

# Inferior Alveolar Nerve Injury Caused by Coronectomy or Conventional Method in Third Molar Extractions

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## Abstract

**Background:** To compare the frequency of injury to the inferior alveolar nerve as a result of coronectomy and removal of mandibular third molars having nerve approximation.

**Methods:** In this comparative study 110 patients with inferior alveolar nerve approximation were selected and randomly allocated into Group-A and Group-B. Group-A patients underwent coronectomy and Group-B patients underwent traditional removal. Inferior alveolar nerve damage was assessed one week post operatively, then further assessed after 01, 03 and 06 months.

**Results:** Out of total 110 patients included in the study, 9 (8.2%) patients were having nerve damage. In traditional removal group, 9 (16.4%) patients were found to have nerve damage. Seven patients with nerve injury recovered within 06 months whereas 2 patients had permanent nerve damage. In coronectomy group none of the patients had nerve damage.

**Conclusion:** Coronectomy is an effective procedure in significantly reducing the incidence of inferior alveolar nerve injury when compared with traditional removal of wisdom teeth.

**Key words:** Coronectomy, Inferior alveolar nerve, Molar extraction

## Introduction

Mandibular third molars are the most frequently impacted teeth. Complete surgical removal is the traditional method of treatment of the most impacted mandibular third molars. One of the serious complication associated with traditional removal of these teeth is injury to the inferior alveolar nerve resulting in dysaesthesia. Risk factor associated with inferior alveolar nerve injury is approximation of the inferior alveolar nerve (IAN), to the apex of the root which can be predicted by certain radiographic features. Current trend is that whenever nerve approximation exists, option of coronectomy is

considered which reduces IAN injury. Injury to inferior alveolar nerve (IAN) is a well recognized serious complication of mandibular third molar extraction.<sup>1</sup> Incidence of temporary injury to inferior alveolar nerve (IAN) after third molar extraction range from 0.41% to 8% and permanent injury upto 3.6% of cases.<sup>2</sup> Risk factors for IAN injury include advanced age, gender of the patient, amount of bone cutting required in operation according to the difficulty index and an important risk factor is the proximity of the third molar to the nerve canal.<sup>1</sup>

The intimate relationship of inferior alveolar nerve to the apex of the root can be predicted by radiographs such as peri-apical and panoramic tomographic views. This offers the opportunity to alter the extraction technique to minimize risk to the nerve. It is common practice for the broken root fragments of vital teeth to be left in place and most heal uneventfully. This has led to evolution of concept of coronectomy which is deliberate retention of the roots adjacent to the nerve.<sup>3</sup> Coronectomy was proposed as a clinical procedure more than 30 years ago.<sup>3</sup>

Studies have provided evidence that coronectomy decreases the risk of IAN damage when compared to the traditional extraction. Coronectomy prevents nerve damage as it avoids the nerve canal by ensuring retention of the roots which are close to the canal.<sup>4</sup> Renton et al.<sup>2</sup> reported 0% IAN injury in coronectomy patients and 19% IAN injury in those having traditional extractions. The incidence of inferior alveolar nerve injury according to different authors varies from 0.81% to 22% of cases.<sup>5,6,7,8,9</sup> Coronectomy is an alternative procedure to complete extraction when a tooth is deemed 'high risk' but vital and in a patient who is not medically compromised (diabetic, long term steroids, chemotherapy, HIV); or potential poor healing [previous irradiation].<sup>10</sup> Inferior alveolar nerve injury can cause paresthesia to complete numbness or pain in the zone of the mental area, the lower lip, mucous membranes, and the gingiva as far posteriorly as the second premolar.<sup>11</sup> Furthermore this commonly

interferes with speech, kissing, eating, make-up application, drinking and shaving.<sup>12</sup>

## Patients and Methods

The study was carried out in the Department of Oral and Maxillofacial Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad. Approval from the hospital ethical committee was sought before the start of the study. Patients were selected from the out patient department of Oral & Maxillofacial Surgery, PIMS, Islamabad. Routine baselines were carried out for fitness purpose. Informed consent of the patients were taken on consent form after explaining the procedure. Patients who were judged to be at high risk of injury to the inferior alveolar nerve i.e. proximity of mandibular third molar to nerve canal, based on radiographic features in routine pre-operative dental radiograph including peri-apical and panoramic views were included in the study. These features included darkening of the roots, deflection of roots, narrowing of the roots, bifid root apex, narrowing of the canal, diversion of canal, interruption of lamina dura.

Patients who were predisposed to local infection in diabetes, immuno-compromised patients including HIV and chemotherapy, previous radiotherapy to the head and neck, osteosclerosis or osteopetrosis, patients having carious and non-vital third molars, patients having previous or existing defects of the inferior alveolar nerve and neuromuscular disorders were excluded from the study. Random allocation of patients into group A and group B was done by table of Random Numbers generated by Microsoft Excel. OPG and periapical X-rays were also advised. Group-A patients underwent coronectomy and Group-B patients underwent traditional removal. All patients were advised pre-operative Chlorhexidine mouthwash rinse. Patients were draped under aseptic condition. LA was given on the involved side. Full thickness mucoperiosteal flap was raised. Flap elevation and reflection was done. Buccal bone osteotomy was done till full crown exposure, then both procedures were performed. Full tooth extraction was done in traditional manner. Coronectomy was performed by doing transection of the tooth with fissure bur using controlled force. The crown was totally transected so that it could be removed with tissue forceps alone and did not need to be fractured off the roots. This minimizes the possibility of mobilizing the roots. The pulp was left in place after crown has been levered off (Figures 1 -3).

The socket was then irrigated with saline and mucoperiosteal flap was replaced with vicryl suture.

Inferior alveolar nerve function was assessed after 01 week by the presence of subjective sensory changes and objective neurosensory testing by light touch test, pain threshold test and two-point discrimination test. Inferior alveolar nerve damage was diagnosed if both subjective and objective measurements were different from non-affected side or preoperative baselines. These patients were further followed up after 01, 03 and 06 months to determine the duration of nerve injury whether temporary or permanent.



Fig 1: Pre-operative radiograph of patient showing mandibular right sided third molar with IAN approximation



Fig 2: Coronectomy done



Fig 3: Post-operative OPG showing retained roots of Rt mandibular third molar

## Results

Total of 110 (n=55 in each group) subjects of mandibular third molar with IAN approximation were included in this study. Mean Age (yrs.) of the study subjects was  $28.66 \pm 6.154$  with ranges from 17 to 50 years (Table 1). Males constituted 55.5 % (n = 61) of the study subjects, whereas female subjects were 44.5% (n=49). (Table. 2). Nerve damage was observed postoperatively at 01 week, then further assessed after 01, 03 and 06 months. Out of total 110 study subjects, 9 (8.2%) patients were having nerve damage and all were from traditional removal group. Seven subjects with nerve injury recovered within 06 months whereas 2 subjects had permanent nerve damage. In

coronectomy group none of the subjects had nerve damage. In traditional removal group 06(9.8%) males and 03(6.1%) females had IAN damage. In coronectomy group no nerve damage was present both in males and females, however coronectomies in 2 female subjects failed as the roots were mobilized and were removed as a whole, but no nerve damage was present (Table 2 & 3). P value calculated using Chi-square test was 0.002.

**Table 1: Age characteristics of patients**

Age	N	Min	Max	Mean	Std. Deviation
	110	17	50	28.66	+ 6.154

**Table 2: Frequency of nerve damage**

Groups		Nerve damage			P value
		Temporary Nerve Damage	No Nerve Damage	Permanent Nerve Damage	
Coronectomy		0	55	0	0.002
	Traditional Removal	7(6.4 %)	46	2(1.8%)	
Total		7	101	2	

**Table 3: Gender distribution**

Groups		Gender		Total
		Male	Female	
Coronectomy		27	28	55
	Traditional removal	34	21	55
Total		61	49	110

## Discussion

Coronectomy was proposed as a clinical procedure more than 30 years ago but has not been commonly performed, largely owing to the lack of well-designed evidence-based trials to support its use. The first published description of this technique was by Ecuyer and Debien in 1984. Their technique was further elaborated in a letter in 1995.<sup>13</sup> No clinical trial demonstrating effectiveness of coronectomy in reducing IAN injury versus traditional removal in mandibular third molars (MTM) having IAN approximation has been reported from this part of the world, despite very encouraging results from studies conducted in different parts of the world.

The predominant age in the present study was second and third decade of life. No significant co-relation between patient's age and IAN injury is seen in this study. However removal of impacted teeth in adult patients was found to be more difficult. The influence of the patient's age on the incidence of injury to the

inferior alveolar nerve is discussed controversially. Several investigators demonstrated a correlation between these factors,<sup>14</sup> whereas others did not.<sup>15</sup> According to Bruce et al.<sup>16</sup> older patients had higher rates of IAN injury.<sup>14</sup>

IAN damage was more common in males 06(9.8%) than females 03(6.1%) according to the current study. Some papers dealing with nerve injuries following variant surgical procedures, including third molar surgery, observed a distinct female over representation.<sup>17</sup> Several other studies showed that sensory deficit was evenly distributed among male and female patients.<sup>14</sup> The reason for increase IAN damage in males in the current study is due to increased male population in the study and more dense bone in males as compared to females.

Nerve damage was the primary outcome variable which was observed postoperatively at 01 week. The results of this study are in line with those reported in the randomized controlled clinical trial of Renton et al.<sup>2</sup> who compared the incidence of injury to the inferior alveolar nerve as a result of coronectomy and removal of mandibular third molars. In the study by Renton et al, out of total 128 patients, 102 teeth were extracted, while coronectomy was performed for 94 teeth.<sup>2</sup> Among all cases, no nerve damage was found in the coronectomy group. However, nerve damage was observed in 19(19%) subjects in the extraction group. Leung et al.<sup>18</sup> showed 09(5%) patients in the control group presented with IAN injury, compared with 01 (0.06%) in the coronectomy group. Hantano et al.<sup>19</sup> reported that in the extraction group 6 patients (5%) suffered IDNI, of which 3 patients were diagnosed with permanent injury, whereas in the coronectomy group 01 patient (1%) complained of altered sensation post-operatively which resolved within one month. In retrospective analysis of O'Riordan<sup>13</sup> 03 cases had transient IAN injury, 01 patient developed permanent IAN injury, which was thought to be as a result of perforation of the canal due to operator error rather than the coronectomy technique itself. Though the volume of evidence remains small it shows clear drift that coronectomy can reduce IAN injury in high risk MTMs.

In this study, we observed a low rate of coronectomy failure (3.6%) and found no IAN damage associated with failed coronectomies. Both the patients with failed coronectomies were females and had conical roots. Our findings of risk factors associated with failed coronectomies (female patients with conical roots), co-relate with that of Renton's findings. Renton et al.<sup>2</sup> reported a 38% failure rate of coronectomy, in

which subsequent root removal was needed. The author was of view that women below the age of 30 years with conically shaped roots of the third molars were more likely to sustain mobilization of the roots during coronectomy. Another reason for high failure rate in Renton et al.<sup>2</sup> study maybe due to the reason that the roots were only sectioned halfway before an attempt was made to remove the crown. <sup>2</sup> This appeared to mobilize the roots in many cases and did result in an 8% incidence of temporary IAN involvement with no permanent injuries in the failed coronectomy group. In Pogrel's second report,<sup>20</sup> 18/450 were failed coronectomies, whereby the roots were mobilized during the procedure when the crown was elevated. These roots were removed at the same time, and paraesthesia developed in 02 patients, which was resolved.

However in our opinion, low failure rate of coronectomies in our study may be due to full sectioning of crown with fissure bur, using controlled force. Sectioning through the crown was partial by Renton<sup>2</sup>, Leung & Cheung<sup>21</sup> and O'Riordan.<sup>22</sup> <sup>2,21,22</sup> Complete section of the crown from the roots was undertaken by Pogrel and Dolanmaz<sup>23</sup>. This may explain why there were relatively few root mobilizations in the fully sectioned groups.

The follow-up duration of our study for coronectomy patients was not as long as in other studies. However, this would not affect the assessment of the primary outcome of the study, which was to compare the postoperative IAN deficit of coronectomy and total removal of wisdom teeth. Coronal migration of the roots has been reported as the most commonly reported long-term consequence of coronectomy.<sup>2,24,25</sup>

## Conclusion

1. Coronectomy is an effective procedure insignificantly reducing the incidence of IAN injury when compared with traditional removal of wisdom teeth and is the best treatment alternative for third molars with roots in close proximity to the IAN.
2. The risk of the injury to IAN during MTM surgery can be significantly reduced through appropriate patient assessment, planning of the surgery, proper patient counseling and considering the alternative techniques like coronectomy when indicated.
3. Longer follow-up of the patients undergoing coronectomy is required for the assessment of other factors like root migration away from IAN

and need for reoperation for removal of retained roots.

4. Assessment of high risk third molars using cone beam computed tomography (CBCT) is also a feasible option, due to ease of availability of CBCT. CBCT reaffirms the relationship that would support the planned coronectomy and help in decreasing inferior alveolar nerve injury

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- Authorship:** <sup>1</sup>Conception , synthesis and planning of the Research; <sup>3,4</sup>Active participation in methodology, interpretation and discussion

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