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Review Article

FRACTURES FOLLOWING MANDIBULAR THIRD MOLAR REMOVAL - A CRITICAL REVIEW

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Abstract

Mandibular third molar surgery is the most common surgery performed in dental office. Mandibular third molar removal pertains to number of complications that may be encountered intraoperative or postoperatively. Fractures of mandible at angle region are the most common complications following mandibular third molar surgery. Various surgeons have different views regarding such complication. The purpose of this article is to discuss the various causes and pattern of fracture occurring along with ratio of such incidence.

Keywords: third molar, fractures, complications.

Introduction

Although the mandible is a membrane bone during its embryonic stage, its physical structure resembles a bent long bone with 2 articular cartilages and 2 nutrient arteries. This arch of cortcocancellous bone projects downward and forward from the base of the skull and constitutes the strongest and most rigid component of the facial skeleton. However, it is more commonly fractured than the other bones of the face, fact directly related to its prominent and exposed situation [1].

The outer cortical plates are composed of inorganic salts which provide strength to resist compression and of a fibrous structure of collagenous connective tissue which provides tensile stability to counter disrupting forces. The inner cancellous bone is formed in a pattern of trabeculae which are arranged at right angles to one another and aligned to support the cortical bone in areas of stress [2].

The cross sectional anatomy of the mandible shows that the superior border is thicker or larger and the inferior border is thinner or smaller. The purpose of thick alveolar component of mandible is merely to accommodate teeth in dentulous state. It is basilar bone that remains thickest and most stress bearing component of the mandible [3].

The mandibular fracture patterns are multi-factorial [4]. The contributing factors

include direction and amount of force, presence of soft tissue bulk and biomechanical characteristics of the mandible such as bone density and mass or anatomic structures creating weak areas.

The teeth are the most important factor in determining where fracture occurs. Partially erupted wisdom teeth represent lines of relative weakness and unerupted teeth are important in the same way.

Internationally, two strong theories have emerged regarding relation between mandibular third molar and angle fracture. One is based on biomechanical studies which states that mandibular resistance is maintained by the integrity of the cortical bone and not the medullary bone highlighting the importance of external oblique line [5]. The other theory which is at odds with this, reports that the deeper the localization of the mandible third molar, the more bone space occupied therefore making the mandible much weaker [6]. Clinically, the first theory would be related to the presence of partially erupted impacted mandible third molars in which the superficial crown portion of the mandible third molar would create a line of weakness whereas the second theory would focus on deeply impacted impacted mandible third molars.

The mandible is the most commonly fractured facial bone a fact directly related to its prominent and exposed location [1]. Fractured through the angle are frequent because the angle of mandible forms an area of lowered resistance its thicker superior border , thin basilar bone and presence of impacted mandible third molar [7].

Mandible fractures are frequently located in the angle region. The increased frequency of mandible angle fractures relative to other locations has been hypothesized to be attributable to the presence of mandible third molars [8].

The angle of mandible is unique anatomical region as it acts as transition zone between the dentate and edentate region [9]. This anatomical region is associated with the presence of the mandibular third molar (M3) which may be either erupted or unerupted with different types and depth of impaction [10]. Fractures of the angle of mandible contributes to 40% of all fractures involving the mandible and often seen in the younger age group [11]. Prophylactic pre-emptive removal of M3 to prevent angle of mandible fractures especially in athletes and individual at high risk to have facial trauma has until today been an ongoing controversy among clinicians [12].

Incidence

Various authors have suggested that angle of the mandible forms an area of lowered resistance to fracture. Oikarinen et al showed that the region of angle was involved in more than 17% of all Maxillofacial fractures in series of 1248 cases reviewed [13]. According to Halazonetis, angle fractures are twice as likely to occur in dentate patients compared with edentulous persons [14]. This study was confirmed by Amaratunga [15]. Ueno et al and Ellis et al reported peak incidence of angle fractures in the 20 to 29 years group [16, 17]. Halazonetis showed that between the ages of 12 to 29 years, 69% of single mandibular fractures occurred at the angle. [14]. Wolujewicz addressed the issue of buried teeth within the angle region as a predisposing factor to its weakness and concluded that there was no relationship between the state of eruption of the respective lower third molar and the incidence of angle fractures [18].

Reitzik et al did study on dry isolated vervet monkey mandibles and compared the forces necessary to fracture the angle region when the third molar tooth was erupted with those needed when it was unerupted [6]. According to them fractures occurred at

significantly lower loads when the third molar tooth was buried within bone.

Nahum studied the forces necessary to fracture the mandible and other facial bones in the cadaver and described that fractures occurred at significantly lower loads when soft tissues are removed from bone [19]. Thus according to him superficial tissues play an important role in determining fracture pattern.

N. Safdar et al studied the relationship between fractures of the mandibular angle and the presence and state of eruption of the lower third molar [20]. According to them, angle fractures were significantly greater when unerupted lower third molars were present ($p<0.001$). Bilateral unerupted third molar predisposed to fracture at angle more significantly than unilateral unerupted third molars ($p<0.01$). Moreover, amount of bone space occupied by unerupted third molar is directly related to weakness of that area of bone ($p<0.001$).

Jasser Maaita et al discussed whether mandibular third molar is Rick factor for angle fracture and found out that incidence of angle fracture were significantly greater when unerupted M3 was present ($P<.05$). They found that out of 426 patients with M3, 127 (98%) had angle fractures and out of 189 patients without M3, 25(13.2%) had angle fractures [21].

R. K. Rajandram et al studied the relationship between partially erupted impacted M3 and risk of angle fracture and found out that patients with partially erupted M3 had 3.3 times greater chance of angle fracture than patients without M3 ($p<0.001$) [22].

David S. Tevepaugh and Thomas B. Dodson discussed the anecdotal reports regarding the presence of M3 as risk factor for angle fractures. They found out that out of 73 patients with M3, 30 (41.1%) had angle fractures and out of 28 patients without M3, 3(10%) had angle fractures [23].

Joyce Lee and Thomas Dodson studied the relationship between presence and position of M3 and angle fractures. They found that patients with M3 present had 1.9 times greater chance of angle fracture than patients without M3s ($p=.003$) [24].

Seiji et al studied the influence of eruption status of incompletely erupted M3 on incidence of mandible angle fractures. They found out that incompletely erupted M3 close to the inferior border of mandible have high risk of mandibular angle fractures [25].

Discussion

Several factors have been proposed to influence the location of mandible fractures including site, force and direction of impact, systemic disease, bony pathology and presence of impacted teeth [26-29]. Site, force and direction of impact are important determinants of fracture location. When large forces are applied to a small area of the mandible as in motor vehicle accident, the fracture will occur at the point of impact regardless of the architecture of mandible at that site. When the force is distributed to a wider area, as by a fist to face, the mandible will fracture at its weakest point. Hyperparathyroidism, osteopetrosis, osteoporosis, Paget's disease and other systemic metabolic diseases may predispose the mandible to fracture by decreasing the density of bone. Alterations of bony architecture due to cysts, neoplasms or osteomyelitis may also weaken the mandible.

Some of the complications of wisdom teeth removal are pain, swelling, damage to the lingual or inferior dental nerves and postoperative haemorrhage. In most Oral and Maxillofacial surgery units and many dental surgeries, the patients are warned of these complications and the fact that this warning has been issued is recorded in the notes. However, only patients with deeply impacted wisdom teeth are routinely warned about perioperative mandibular fracture.

Retained roots, cyst or neoplasms to may all predispose to fracture when the bone is damaged [30]. Removal of the wisdom teeth often requires removal of bone, thereby weakening an area already prone to fracture [31].

Aside from M3 presence and position, other factors may influence risk of angle fractures such as the character of the soft tissues adjacent to the mandible and state of the remaining dentition [19]. The pterygo-massetric muscle sling provides protection against traumatic forces to the angle region of the jaw. According to Weiss, angle region is more prone to fracture in partially or fully edentulous mandibles than in dentulous ones suggesting that the more atrophic the mandible became after the loss of teeth, the less bone mass remained and the weaker the site [32].

Tams et al did three dimensional studies and characterised the biomechanical properties of the mandible during angle fractures. They identified the angle region as having the greatest amount of positive bending moment (resulting in tension at the alveolus and compression at the inferior border), a small amount of torsion (resulting in the proximal segment being lingually displaced and the distal fragment being buccally displaced), and the greatest amount of shear force (caudal displacement of the proximal segment and the cranial displacement of distal segment) [33]. These sophisticated computerised biomechanical studies suggest the need to account for the unique shape and hence intrinsic strength and weakness of the mandible when analysing fractures in the angle region.

According to N. Safdar et al, mandible angle that contains an impacted third molar is weaker than an angle region without buried tooth. In addition, bilateral unerupted third molars predispose at least one angle region to fracture significantly more than do unilateral impactions [20]. These results are consistent with Huelke et al hypothesis of stress-strain distribution within the mandible [34]. The site of impact is usually restricted to the side of mandible. If the impact is of high force or concentrated over a small area, then a direct fracture at point of application will occur. If the impact is of low force or distributed over larger area, the stress-strain will transfer to the contra lateral side causing an indirect fracture. In either scenario, mandible with bilateral unerupted third molar teeth will have double the chance of fracture of the angle compared with mandible with one unerupted third molar tooth where the maximum force may be distributed to the non unerupted third molar tooth side.

The question of whether to remove unerupted third molar teeth as preventive measure against fracture of mandible has never been fully justified. According to Peterson, prophylactic removal of unerupted third molar teeth should be done in patients who engage themselves in contact sports as prevention against mandible fracture [35]. The question here is not whether unerupted third molar teeth weaken the angle of mandible but whether they weaken it to such an extent that the angle region then becomes "pathologically" weak in relation to the remainder of the mandible.

The angulation of third molars, its distance to the inferior border of the mandible and consequently reduced amount of bone are considerable risk factors for mandible angle fractures. The young individuals with partially erupted M3 have high tendency of sustaining mandible angle fractures. The young individuals who are active in contact sports or those who are exposed to high risk of facial trauma should use protective facial gear and mouth guards.

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