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## Educational Article

# Management of third molars projected into the temporal fossa and infratemporal fossa: systematic literature review

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Third molar / tooth extraction / Zygoma / impacted tooth

**Abstract – Introduction:** Projection of the maxillary third molar into the temporal or infra temporal fossa is a rare complication. There is no recommendation for the management of such complication. The aim of this work is to try establishing a removal protocol. **Materials and methods:** A systematic review of the literature was conducted using all cases reports of iatrogenic projection of the tooth into the temporal fossa or infratemporal fossa and how they were treated. The last search was conducted in July 2021. **Results:** 27 cases involving 28 teeth, published between 1986 and 2020 were included. **Discussion:** The intraoral approach seems to be preferred in the first instance for teeth in the infra temporal fossa and a cutaneous approach for teeth in the temporal fossa. This should be done within 3–6 weeks after projection to attempt removal. This allows the formation of a fibrous capsule and the downward migration of the tooth to facilitate removal. The use of complementary technological means can improve the chances of success. **Conclusion:** Resulting a flow chart, who is an aid to management of this type of situation, providing a clear idea of the approach to be taken.

## Introduction

The avulsion of the maxillary third molar (MTM) is a common procedure in oral surgery, performed for prophylactic or therapeutic purposes. This surgery, like all surgery, has its share of complications which are of the order of 5% [1]. Tuberosity fracture, root fracture, perforation of the maxillary sinus with or without tooth projection, prolapse of the buccal fat pad are the most frequent [1].

Displacement into neighboring anatomical spaces is related to inadequate clinical and radiological examination, disrespect of basic principles such as anatomical knowledge, inadequate flap, reduced visibility, excessive or uncontrolled force during extraction, incorrect extraction technique, tooth angulated distally, third molar crown over adjacent molar roots, limited bone distally or holding a mouth opener in place [2,3].

Among the intraoperative incidents, the projection of the MTM into the temporal fossa (TF) or the infra-temporal fossa (ITF) is a rare complication [4].

The TF is limited above by the temporal line and below by the zygomatic arch. The ITF is limited in its upper part by the zygomatic arch and the infra-temporal ridge and in its lower part by the pterygo-mandibular ligament. These spaces are crossed by various vascular and nerve elements such as the maxillary artery, the branches of the mandibular nerve, the otic ganglion, and the tympanic cord [5,6]. Prominent branches of the maxillary artery found in the infratemporal fossa include the middle meningeal artery, inferior alveolar artery, deep temporal artery, and buccal artery. This makes it a complex anatomical area where any intervention carries a risk, as to injury the maxillary artery which is a branch of the internal carotid artery. This can lead to massive haemorrhage. It can also lead to injury of the otic ganglion, the corda tympani or the mandibular nerve, resulting in sensory disorders (facial paralysis, labiomental anaesthesia).

No standardized MTM iatrogenic displacement in the temporal or infratemporal fossa removal protocol has yet been established.

The objective of this systematic literature review is to try establishing a removal protocol.

## Materials and methods

This systematic review was conducted according to PRISMA (preferred reporting Items for systematic Reviews and Meta-Analyses) recommendations [7].

The population was: any patient who has had a MTM projected into the temporal or infra temporal fossa, for which the method of retrieval is observed and collected, in order to propose a removal protocol according to the location (PICO).

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Data were collected from Medline, Science Direct, Google scholar databases, from 1971 to July 2021, using the followed MeSH combination of terms:

- Equation: ["Molar, Third" [Mesh] OR "Tooth Germ" [Mesh] OR "Tooth Avulsion" [Mesh] OR "Tooth, Impacted" [Mesh] OR "Tooth Loss" [Mesh] OR "Tooth Extraction" [Mesh] OR "Tooth" [Mesh] OR "Tooth Migration" [Mesh]] AND ["Intraoperative Complications" [Mesh] OR "Cranial Fossa, Middle" [Mesh] OR "Temporal Bone" [Mesh] OR "Zygoma" [Mesh] OR "Cranial Fossa, Posterior" [Mesh] OR "Cranial Fossa, Anterior" [Mesh] OR "Pterygopalatine Fossa" [Mesh]).

The equation MeSH was completed using the following equations:

- Equation: ["infratemporal fossa"] AND [Molar [Mesh] OR "Tooth, Impacted" [Mesh] OR "Tooth Extraction" [Mesh] OR "Tooth" [Mesh] OR "Tooth Avulsion" [Mesh] OR "Tooth Injuries" [Mesh] OR "Molar, Third" [Mesh] OR "Tooth Migration" [Mesh] OR "Tooth Germ" [Mesh]].
- Equation: ["temporal fossa"] AND [ "molar"].
- Equation: ["infratemporal fossa"] AND [ "molar"].

The inclusion criteria were: all cases report to iatrogenic projection of MTM into the infratemporal fossa or the temporal fossa were included in this study.

The exclusion criteria were: the articles that were not available in their entirety, articles that did not have an imaging examination that allowed the tooth to be located, the articles that after a complete reading and analysis of the images did not have teeth in the temporal fossa or infratemporal fossa despite what was stated, and finally articles where the approach was not mentioned.

Data were collected by two independent reviewers on two occasions at one-month intervals and compared with each other. Any discrepancies were re-assessed a third time and finally validated.

Were search: the location of the projected tooth; surgical technique; time to management of the complication; type of anesthesia; symptomatology; whether the tooth was palpable; use supplementary aid; radiological images; success or failure of the procedure; migration of the tooth; presence of a fibrous capsule; age; gender; and projected tooth number were also collected.

No meta-analysis was performed because data come from cases reports.

## Results

### Characteristics of the studies

A total of 39 clinical cases were retrieved and selected from databases dating from 1977 to June 2020. All articles available in full text on the internet or at the university library in Montpellier were read. The 8 articles not available in full text were excluded. Two articles were excluded because after analysis of the imaging the tooth was not actually in the infra temporal fossa or in the temporal lodge, one article was excluded because it did not present imaging to confirm the temporal or infra temporal position of the tooth. Finally, another case was excluded because it reported the presence of a tooth in the infratemporal fossa but not of iatrogenic origin.

A total of 26 clinical cases involving 27 projected teeth were included (Fig. 1).

The characteristics of the included studies are presented in Table I.

### Characteristics of the population

The population consisted of 13 females and 13 males, aged between 14 and 46 years with a mean age of 26.2 years.

Of the 27 projected teeth in the study population, the left MTM was the most frequently projected tooth. The distribution was 62.96% left maxillary third molars ($n = 17$), 37.04% right MTM ($n = 10$).

### Location and success

17.9% ($n = 5$) were projected into the temporal fossa (including one case of bilateral migration), 82.1% ($n = 22$) were projected into the infratemporal fossa.

They were successfully recovered in 25 cases (92.59%) out of 27.

### Approach

For the 22 teeth in the infratemporal fossa, an intra oral approach was performed in each case (100%). Of these 22 teeth, in only one case the tooth was not recovered. In one case the intra oral approach was combined with an extra oral approach, the modified Gillies technique (2 cm temporal incision, 2.5 cm above and in front of the helix, in the hairline, dissection and exposure of the temporal muscle. An instrument is inserted between the temporal fascia and the temporalis muscle. Using a back-and-forth motion, the instrument is advanced until it contacts the tooth). Of the 22 cases, a deep vestibular approach was performed in 50% of cases ($n = 11$). A transinusal approach was performed in 9.1% of cases ($n = 2$). In 31.8% of cases ($n = 7$) the incision was intra-sulcular extended horizontally over the tuberosity and with vertical discharge mesial to the first or second molar and in 9.1% of cases ($n = 2$) the type of incision (intra sulcular or vestibular) was not specified.

For the 5 teeth that were projected into the temporal space, none were recovered by the intra-oral approach; they were extracted by the extra oral approach in 100% of cases. In 50% of cases ($n = 2$) they were recovered by the hemi-coronal approach, in 25% of cases ($n = 1$) they were recovered by the coronal approach (case of bilateral migration), and in 25% cases ($n = 1$) by the modified Gillies approach Table II.

The only attempt at an endobuccal approach was unsuccessful and resulted in a hemi-coronal approach.

The tooth was palpable preoperatively in 23.1% of cases ($n = 6$). In 23.1% of cases ($n = 6$) it was no palpable and this was not reported in the 53.8% of cases remaining ($n = 14$).

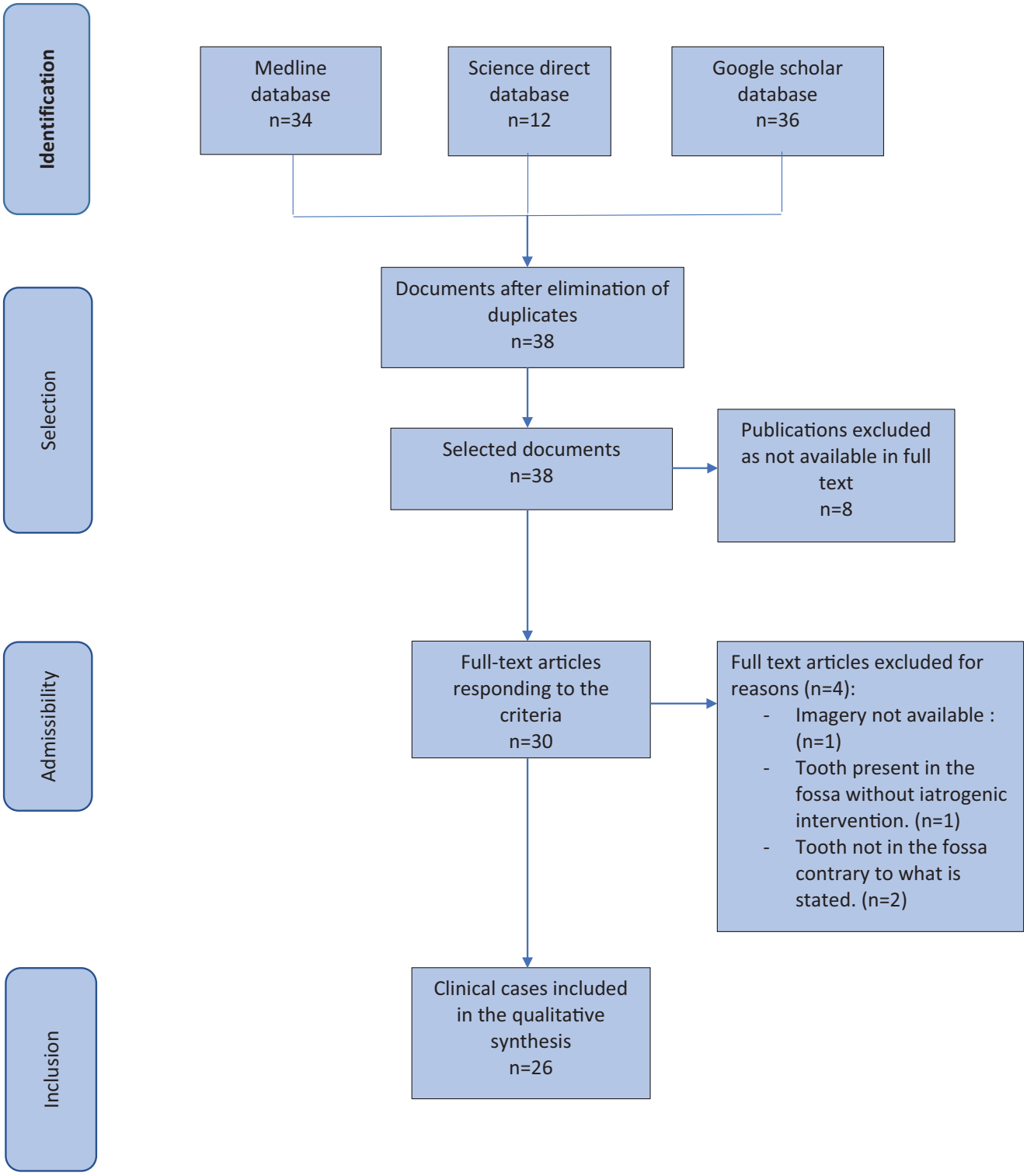


**Fig. 1.** PRISMA flow diagram of the article selection process.

**Table I.** Characteristics of the included case reports.

| Authors (Year) | Sex | Age | Tooth n° | Fossa | Technique approach | Anaesthesia | Time to recovery | Symptoms at the time of recovery | Post-operative | Imaging | Success |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oberman *et al.* (1986) [1] | F | 26 | 28 | ITF | Endobuccal long incision in the vestibule fundus | GA | NR | Asymptomatic | | Panoramic/CT | No |
| Mace *et al.* (2020) [2] | M | 17 | 18 | ITF | Endobuccal without precision | GA | 3 Weeks | Cellulitis, right facial swelling, skin fistula, trismus, subcutaneous abscess, emphysema | Asymptomatic | CT injected scan | Yes |
| Gómez-Oliveira *et al.* (2010) [3] | F | 23 | 28 | ITF | Endobuccal without precision | LA | 2 Weeks | Asymptomatic | Asymptomatic | CT/panoramic | Yes |
| Sencimen *et al.* (2017) [4] | M | 21 | 28 | ITF | Transinusian | LA | 4 Years | Swelling, chronic suppuration | Asymptomatic at 10 days | CT/panoramic | Yes |
| Selvi *et al.* (2011) [8] | M | 35 | 28 | ITF | Endobuccal small incision parallel to the buccinator fibres | LA | 3 Weeks | NR | NR | CT/panoramic | Yes |
| Nogueira *et al.* (2019) [9] | M | 19 | 28 | ITF | Endobuccal long incision in the vestibule fundus | LA | 1 Week | LMO, Swelling | Asymptomatic at 7 days and opening at 38 mm at 15 days | CT | Yes |
| Polo *et al.* (2016) [10] | F | 19 | 28 | ITF | Endobuccal, sulcular extended over the tuberosity and with vertical discharge mesial to the molars | GA | NR | LMO, Swelling | Asymptomatic | CT/panoramic | Yes |
| Battisti *et al.* (2017) [11] | F | 28 | 28 | ITF | Endobuccal, sulcular with vertical discharge mesial to molars + endoscope | GA | 0 day | LMO, Swelling, pains | NR | CT | Yes |
| Gulbrandsen *et al.* (1987) [12] | M | 22 | 28 | TF | Endobuccal sulcular but failed, then hemicoronal | GA | 2 Years | Asymptomatic | Mild post-operative pain | Frontal, lateral and axial tomography. | Yes |
| Sverzut *et al.* (2009) [13] | H | 22 | 28 | ITF | Endobuccal small incision parallel to the buccinator fibres | LA | 3 Weeks | LMO, pain on opening, painful and restricted mandibular movement. | Asymptomatic at 2 weeks | CT | Yes |
| Ozer *et al.* (2013) [14] | M | 23 | 28 | ITF | Endobuccal, sulcular extended over the tuberosity and with vertical discharge mesial to the molars | GA | 1 Week | LMO, Swelling, pains | Asymptomatic | CT/panoramic | Yes |
| Dawson *et al.* (1993) [15] | F | 18 | 28 | ITF | Endobuccal long incision in the vestibule + Gillies' approach + cineradiography | GA | 5 Months | Asymptomatic | Asymptomatic | Profile skull and Blondeau | Yes |
| Yücesoy *et al.* (2018) [16] | M | 40 | 18 | ITF | Endobuccal, sulcular extended over the tuberosity and with vertical discharge mesial to the molars | LA | 0 Day | NR | Asymptomatic | CT/panoramic | Yes |
| Shruthi *et al.* (2020) [17] | F | 26 | 18 | TF | Gillies modified only | GA | NR | Swelling, pain | Asymptomatic at 3 weeks | CT | Yes |
| Lutz *et al.* (2019) [18] | F | 17 | 18 | ITF | Endobuccal long incision in the vestibule + interventional radiography | GA | 2 Months | Asymptomatic | Asymptomatic at 3 weeks | CT | Yes |
| Elgbouri *et al.* (1999) [19] | M | 42 | 18 | TF | Hemicoronal | GA | 4 Days | Asymptomatic | Asymptomatic | Front and profile tomography | Yes |

**Table I.** (Continued).

| Authors (Year) | Sex | Age | Tooth n° | Fossa | Technique approach | Anaesthesia | Time to recovery | Symptoms at the time of recovery | Post-operative | Imaging | Success |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Paoli *et al.* (1995) [20] | M | 15 | 18-28 | TF | Coronal | GA | 6 Weeks | LMO, bilateral swelling | Mouth opening at 40 mm at 6 months | Blondeau, Skull face and profile, face up, panoramic, CT | Yes |
| Campbell et Costello. (2010) [21] | F | 18 | 18 | ITF | Endobuccal long incision in the vestibule + guided navigation | GA | 6 Weeks | Diplopia | NR | CT | Yes |
| Díaz-Condal *et al.* (2011) [22] | F | 42 | 28 | ITF | Endobuccal small incision parallel to the buccinator fibres | GA | 24 Years | LMO, pain | Opening to 42 mm at 7 weeks | CT/panoramic | Yes |
| Bodner *et al.* (2012) [23] | M | 34 | 28 | ITF | Endobuccal, sulcular extended over the tuberosity and with vertical discharge mesial to the molars | LA | 0 Day | NR | Asymptomatic at 2 weeks | CT/panoramic | Yes |
| Baig *et al.* (2012) [24] | M | 24 | 28 | ITF | Endobuccal long incision in the vestibule fundus | LA | 3 Days | Swelling, pain | Asymptomatic at 2 weeks | Skull face and side | Yes |
| Kajla *et al.* (2016) [25] | F | 45 | 18 | ITF | Endobuccal long incision in the vestibule fundus | LA | 6 Months | NR | Asymptomatic | CT/panoramic | Yes |
| Primo *et al.* (2014) [26] | F | 14 | 18 | ITF | Endobuccal small incision parallel to the buccinator fibres | LA | 4 Months | Asymptomatic | Asymptomatic at 2 weeks | CT/panoramic | Yes |
| Khaladkar et Reddy (2020) [27] | F | 36 | 18 (Root) | ITF | Transinusian | NR | NR | NR | NR | CT/panoramic | Yes |
| Roshanghias *et al.* (2016) [28] | M | 14 | 28 | ITF | Endobuccal, sulcular extended over the tuberosity and with vertical discharge mesial to the molars | GA | NR | NR | Asymptomatic at 3 weeks | CT | Yes |
| Dimitrakopoulos et papadaki (2007) [29] | M | 46 | 28 | ITF | Endobuccal without precision | GA | NR | Emphysema/BSC | Asymptomatic | CT/panoramic | Yes |

**Table II.** Distribution of approaches.

| Approach | Number |
|---|---|
| Intra oral (sulcular or vestibular) | 19 |
| Hemicoronal | 2 |
| Transinusal | 2 |
| Coronal | 1 |
| Endobuccal + Gillies | 1 |
| Gillies | 1 |

Of the 6 cases where the tooth was palpable, the incision in the vestibule floor over the tooth was chosen in 83.3% of cases ($n = 5$). In the other case, an sulcular incision was preferred.

### Type of anaesthesia

General anaesthesia was chosen in 100% of cases ($n = 4$) for teeth in the temporal fossa.

For teeth in the infratemporal fossa, general anaesthesia was chosen in 52.38% of cases ($n = 11$) and local anaesthesia in 47.62% cases ($n = 10$). In one case the anaesthetic technique was not reported.

### Time to treatment

The time taken for management ranged from re-operation at D0 to an operation 24 years later. In 6 cases the time to recovery was not reported. In the remaining 20 cases, there were 40% of cases ($n = 8$) where management was achieved early in less than a week. In 45% of cases ($n = 9$) it was delayed between 2 weeks and 6 months and in 15% of cases ($n = 3$) it was delayed beyond 6 months.

### Symptomatology

Of all cases where symptoms were described: the most frequently reported symptoms were limitation of mouth opening (43.5%), swelling (43.5%) and pain (34.8%). Collection (8.7%), emphysema (8.7%), diplopia (4.3%) and oral-sinus communication (4.3%) were also reported. The patient was asymptomatic in 7 cases (30.4%). In 4 cases the symptoms were not specified.

In the early management, one case was asymptomatic. One case did not report symptoms and in the other six cases the symptoms reported were mouth opening limitation was present in 4 cases (57.1%), swelling in 4 cases (57.1%) and pain in 4 cases (57.1%) as well.

In the delayed management, 60% of the patient was asymptomatic, one case where nothing was reported, 1 case (10%) of mouth opening limitation and swelling and one case of cellulitis with mouth opening limitation, pain and swelling and one case of diplopia which regressed.

In the late management the patient was symptomatic in 2 cases, one with limited mouth opening and pain, one with regular periods of swelling and suppuration and in one case the patient had no symptoms.

After removal of the tooth all patients (100%) recovered and were symptom free.

### Imaging

Computer tomography (CT or CBCT) was use in 84.62% of cases ($n = 22$); the combination of two images (CT or skull X-ray) taken on different axes (front, side, axial or Blondeau) in 19.23% of cases ($n = 5$); 3.85% of case ($n = 1$) combined both.

### Removal assistance

Surgery was performed with technological assistance in 14.8% of cases ($n = 4$), with success in these 100% of cases ($n = 4$). One case of assistance with an endoscope, one case of assistance by interventional radiology, one case of assistance by cineradiography and one case by navigational guided surgery.

### Migration

In 7.69% of cases ($n = 2$) the immediate and 3-week post-operative radiographs accurately show downward migration of the tooth. The other cases do not mention it and there is no imaging to interpret it.

### Encapsulation

The presence of a fibrous capsule was reported in 11.54% of cases ($n = 3$). The other cases do not mention it.

### Complications

In no case were there any intraoperative complications.

Publication bias was present for the migration of the projected teeth and the presence of the fibrous capsule.

## Discussion

Our study is the first to review the different approaches used to manage dislocated wisdom teeth in the lateral aspect of the skull, the elements that increase the chances of successful recovery and the decision factors.

### Surgical approach and technique

For teeth located in the infratemporal fossa, a strict intra oral approach is preferable in the first instance. This may be associated with various technological aids (endoscope [11], guided navigation [21], cineradiography [15], interventional radiology [18]) which can be of precious help and increase the chances of success. Then, in a therapeutic gradient approach, the intra oral approach will be completed, if necessary, by a Gillies approach as proposed by Dawson *et al.* [15], then finally a hemicoronal approach [12].

In case of palpation of the projected tooth, an approach in the vestibule in direct contact with the tooth facilitates the search, avoids loss of landmarks and blind dissections.

The extra oral approach in first intention seems rather indicated for the teeth projected in high position, as the teeth located in the temporal space. This was done by Paoli *et al.* [20], Elgbouri *et al.* [19] and Shruthi *et al.* [17]. The full coronal approach is reserved for bilateral projections [20].

The intra oral approach has a very satisfactory success rate and has the advantage of leaving no aesthetic damage, as well as limited postoperative effects in the absence of complications [25,28,29]. Even if the incision at the bottom of the vestibule is the most practiced, the intrasulcular incision may seem more comfortable [16,23]. Knowing that the migration is generally done through the periosteum, a wide muco-periosteal detachment is made up to the projection area of the tooth, with mesial discharge in front of the maxillo-zygomatic hanger and then an incision of the periosteum as close as possible to the tooth, which reduces the risk of vascular and nerve damage.

The extra oral approach, with an incision at the capillary level also remains very acceptable aesthetically with a scar camouflaged in the hairline, a low morbidity for the modified Gillies incision but more important for the hemicoronal or coronal approach with a risk of injury to the facial nerve and alopecia, atrophy of the temporal muscle [12,17,19–21].

The transinusal approach, generates some morbidity and is also traumatic, especially in the absence of a pre-existing bucco sinusal communication, as described by Sencimen *et al.* [4,27]. Its use is limited to cases where the tooth is in direct contact with the posterior wall of the maxillary sinus. Capture of the projected tooth is also complex, with limited insertion and access for instrumentation.

The technique used will be chosen by the practitioner according to her abilities, skills and preferences, in relation to tooth position. It will partly determine the choice of anaesthetic technique.

### Complementary means

The surgical techniques associated with either interventional radiography or cineradiography, used respectively by Lutz *et al.* [18] and Dawson *et al.* [15] are reliable and reproducible complementary means. Despite the ionization of the subject, they allow intra-operatively to locate the instrument and the tooth accurately, without being hindered by soft tissue or bleeding, and to locate the tooth despite possible additional migration.

The association of an endoscope, as described by Battisti *et al.* [11], has the advantage of being no irradiating, relatively simple to use and allows a direct view in real time. Its use may seem uncomfortable at first as only one hand is available, but this is easily overcome with practice or with the assistance of the operator's assistant.

In the future in case of a transinusal approach, the use of a surgical drill guide can be very well considered, in order to have a clear defined axis of approach avoiding approximate and blind posterior and anterior wall openings.

### Imaging

Computed tomography (CT or CBCT) is an essential diagnostic tool for the management of this type of situation, especially 3D reconstructions [3,22] which allow precise location of the teeth, and give the practitioner an accurate picture of the situation. CBCT has the advantage of being less irradiating [30] and respect the ALARA (As Low Reasonably Achievable) principle [31].

The combination of front and side views also allows the tooth to be located, but in a less precise manner due to the superposition of structures. They are indicated when it is impossible to perform a tomography.

Panoramic X-rays are of no use and their use leads to an unfavorable benefit-risk ratio, resulting in ionisation of the subject and the impossibility of locating the projection with precision.

### Action time

The typical management of MTM projection involves an immediate and careful attempt at intraoperative removal, by making a wide mucoperiosteal flap to obtain sufficient visual access, to have a direct view of the projected tooth and to grasp it safely. If these last two criteria cannot be met or if the operation fails, the site is irrigated and then closed, in order to avoid any risk of deeper projection [21]. Delayed management will then be performed.

Any case reports show downward migration of projected teeth in the first few days after projection [8,18]. Others have described cases of fibrous encapsulation around the tooth, immobilising the latter [10,12,18]. Olusanya *et al.* [32] describes the same phenomenon when a tooth is displaced into the submandibular space.

These elements are arguments in favor of a delayed management as reported by several authors who recommend a management within 3–6 weeks [8,18,21]. The downward migration facilitates the removal procedure, as the tooth is more accessible. Immobilisation by the capsule stabilises the tooth and reduces the risk of deeper projection during removal maneuvers. This must be balanced against the risk of infectious complications associated with the persistence of a tooth in this anatomical area.

### Symptomatology

The presence of a tooth in the temporal or infra-temporal spaces can lead to immediate or delayed symptoms, such as limited mouth opening, pain or swelling [2,4,11,13,14,17,20,22,24,33]. They can also be completely asymptomatic over periods ranging from 4 days to 2 years [1,3,12,15,18,26]. These symptoms were most frequently

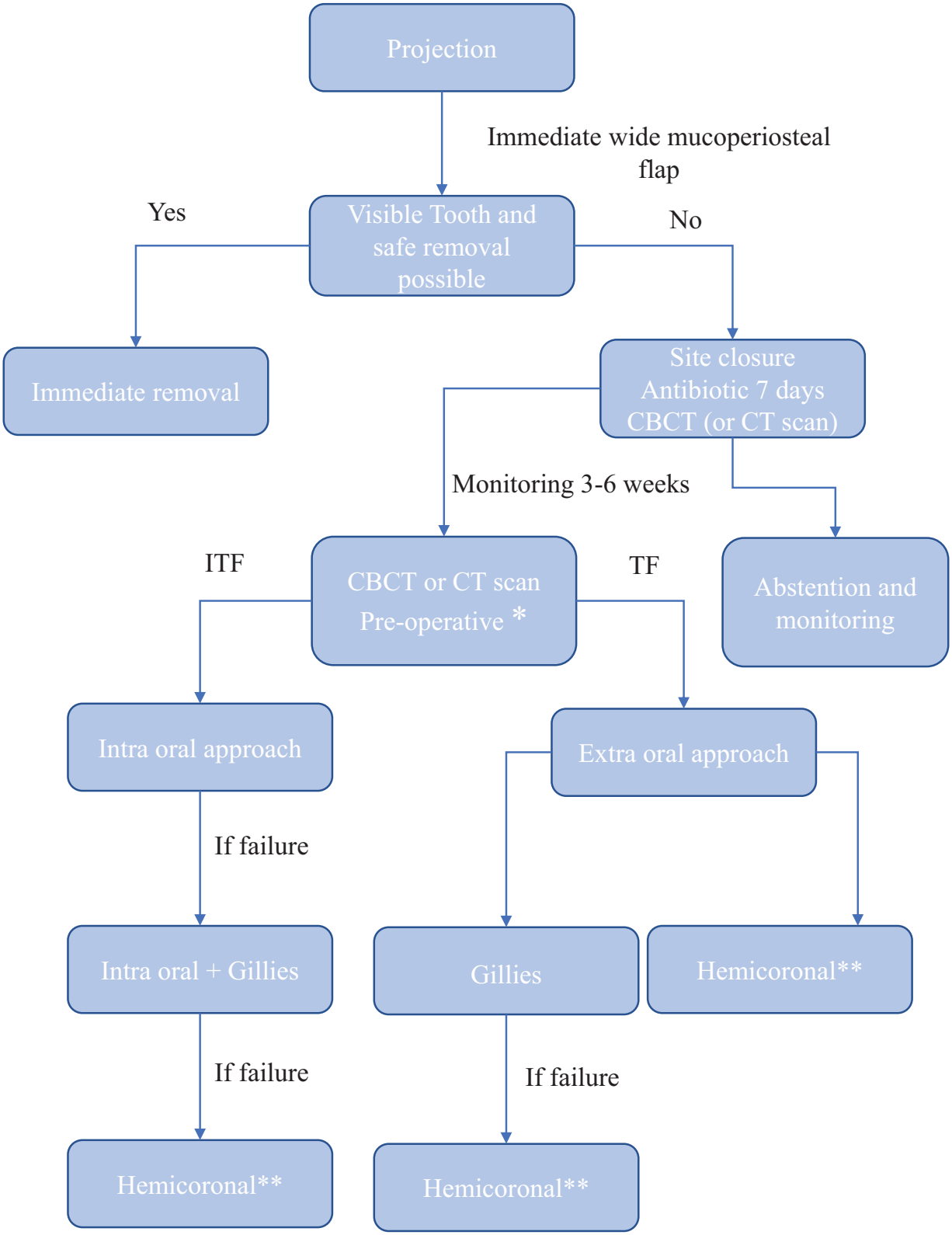


**Fig. 2.** Flowchart for the recovery of a third molar in the temporal and infra temporal spaces. * To be carried out as close as possible to the new operation. **coronal if bilateral. ITF: Infra Temporal Fossa. TF: Temporal Fossa.

found in the first few weeks. This can be explained independently of the dislocation by the classic postoperative course of third molar avulsion.

In the case of delayed removal, it is necessary to start antibiotic therapy immediately after the projection to prevent the risk of infection or a foreign body reaction that could lead to temporal cellulitis [34]. The only case in which infection occurred in early or delayed management was a case where the gauze pad was forgotten by the operators [2].

The left MTM are the most projected, this is consistent with what was observed in the study by Nogueira *et al.* This may be related to the fact that the majority of operators are right-handed and position themselves to the right of the patient, thus reducing the field of view [9].

### Flowchart

The schematisation of these results leads to this flowchart (Fig. 2). This diagram summarises the procedure to be followed with an attempt at immediate recovery if it is safe. Abstention is a therapeutic option in the absence of functional or infectious complications. It will involve close and regular monitoring. Or delayed for at least 3 weeks if not, with a different approach depending on the location of the tooth. Antibiotic therapy is given during the timeout. A CBCT (or CT-scan) will be carried out in preoperative. The therapeutic gradient is to be respected. For teeth in the infra-temporal fossa, in case of failure of an intra oral approach, the use of the modified gillies technique will allow to push the tooth into the intra oral incision. In case of further failure, a coronal approach should be considered. For teeth in the temporal fossa an extra oral approach is immediately considered. Due to the complex anatomy of the infratemporal fossa, a multidisciplinary team-based approach involving ENT and maxillofacial surgeon is necessary to treat these issues surgically (in particular, for the extra oral approach).

These suggested management of the complication, are based on case reports only and therefore on the lowest level of evidence in the scientific literature, but there are no guidelines or even a consensus on this subject and this work, can help to take therapeutic decision.

## Conclusion

To avoid this type of complication, it is important to remember to use an instrument distal to the tuberosity (retractor, buser periosteal, *etc.*) to guide the elevation and prevent the tooth from being projected under the flap and soft tissue. Keep constant visual contact with the tooth, remove the mouth opener and finally do not apply excessive, uncontrolled and blind forces.

The management of the complication must be rigorous, otherwise it may fail and worsen. The use of this protocol facilitates and structures the decision-making process.

## Conflict of interest

The authors declare no conflict of interest in regard to this article.

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## Ethical approval

Ethical Approval was not required.

## Informed consent

Informed consent was not required.

## Author contributions

B. Guégan: Methodology, Writing original draft, Reviewing, Investigation; T. Casenave: Reviewing; P. Lapeyrie: Supervision; V. Benard: Investigation.

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