

Impacted maxillary third molar displaced to the infratemporal space: a critical review and case report

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The aim of the present study was to use the scientific evidence found in a critical literature review as a basis to discuss the displacement of maxillary third molars to the infratemporal fossa in terms of anatomical and demographic characteristics and the treatment protocols used. In addition, this article reports a new clinical case of third molar displacement in a 19-year-old man. For the literature review, the Cochrane, Medline, Lilacs, and BBO databases were searched for relevant key words, and the selected articles were classified in accordance with their level of evidence according to the Oxford Centre for Evidence-Based Medicine criteria. Twenty-two articles were found, but only 13 were considered relevant and met the criteria for inclusion in this review. All of the articles were classified as Level 6b for scientific evidence (case reports). The maxillary left third molar was more commonly displaced to the infratemporal fossa (69.23%) than was the right third molar. Most of the molars exhibited complete root formation (53.84%), were multirooted (69.23%), and had fused roots (53.84%). During the procedures for removal of the displaced molars, either general or local anesthetic agents were used. Surgical access for molar removal was almost always intraoral, and no permanent postoperative complications were recorded. The time from tooth displacement until attempted surgical removal ranged from immediately to 24 years after the displacement. Both general dentists and oral and maxillofacial surgeons were responsible for the displacements.

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The removal of third molars is one of the most frequent procedures performed by oral and maxillofacial surgeons. Common complications associated with the removal of maxillary third molars include tuberosity fracture, maxillary sinus perforation, exposure of buccal fat, and displacement to the maxillary sinus. Displacement to adjacent anatomical spaces is seldom reported.¹ Nevertheless, only a thin layer of bone may separate superiorly located maxillary third molars from the infratemporal space.² The tooth can be displaced posterosuperiorly into the infratemporal space if a retractor is not placed behind the tuberosity (within the mucoperiosteal flap) during distal elevation.²

Management of third molar displacements presents many variations, as the literature shows.³⁻⁷ Therefore, the aim of the present study was to discuss the characteristics and treatment of maxillary third molars displaced to the infratemporal space within the context of a critical literature review. A new clinical case of third molar displacement in a 19-year-old man is also presented.

Materials and methods

A search was conducted in the Cochrane, Medline, Lilacs, and BBO databases. The following medical subject heading (MeSH) terms were used in the search strategy: (*third molar*), (*tooth*) AND (*displacement*). The following keywords were also used: (*third molar*) OR (*dental*) OR (*tooth*) AND (*infratemporal*).

The articles found were read to determine if they fit the eligibility criteria. Articles that were selected were categorized according to a modified version of the levels of evidence proposed by the Oxford Centre for Evidence-Based Medicine (Table 1).^{8,9} This tool provides a classification system for judging the quality of published evidence.

The inclusion criteria defined for this review were clinical articles on dental displacement to the infratemporal space that were published in any language in the last 40 years. The exclusion criteria were defined as articles that were not available in their full form; literature reviews; articles in which it was impossible to visualize the tooth and/or its postdisplacement position; articles lacking imaging examinations or providing images of poor quality; and clinical case reports in which the authors stated that the tooth was located in the infratemporal space but our analysis of the imaging examinations revealed that the tooth was in another location.

Due to the retrospective nature of this study, it was granted an exemption from institutional review board approval by the University of Pernambuco, Recife, Brazil. The patient gave informed consent for his inclusion in the new case report.

Results

In total, 22 articles were found in the searched databases. After review, 9 articles were excluded for the following reasons: 3 reports were not complete; in 2 articles the tooth was not located in the infratemporal space; and in 4 articles it was not possible to see the tooth in the images provided. The remaining 13 articles were considered relevant to the study and thus included in the critical review (Table 2).^{4,5,7,10-19} All 13 articles were Level 6b (case reports).⁹

The patients' ages ranged from 14 to 42 years. The average age was 23.3 years. A majority of the patients were women (61.54%).

The maxillary left third molar was more commonly displaced than the maxillary right third molar (69.23% and 30.77% of cases, respectively). Root formation was found to be complete in 53.84% of the molars, while 38.46% of the teeth exhibited incomplete root formation. The status of root formation could not be clearly defined in 1 case (7.69%). Most of the teeth were multirooted (69.23%) with fused roots (53.84%). There were no single-rooted molars, but roots were absent in 30.77% of cases and divergent in 15.38% of teeth.

An absence of symptoms was reported in 4 (30.77%) of the patients. When symptoms were present, the most common were limited mouth opening (30.77%) and pain (30.77%). Edema and diplopia were noted in 2 patients (15.38%) and 1 patient (7.69%), respectively. In 2 cases (15.38%), the presence or absence of symptoms was not reported in the articles. In 1 case (7.69%), surgical removal was conducted immediately after the displacement.

General or local anesthesia was used in all of the surgical procedures to remove the displaced third molars. The surgical access was almost always intraoral. In 2 cases, it was not possible to remove the displaced tooth on the first attempt. One tooth was subsequently treated conservatively through preservation. The other was surgically removed on the second attempt, a surgical approach that used extraoral access. No permanent postoperative complications were recorded.

The time until surgical management ranged from immediate removal in 1 case to delayed removal 24 years after dental displacement in another. Including the case of immediate removal, the tooth was removed within 3 weeks in 3 cases (23.08%). Another 3 molars (23.08%) were removed 6 weeks to 4 months after displacement. In total, 2 (15.38%) were removed more than 1 year after displacement. In 5 cases (38.46%), the time at which the surgical intervention took place was not mentioned in the article.

In the 13 cases included in this critical review, the displacement occurred during an extraction performed by a general dentist in 4 cases and during an extraction performed by an oral and maxillofacial surgeon in 4 cases. Information about the practitioner was not specified in 5 cases.

Case report

A 19-year-old man was referred to a Department of Oral and Maxillofacial Surgery clinic 1 week after an attempted extraction of his maxillary right third molar, which had been performed by a general dentist. At the time of the consultation, the patient complained about pain and limited mouth opening. During the intraoral examination, an interincisal distance of 28 mm was

Table 1. Modified Oxford Centre for Evidence-Based Medicine levels of evidence.^a

Level	Description
1a	Multicenter RCT; meta-analysis; SR of RCTs (clear search strategy, appraisal by 2 or more reviewers using published grading scheme for RCTs)
1b	High-quality, individual RCT
2a	SR of controlled cohort studies; missing 1 criteria for SR in RCTs
2b	Prospective cohort studies; lower quality RCT
3a	SR of case-control studies; missing 1 criteria for SR in cohort study
3b	Retrospective cohort study; case-control study
4a	Case series; low-quality cohort studies; low-quality case-control studies
4b	Physiological study (human)
5	Preclinical study (animal)
6a	Review of the literature, without documented or systematic methodology
6b	Expert opinion; case report; technical note

Abbreviations: RCT, randomized controlled trial; SR, systematic review.

^aAdapted from McMullen et al, based on the levels of evidence system developed by the Oxford Centre for Evidence-based Medicine.^{8,9}

observed, as was a slight increase in the volume of the buccal region above the right maxillary tuberosity.

Waters radiography initially showed a radiopaque image lateral to the maxillary tuberosity. Subsequently, computed tomography showed a hyperdense image located among the maxillary tuberosity, the mandibular ramus, and the zygomatic bone, invading the right infratemporal space (Fig 1). The clinical findings associated with the image results suggested iatrogenic displacement of the third molar to the infratemporal space, for which the treatment of choice was surgical removal under local anesthesia in an outpatient environment.

The maxillary posterior alveolar nerve was blocked with 3% mepivacaine with epinephrine (1:200,000). An incision was made in the maxillary vestibule, and delicate dissection was continued until the location of the tooth was confirmed. At all times, retractors were maintained in the posterior region, in contact with bone, in an attempt to minimize the risk of greater tooth displacement. After the tooth was removed, the surgical site was irrigated with 0.9% saline solution and sutured with 4-0 silk thread (Fig 2). The tooth was found to be multirooted, with fused roots and incomplete rhizogenesis (Fig 3). The patient returned 7 days postsurgery and exhibited no pain, infection, or dehiscence. The patient's mouth opened to 38 mm on postoperative day 15.

Discussion

Third molar surgery is one of the most common procedures carried out by maxillofacial surgeons. These procedures can

Table 2. Summary of cases of displaced maxillary third molars reported in the literature.

Authors (year)	Patient			Signs and symptoms	Surgical removal of the displaced tooth			
	Age (y)	Sex	Tooth No.		Time to surgery	Anesthesia	Access	Outcome ^a
Dawson et al (1993) ⁴	18	F	16	None	4 mo	General	Intraoral combined with hemicoronal	Successful
Orr (1999) ⁵	16	M	1	NR	Immediately after displacement	General	Intraoral	Successful
Campbell & Costello (2010) ⁷	18	F	1	Diplopia on upward eye movement	6 wk	General	Intraoral	Successful
Oberman et al (1986) ¹⁰	26	F	16	NR	NR	General	Intraoral	Unsuccessful
Patel & Down (1994) ¹¹	19	F	1	NR	NR	General	Intraoral (1st); extraoral (2nd)	Unsuccessful; successful after extraoral access and use of image enhancer
Sverzut et al (2009) ¹²	22	M	16	Limited mouth opening, pain during mandibular movements	NR	Local	Intraoral	Successful
Baig et al (2012) ¹³	24	M	16	Pain, edema	NR	Local	Intraoral	Successful
Gómez-Oliveira et al (2010) ¹⁴	23	F	16	None	2 wk	Local	Intraoral	Successful
Primo et al (2014) ¹⁵	14	F	1	None	4 mo	Local	Intraoral	Successful
Selvi et al (2011) ¹⁶	35	M	16	None	3 wk	Local	Intraoral	Successful
Corega et al (2013) ¹⁷	24	M	16	Limited mouth opening, pain	8 y	General	Intraoral	Successful
Díaz-Condal et al (2012) ¹⁸	42	F	16	Limited mouth opening, pain	24 y	General	Intraoral	Successful
Ozer et al (2013) ¹⁹	23	F	16	Edema, limited mouth opening	NR	General	Intraoral	Successful

Abbreviations: F, female; M, male; NR, not reported.

^aNo permanent postsurgical complications were reported in any of the patients.

range in complexity from straightforward to extremely difficult, depending on the location, depth, angulation, and bone density involved.^{20,21}

The aim of this critical review was to define the main conditions associated with impacted maxillary third molars that are displaced to the infratemporal space. This was done by means of a search of the scientific literature in 4 databases and the selection of relevant articles that matched the defined eligibility criteria. Thirteen articles were included in this review, all of which were classified as Level 6b in terms of evidence.^{4,5,7,10-19}

Tooth displacement to the infratemporal space after an extraction is considered rare. Based on the results of this critical review, it is most commonly associated with left third molars, multirooted teeth with fused roots, and teeth with complete root formation. The left side may be more commonly affected due to the fact that most surgeons operate from the patient's right side. The contralateral tooth is more difficult to see, which may hinder its surgical removal.

Despite the fact that impacted maxillary third molars cause more problems when their roots are divergent, this scenario

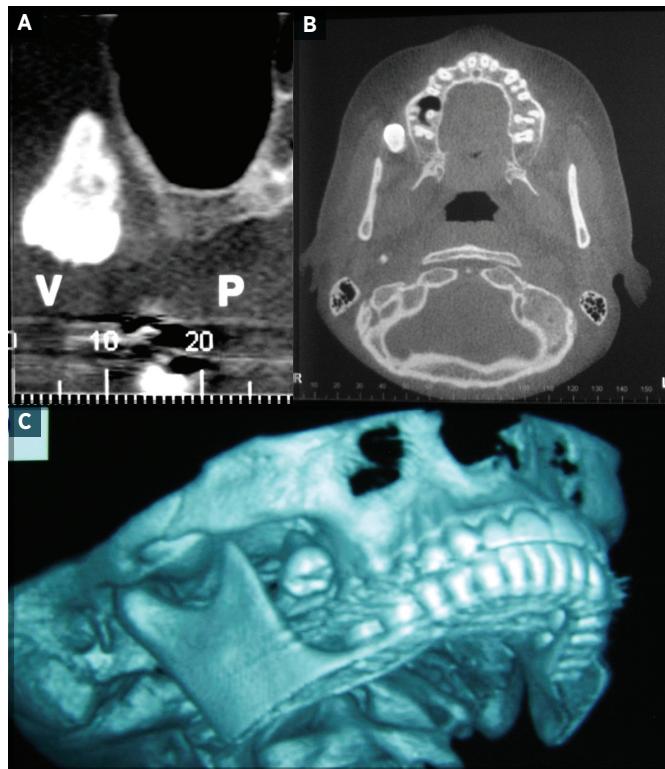


Fig 1. Computed tomography revealing a displaced maxillary right third molar. A. Coronal section. B. Axial section. C. Three-dimensional reconstruction.

actually decreases the possibility of surgical displacement because of the resulting mechanical impaction; teeth with fused roots can be displaced more easily. Teeth with missing roots would be expected to exhibit an even greater risk of displacement than teeth with fused roots. However, most patients subjected to third molar extractions are adults, and therefore the root formation of the tooth is complete or in its final stages.

Poorly planned incisions and osteotomies, surgical fluids (which obscure the site), low lighting, and incorrect positioning of the retractor can increase the risk of displacement to fascial spaces.

In the cases reviewed for this study, displacement occurred during procedures conducted by both general dentists and oral and maxillofacial surgeons.^{5,7,10-15} In some articles, there was no reference as to who performed the procedure.^{4,16-19} However, after a displacement, an oral and maxillofacial surgeon is responsible for removal of the tooth from the infratemporal space.

The clinical case reported herein involved a man (the minority affected sex, according to the literature review) who was younger than the average age of the majority of those described in the literature. In the newly reported case, the displaced tooth was the maxillary right third molar, which was also less common in previously reported cases. However, the affected tooth was a multirooted tooth with fused roots, similar to the majority of cases described in this review. However, it is notable that root formation was incomplete, while most displaced teeth in previous reports have exhibited complete rhizogenesis.

In the present case, the patient exhibited the most common symptoms (pain and limited mouth opening). These symptoms



Fig 2. Surgical removal of the displaced tooth.

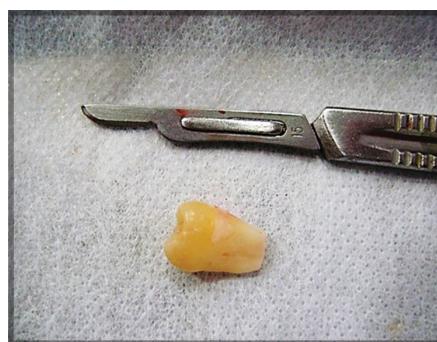


Fig 3. Extracted third molar showing incomplete root formation (multirooted with fused roots).

resolved within 7 and 15 days, respectively, after the removal of the displaced tooth. Other symptoms—such as swelling and diplopia—have also been described in the literature.^{7,10-13}

In most of the cases reviewed for the study, successful removal of the displaced tooth was achieved on the first attempt without complications, regardless of the type of anesthesia (local or general) used. The time between the displacement and removal of the tooth ranged from immediately after the displacement to 24 years later, although the majority were removed within 4 months. In the patient in the new case report, the displaced tooth was removed successfully 1 week after displacement. The molar was removed after administration of a local anesthetic agent, which has become an accepted approach to anesthesia for this procedure.¹²⁻¹⁶ The access in the present case was intraoral, which is also the most common form of access used for this complication.

Failure to locate a displaced tooth often leads the surgeon to use additional access routes or adjunct forms of technology to complete the removal. Orr described a method of removing a maxillary third molar that had been displaced to the infratemporal space.⁵ This method involved inserting a needle above the zygomatic bone and behind the orbital rim. Other methods that have been described in the literature include a combination of intraoral and extraoral incisions, a transantral approach, and the use of an intraoperative image enhancer.^{3,4,11,22} A more precise and minimally invasive technique was described by Campbell & Costello, who successfully used active image guidance with a navigation system.⁷

Third molars should be extracted by an oral and maxillofacial surgeon who has the necessary skills and expertise, thereby minimizing the risk of injuries and complications inherent to the procedure. When faced with a tooth that has been displaced into the infratemporal space, the surgeon should correlate the findings of the clinical examination to the images that are required to locate the displaced tooth, such as tomographic sections and 3-dimensional reconstructions. Based on these results, the best access route and most appropriate anesthetic technique can be chosen with the objective of resolving the complications.

Conclusion

Previous reports related to the displacement of third molars to the infratemporal space have been classified as Level 6b for scientific evidence (case reports). The teeth most commonly involved in these prior incidents were the maxillary left third molars, teeth with complete roots, multirooted teeth, and teeth with fused roots. However, many of the studies reviewed did not completely describe the tooth involved, omitting important data that could provide a more accurate assessment of each case.

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