figure 1), the specific high risk panoramic sign, darkening of the third molar's root, can be observed before tooth removal. This sign was highly associated with IAN exposure (when the neurovascular bundle is visible and palpable) and IAN injury according to several studies [9–14]. After tooth removal during inspection of the alveolus, the IAN was visible on the buccal side of the socket, while macroscopic injury and concurrent paresthesia was absent. These neurovascular bundle exposures can be followed by postoperative paresthesia up to 20% of exposures, without visible signs of injury or in absence of excessive bleeding

[16]. The buccal localization of the IAN means usually higher chance for nerve injury, because bone removal is performed in most of the cases buccally, increasing the possibility of direct trauma to the nerve by the drills.

Similarly to the first case, in the second case darkening was seen on the third molar's root (Figure 2). The clearly visible separation of the mesial and distal roots in the middle third of the tooth and the slightly rotated position of the tooth suggested the possibility of "roots surrounding the IAN" situation. After sectioning of the crown and separating carefully the two roots, roots could be carefully removed from beside of the nerve. However, the nerve's continuity was preserved (Figure 2). A paresthesia of the nerve was observed in the first six postoperative weeks. Vitamin B complex was prescribed for the patient during this period and neurosensory disturbances healed totally.

The third case was similar to the second case, but the chance of "surrounded nerve" was rejected by the trainee oral surgeon during surgery, because there was no visible separation of the roots after buccal bone removal (Figure 3). After the removal of the tooth the small lingual root, which formed a tunnel for the IAN, was observed by the colleague, the possibility of nerve disruption (excessive bleeding made visualization and photo-documentation impossible) was expected. In case of total postoperative anesthesia the repair (e.g., suturing, grafting) of the transected IAN nerve stumps is usually recommended after 3–4 months postoperatively.

Lastly a case is presented (Figure 4), where the 3D CBCT image clearly identify the buccal localization of the IAN (determining the maximum depth of buccal bone removal above the dental canal), showing the exact root anatomy of the third molar and the roots' relation to the nerve. According to the panoramic radiography a coronectomy was suggested, while after the CBCT a tooth

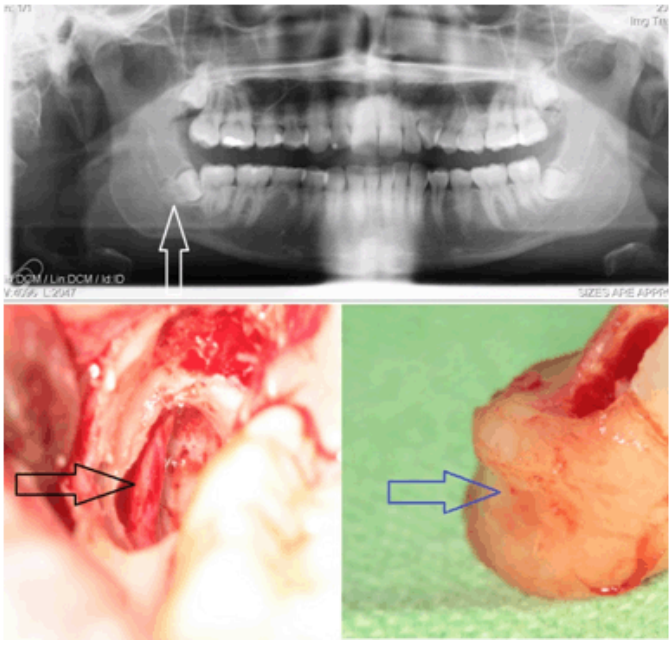

Figure 1: The panoramic radiograph showing "dark band" specific risk sign on the right impacted third molar's roots (white arrow). After tooth removal, the inferior alveolar nerve (more exactly the neurovascular bundle) became visible (black arrow). The groove formation of the removed tooth's roots (blue arrow) explains the radiographic "dark band" formation; inferior alveolar canal caused groove lets more radiation through the molar tooth.

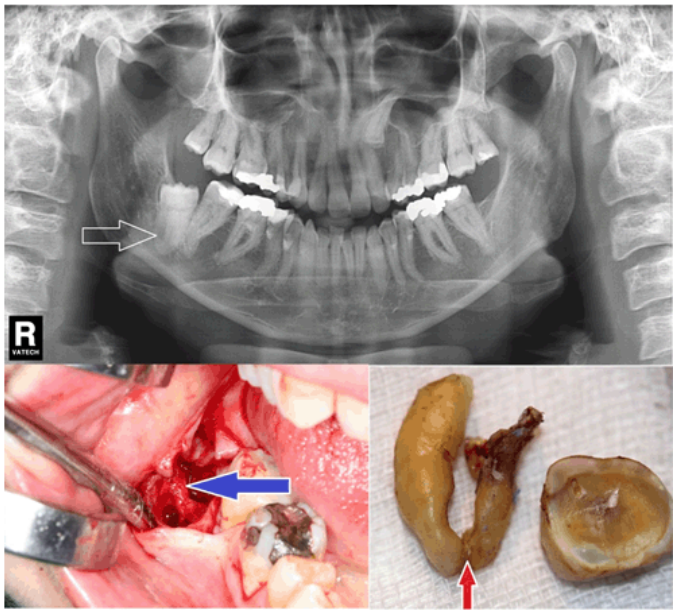

Figure 2: The "dark band" formation on the root (white arrow) was combined with slight rotation of the tooth, while separation of the mesial and distal roots of the third molar tooth was possible. Sectioned removal (firstly the crown, after the roots separately) gave the chance for the neurovascular bundle to keep its integrity (blue arrow). In the photograph the roots of removed tooth were glued together for representing the original situation (red arrow).

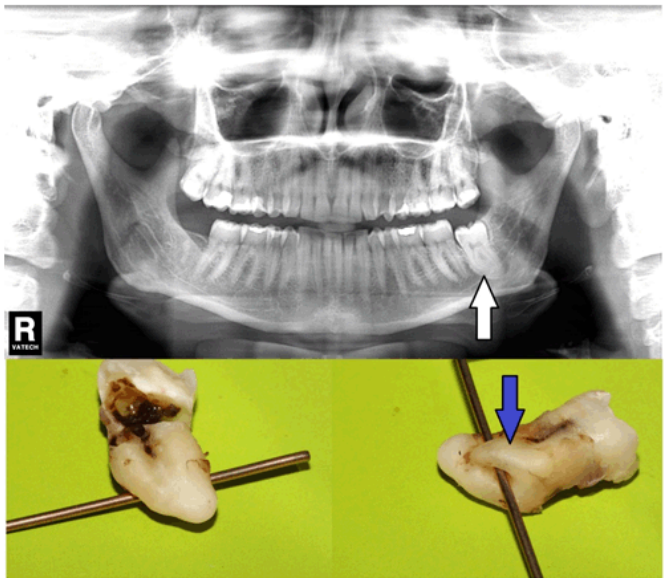

Figure 3: Dark band is seen on the roots in the panoramic radiograph (white arrow). After tooth removal, the metal wire represents the suspected course of the inferior alveolar neurovascular bundle. The lingual root and its nerve-surrounding conformation (blue arrow) could be detected on cone-beam computed tomography scan image, with the possible modification of the removal to coronectomy.

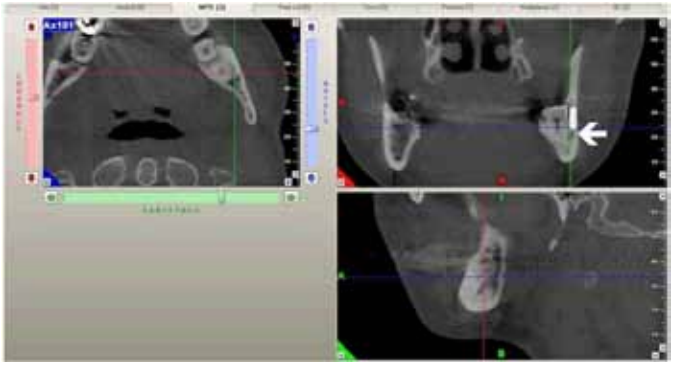

Figure 4: The cone beam computed tomography scan showing clearly the buccal position of the inferior alveolar canal (white arrow), the root anatomy in the coronal plane and their exact conformation. The extent and depth of buccal bone removal can be planned accurately (white bar).

removal was performed, without any postoperative IAN neurologic disturbance.

In fact, neurological complications of third molar surgical removal cannot be reduced to zero level. Despite of any comprehensive diagnostic analysis, including three-dimensional CBCT scan, nerve injury occasionally will occur. The informed consent and the exact determination of the indications for surgical tooth removal is substantial.

Keywords: Inferior alveolar nerve, Nerve injury, Paresthesia, Panoramic radiography, Third molar

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Conflict of Interest

Authors declare no conflict of interest.

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