INCIDENCE OF MANDIBULAR FRACTURES AS A COMPLICATION OF LOWER THIRD MOLAR EXTRACTION: A RAPID REVIEW

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ABSTRACT

Introduction: The extraction of third molars is one of the most common procedures in dentistry, but that does not mean the risks and complications are uncommon. One of the complications of third molar extraction is a mandibular fracture. This study aimed to determine the incidence of mandibular fractures as a complication of lower third molar extraction from published literature. Methods: This rapid review was done in December 2020 until February 2021 towards articles in English reporting the incidence of mandibular fractures due to the extraction of lower third molars. The literature search referred to Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) diagram, conducted without year restriction using PubMed, ScienceDirect, and Google Scholar. Selected articles met the criteria according to the Population, Intervention, Comparison, and Outcome (PICO) framework. The articles were screened by checking for duplication, reading titles and abstracts, and reading full-text articles. Results: Eight articles with observational study design were included in this study, with 1,231 articles identified. The incidence of mandibular fractures as a complication of lower third molar extraction ranges between 0.0046%-3.03%. Fractures were more frequently found in male patients (n=42) rather than females (n=20), with a mean age over 39 years, in complete dentition (n=31) rather than incomplete dentition (n=3), in full bony impaction (n=47) rather than partial bony impaction (n=14), and in horizontal (n=22) or vertical (n=20) angulation rather than mesioangular (n=13) or distoangular (n=6) angulation. Conclusion: Mandibular fractures resulting from the extraction of lower third molars are rare. The increase in cases was found in male patients over 39 years of age, with complete dentition, full bony impactions, and horizontal or vertical angulation.

KEYWORDS mandibular fracture, tooth extraction, third molar, complication, incidence

Introduction

The extraction of third molars is one of the most common dental procedures. The extraction of third molars may be considered if there are any pathological conditions related to it, either symptomatic or asymptomatic.[1] A third molar that cannot reach its normal position is a pathological condition called tooth impaction.[2] The extraction of impacted third molars is considered if there are acute or chronic pericoronitis, cysts or tumours, periodontal problems, caries lesions, and preparation for orthodontic treatment or orthognathic surgery.[3] The extraction of third molars can cause common risks and complications. The risks of third molar extraction are pain, trismus, and swelling. Meanwhile, the complications of third molar extraction are alveolar osteitis (dry socket), secondary infection, nerve dysfunction, bleeding, temporomandibular joint (TMJ)
disorder, permanent paresthesia, and mandibular fracture.[3,4]

Mandibular fracture is the most severe complication of lower third molar extraction. The factors that can affect the occurrence of mandibular fractures are tooth impaction, type of tooth angulation, root length, patient age, surgeon’s experience, presence of a cyst or tumor around the impacted tooth, systemic disease or medications that impair bone strength, preoperative infections, and inadequate preoperative examination.[3] These factors influence the incidence of mandibular fractures as a complication of lower third molar extraction.

Based on research in Brazil, Pires et al.[5] showed that the incidence of mandibular fractures after lower third molar extraction is below 0.005%.[5] Similar research was conducted in China by Xu et al.[6] that showed the incidence of mandibular angle fractures during or after lower third molar extraction is 0.05%.[6] In England, Ethunandan et al.[7] showed that the incidence of mandibular fractures after lower third molar extraction is 0.0033%-0.0049%.[7]

Literature reviews that combine incidences from various studies regarding mandibular fractures as a complication of mandibular third molar extraction have not been widely found. This rapid review was conducted because the mandibular fracture is the most severe complication of lower third molar extraction, and it requires further study and attention.[8] The problem, Intervention, Comparison, and Outcome (PICO) framework was used to formulate research questions and develop a more complex search strategy to obtain more precise search results.[9] This study aimed to determine the incidence of mandibular fractures as a complication of lower third molar extraction from published literature.

Methods
This study was conducted using rapid review, which referred to the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) flow diagram.[10] Articles selected met the criteria according to the PICO framework: (1) population: mandibular fracture; (2) intervention: lower third molar extraction; (3) comparison: - ; (4) outcome: incidence. The literature search was conducted without year restriction using PubMed, ScienceDirect, and grey literature search using Google Scholar with the following keywords: ((mandibular fracture[Title/Abstract] OR (mandible fracture[Title/Abstract]) AND (((((third molar removal[Title/Abstract] OR (third molar extraction[Title/Abstract])) OR (third molar surgery[Title/Abstract])) OR (wisdom tooth removal[Title/Abstract])) OR (wisdom tooth extraction[Title/Abstract])) OR (wisdom tooth surgery[Title/Abstract]))) for PubMed; (“mandibular fracture” OR “mandible fracture”) AND (“third molar removal” OR “third molar extraction” OR “third molar surgery” OR “wisdom tooth removal” OR “wisdom tooth extraction” OR “wisdom tooth surgery” for ScienceDirect; and “mandibular fracture” AND “third molar removal” OR “third molar extraction” OR “third molar surgery” OR “wisdom tooth removal” OR “wisdom tooth extraction” OR “wisdom tooth surgery” for Google Scholar.

The inclusion criteria in this study were articles reporting the incidence of mandibular fractures as a complication of lower third molar extraction, studies on humans, and articles in English. The exclusion criteria were articles with only discussions available and articles with study design: case reports and reviews. Articles that are relevant and fit the inclusion criteria were included for analysis. Materials used in this study were internet access, Microsoft Office, and online articles. This study was conducted for approximately three months, starting from December 2020 to February 2021. The name of authors, publication year, names of journals, research titles, study designs, study periods, amount of mandibular fracture cases, amount of lower third molar extractions, and incidence were extracted from included studies. The extracted data was then analyzed descriptively by summarizing all data quantitatively to describe what happened to the sample.[11]

Results
There were 25 articles identified from PubMed, 383 articles identified from ScienceDirect, and 823 articles identified from Google Scholar. There were 1,231 articles identified in total. The duplicates were removed so that 971 articles were obtained. The first screening was carried out by reading the titles and abstracts. Nine hundred forty articles were removed because they were irrelevant and did not meet the inclusion criteria; thus, there were 31 articles selected for further screening. The second screening was carried out by reading articles in full text. There were 23 articles removed with reasons (Figure 1). Therefore, eight articles were included in this study.

The characteristics of included studies were described (Table 1). There were five articles[12–16] conducted in Europe, two articles[17,18] conducted in Asia, and 1 article[19] conducted in America. The highest number of mandibular fracture cases was 37 cases which were reported by Libersa, et al.[13]. Meanwhile, the lowest number of mandibular fracture cases was reported by Werkmeister et al.[14], Trybek et al.[15], and Agarwal et al.[18], each of whom reported 1 case of mandibular fracture. The highest incidence of mandibular fractures as a complication of lower third molar extraction was 3.03% which was reported by Trybek, et al.[15], whereas the lowest incidence was 0.0046% which Perry and Goldberg reported.[19]

The distribution of cases of mandibular fractures due to the extraction of the lower third molar was summarized (Table 2). Seven articles[12,13,15–19] reported the distribution of mandibular fractures as a complication by age, where the youngest age was 19 years, and the oldest age was 75 years, with an average age was above 39 years. Two articles[12,15] reported which side the extraction was, where five fractures occurred while extracting teeth 38 or the left side, and two fractures occurred while extracting teeth 48 or the right side. Type of tooth impaction was reported in 4 articles[12,13,15,19], where 47 fractures occurred in the extraction of complete bony impaction and 14 fractures occurred in the extraction of partial bony impaction. Type of angulation was reported in 4 articles[12,13,17,19], where 22 fractures occurred in the extraction of impacted teeth with horizontal angulation, 20 fractures in vertical angulation, 13 fractures in mesioangular angulation, six fractures in distoangular angulation, and one fracture in mesiohorizontal angulation. Seven articles[12–15,17–19] reported the time of fracture where 49 fractures occurred postoperatively, and 17 fractures occurred intraoperatively. Three articles[12,13,19] reported that the main cause of mandibular fractures after lower third molar extraction was mastication. The sex of the patients was reported in four articles[12,13,15,19], where 42 fractures occurred in male patients and 20 fractures occurred in female patients. Three articles[12,13,19] reported the pathological condition of the patients, where 18 patients had preoperative infections, six patients had cysts, and one patient had osteoporosis. Two articles[12,13] re-
reported the condition of the patient’s teeth where 31 fractures occurred in patients with complete dentition or only missing one tooth, and three fractures occurred in patients with incomplete dentition.

Discussion

Based on the results, it can be seen that the total number of mandibular fractures as a complication from all included articles is 74 cases out of 1,363,105 lower third molar extractions. The reported incidence of it ranges from 0.0046%-3.03%.[12–19] This indicates that mandibular fractures due to lower third molar extraction are rare. Mandibular fractures are not caused by only one factor. However, they are multifactorial, including age, sex, tooth impaction type, tooth angulation, dentition status, extraction technique, surgeon’s experience, preoperative infection or bone lesions, systemic diseases, and medication.[6] The highest incidence is 3.03%, where there was one mandibular fracture due to the extraction of tooth 38 from a total of 33 lower third molar extractions in patients aged over 60 years. Therefore, they were more susceptible to fracture.

Research on mandibular fractures as a complication of lower third molar extraction was mainly conducted in Europe. 73% of young adults in Europe have impacted third molars, which generally erupt at 17-21 years.[20,21] The eruption of the third molar varies by race, as in Nigeria, it can erupt as early as the age of 14 years. Meanwhile, in Europe, it can erupt up to the age of 26 years.[22] This indicates that the third molar extraction procedure in Europe could be performed at an older age, making them more susceptible to complications such as a mandibular fracture.

Mandibular fractures can occur during lower third molar extraction or intraoperatively and after lower third molar extraction or postoperatively. In this study, postoperative fractures occurred more frequently than intraoperative fractures. Intraoperative fractures can occur due to improper instrumentation and excessive force to the bone during extraction. Tooth sectioning before extraction is essential to prevent intraoperative fractures.[13] Postoperative fractures generally occur due to infection or a history of trauma. However, it is possible that spontaneous fractures can occur during the second postoperative week. This indicates that fractures occur not only because of the magnitude of the force during extraction but also because of the weakening of the bone at the angle of the mandible.[23]

Age is a significant factor that affects the risk of fractures. Most of the studies reviewed reported that fractures occurred in patients with a mean age of over 39 years, while third molar extraction procedure is generally performed on younger patients. Patients that underwent third molar extraction in France generally range between 15-20 years of age, whereas, in the United States, it is generally performed on patients under 25 years of age.[13,19] The increasing incidence of mandibular fractures in older patients may occur due to decreased bone elasticity and demineralization due to osteoporosis. Ankylosis in older patients may complicate the extraction procedure, and it requires extensive bone removal, which can weaken the mandible. The decision to do the extraction in older patients needs to be reconsidered because increasing age can affect the difficulty and the morbidity of extraction.[12,23,24]

More fractures were reported during the extraction of the left side than during the extraction of the right side. This can occur because the surgeon’s visualization is better during the extraction on the right side so that the bone removal is not too extensive.[24] The results also showed that complete bony impaction was more likely to cause fracture than partial bony impaction. Complete bony impaction occupies a more significant portion in the mandible and thus requires a more extensive bone removal.[19] This can be a factor in fractures because extensive bone removal can weaken the mandibular bone.

The distoangular angulation is considered more challenging to extract and requires more extensive bone removal, making it more susceptible to fracture.[23] However, in this study, it was found that fractures were more common in horizontal and vertical angulation, followed by mesioangular, distoangular, and mesiohorizontal angulation. This can occur because vertical angulation is the most common type to be found.[25,26] Menziletoglu et al.[27] showed that horizontal angulation had the thinnest lingual bone.[27]

The most commonly reported pathological conditions in fracture patients were preoperative infection, followed by cysts and osteoporosis. There were no data that explain the type of preoperative infection that occurs, but it can be assumed that chronic infection and deep infection can cause decalcification or bone damage. The presence of cysts can also weaken the mandibular bone.[12,19] A study by Goldberg et al.[28] showed that from 600 patients with impacted third molars, 21% had a preoperative infection, and 2% had cysts or tumors. Osteoporosis plays a role in the process of decreasing bone strength.[29]

Fractures were more commonly found in male patients rather than female patients. Males have a greater mastication force than females. Mastication is the leading cause of postoperative fractures, typically occurring in the second and third postoperative weeks when the mandibular bone is in its weakest condition. The granulation tissue is being replaced by the connective tissue in the alveolar socket.[13,19] During the initial healing process, the patient can masticate normally when the pain and swelling begin to subside. Patients with complete dentition have a maximum occlusal force so that there is a high risk of fractures in the mandible that has not been fully calcified.[12,13] This supports the results of this study that fractures were more common in patients with complete dentition or missing one tooth than patients with incomplete dentition. After the extraction, soft diet instruction for 2-4 weeks must be given to the patient to prevent fractures.[23,30] Besides that, patient non-compliance
Table 1: Characteristics of included studies

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Location</th>
<th>Journal</th>
<th>Title</th>
<th>Study Design</th>
<th>Study Period</th>
<th>Number of Mandibular Fracture Cases</th>
<th>Number of Lower Third Molar Extractions</th>
<th>Incidence</th>
</tr>
</thead>
</table>

Table 2: Distribution of mandibular fractures as a complication.

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Sample</th>
<th>Age (Mean)</th>
<th>Teeth 38/48</th>
<th>Type of impaction</th>
<th>Type of angulation</th>
<th>Time of fracture</th>
<th>Main cause of fracture</th>
<th>Sex</th>
<th>Pathological condition</th>
<th>Dentition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perry and Goldberg[19] (2000)</td>
<td>28</td>
<td>20-60 (39)</td>
<td>N/A</td>
<td>18 full bony</td>
<td>9 vertical 7 horizontal 8 mesioangular 3 distoangular</td>
<td>28 postoperative</td>
<td>Mastication</td>
<td>22 M 6 F</td>
<td>18 preoperative infection 2 large cysts</td>
<td>N/A</td>
</tr>
<tr>
<td>Krimmel and Reiner[12] (2000)</td>
<td>6</td>
<td>42-50 (45)</td>
<td>4 teeth 38 2 teeth 48</td>
<td>6 full bony</td>
<td>2 vertical 3 mesioangular 1 mesiohorizontal</td>
<td>6 postoperative</td>
<td>Mastication</td>
<td>5 M 1 F</td>
<td>2 radicular cyst 1 follicular cyst</td>
<td>5 complete 1 missing one tooth</td>
</tr>
<tr>
<td>Libersa, et al.[13] (2002)</td>
<td>37</td>
<td>19-75 (40)</td>
<td>N/A</td>
<td>22 full bony 5 partial bony 10 N/A</td>
<td>9 vertical 13 horizontal 2 mesioangular 3 distoangular 10 N/A</td>
<td>17 intraoperative 10 postoperative 10 N/A</td>
<td>Mastication</td>
<td>15 M 12 F 10 N/A</td>
<td>1 osteoporosis 1 pericoronal cyst</td>
<td>25 complete 2 incomplete 10 N/A</td>
</tr>
<tr>
<td>Werkmeister, et al.[14] (2005)</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>1 postoperative</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Khalesi, et al.[17] (2010)</td>
<td>2</td>
<td>20-40</td>
<td>N/A</td>
<td>N/A</td>
<td>2 horizontal</td>
<td>2 postoperative</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Trybek, et al.[15] (2015)</td>
<td>1</td>
<td>63</td>
<td>1 tooth 38</td>
<td>1 full bony</td>
<td>N/A</td>
<td>1 postoperative</td>
<td>N/A</td>
<td>N/A</td>
<td>1 F</td>
<td>N/A</td>
</tr>
<tr>
<td>Baensch, et al.[16] (2017)</td>
<td>2</td>
<td>≥ 65</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Agarwal, et al.[18] (2017)</td>
<td>1</td>
<td>&gt; 40</td>
<td>N/A</td>
<td>N/A</td>
<td>1 postoperative</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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</tr>
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in carrying out postoperative instructions is also a problem that can cause complications.[19]

Before third molar extraction, consideration should be carried out in patients at risk for mandibular fractures. Information about the risks and complications of third molar extraction must be given to the patients before the extraction procedure. Adequate preoperative examination, proper instrumentation and application of force, and patient compliance with postoperative instructions can help prevent mandibular fractures. Further clinical studies regarding the incidence of mandibular fractures as a complication of lower third molar extraction with prospective or retrospective cohort study design can be carried out to strengthen the results in this study. A systematic review of the incidence of mandibular fracture as a complication of lower third molar extraction with more than one reviewer can also be carried out to reduce the risk of bias to improve the study’s quality.

Conclusion
This study shows that mandibular fractures as a lower third molar extraction complication are rare, with a low incidence of 0.0046%-3.03%. An increasing number of mandibular fractures due to lower third molar extraction were found in male patients, aged over 39 years, with complete dentition, full bony impaction, and horizontal or vertical angulation. Preoperative infection and cysts are pathological conditions that are more frequently found in patients.

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Conflict of Interest
There are no conflicts of interest to declare by any of the authors of this study.

References


