**Displacement of lower third molar into floor of mouth: a single institutional experience**

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**Abstract**

Purpose

The displacement of the tooth/tooth fragment into the floor of mouth sometimes happens during the lower third molar surgery and the patients are usually referred to oral and maxillofacial surgeons. To date, however, there is no consensus how to manage the displaced tooth due to the lack of available data.

Methods

In this study, we have retrospectively analyzed the management of the displaced lower third molar into the floor of mouth. Our institute experienced seven cases during 2010 to 2020.

Results

Incidence rate of the lingual nerve injury caused by displacement of the lower third molar was 1/7. Six patients out of seven underwent surgical removal of the displaced fragment. The direct approach was used when the fragment was palpable superficially and the fragment was horizontally located away from the lingual plate (2 cases). While, when the fragment was not palpable, or was palpable and adjacent to the lingual plate, the lingual mucoperiosteal flap was selected (4 cases).

Conclusion

We conclude that the palpation and preoperative diagnosis with computed tomographic images are significantly important to decide a better and most effective surgical approach.

**Key words**

Wisdom tooth; lower third molar; tooth extraction; infection; Ludwig's angina; lingual nerve injury

## Introduction

Lower third molar removal is one of the most common procedures in oral surgery. Pain, swelling, and trismus are usually seen more or less postoperatively. Analysis of 4338 lower third molar removals found that most unfavorable surgical complications are inferior alveolar nerve (IAN) injury and lingual nerve (LN) injury that might cause permanent neurosensory disturbance, with an incidence of 0.35% and 0.69%, respectively [1]. Other potential complication of the lower third molar removal that might cause LN injury as a secondary complication is a displacement of the tooth into the anatomical spaces. The anatomical spaces include parapharyngeal space, pterygomandibular space, sublingual space, and submandibular space. Of these, displacement into the submandibular space is the most common [2]. Since Doran[4] reported the first case of the displacement into the floor of the mouth, in fact, not so many cases have been reported in English literature [2-21]. It seems like the displacement of the tooth is a rare entity due to the small number of reports. However, oral surgeons think that the displacement of the tooth into the mouth floor is not extremely rare because they empirically know those patients are occasionally referred to their hospitals. Therefore, the authors thought that a number of cases have been unreported as the surgeons might consider those are not worth reporting. However, there is no consensus how to manage the displaced tooth/fragment due to the lack of data. We believe it is extremely important to share our experience of diagnosis, treatment, and prognosis to the public so that it might help to establish consensus of management of the displacement of the lower third molar in the future.

The purpose of this study was to analyze our single institutional experience of the management of the displacement of the lower third molar into the floor of the mouth and add our experience to current understanding.

## Materials and methods

Patients who were diagnosed displacement of the tooth/fragment to the floor of the mouth due to lower third molar extraction of the mandible from 2010 to 2020 were retrospectively reviewed using the database at the Department of Oral and Maxillofacial Surgery, Okayama University Hospital. The patients' age, sex and operator of initial surgery (general dentist or oral and maxillofacial surgeon) were noted. Then, affected side, presence of infection and lingual nerve injury, type of fragment (root, crown, or entire tooth), location of displaced lower third molar, presence of lingual plate fracture/perforation, fractured area (above or below mylohyoid muscle) were recorded using computed tomography (CT) images and patient records. For the patients who underwent surgery for removal, duration of dislocation, anesthesia (local or general), approach, lingual nerve injury, and postoperative infection were noted.

The present study protocol was approved by Ethics Committee of Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences and Okayama University Hospital (Approval No.2011-003), and the study was performed in accordance with the requirements of the Declaration of Helsinki (64th WMA General Assembly, Fortaleza, Brazil, October 2013).

## Results

*Patients*

Seven patients (three females and four males) were diagnosed as displacement of the tooth/fragment into the floor of the mouth due to the lower third molar removal of the mandible during 2010 to 2020. Frequency of occurrence of this complication in our hospital during 2010 to 2020 is 2/8887 (0,023%, case4 and 5). The patients age ranged from 20 to 62 year-old with a mean of 37.7. Five patients had an initial lower third molar surgery by general dentists and two by oral and maxillofacial surgeons. The rate of lingual nerve injury caused by displacement of the lower third molar fragment was 1/7.

*Diagnosis*

Infection of the related area was not observed in any case, and one lingual nerve paresthesia was confirmed (62 year-old male, case 7) at the initial visit. Both panoramic radiography and CT (Multidetector CT for three patients and cone-beam CT for four patients) were taken to detect displaced tooth or tooth fragment in all cases. Five displacements were on the right side and two were on the left. Six cases were the root fragment displacement, one case was the crown, and no entire tooth (Fig. 1). Lingual plate fracture/perforation was observed in seven cases. Location of lingual plate fracture/perforation was above the mylohyoid line in four cases, below in two cases, and on the mylohyoid line in one case. It was difficult to determine the space (submandibular space, sublingual space, or posterior to those spaces) where each fragment was located in.

*Treatment*

Six patients out of seven underwent surgical removal of the displaced fragment and one patient (62 year-old male) refused surgery because he already had lingual nerve paresthesia when his initial visit to Okayama University Hospital and had been mentally traumatized by the previous surgery (Fig. 2).

*Surgical removal*

Duration from displacement to removal ranged 0 to 61 days (mean: 19.2 days). Four removals were performed under general anesthesia and two were local. Prophylactic antibiotics were initiated within one hour before removal and continue to be administrated for 2 days (Cefazolin 1g q8h for inpatients or amoxicillin 250mg q6h for outpatients). Two different approaches were used, direct approach via mucosal incision to the floor of the mouth and lingual mucoperiosteal flap (Fig. 3). Four fragments were approached by lingual mucoperiosteal flap and two were by direct approach.

For the direct approach, a mucosal incision was made onto the surface of the floor right above the fragment following the palpation. Then, connective tissue was bluntly dissected not to damage the LN or Wharton's duct. This approach was indicated for the displaced tooth located in the sublingual space or within the mylohyoid muscle, both of which were palpated by fingers (cases 4 and 5).

The lingual mucoperiosteal flap was utilized the scar which was made when the tooth displaced into the space. Following elevation of the lingual flap, the scar was bluntly dissected to find the fragment. This approach was used for the patient whose displaced fragment was located in the submandibular space (cases 1,2,3) or sublingual space with difficulty in palpation (case 6).

*Prognosis*

Iatrogenic lingual nerve injury or postoperative infection were not reported in any patients (0/6). One patient who did not undergo surgical removal has had no change of symptom during our follow-up.

All cases are summarized in Table 1.

**Discussion**

Displacement of the tooth fragment into the floor of the mouth has been often discussed when the complications of lower third molar removal is considered. Especially dental students and residents are taught the displacement is unfavorable as the fragment might carry the infection to the sublingual or submandibular space that is anatomically connects to the pterygomandibular space, parapharyngeal space, retropharyngeal space, and finally mediastinum [22]. Once the fragment slipped into one of those spaces, it potentially causes life-threatening infection.

*Retrieval or leaving in situ*

No consensus has been reached if the displaced fragment or tooth should be removed or left in situ, as well as immediate or delayed retrieval should be planned [23]. Some agreed that the retrieval should be

performed as soon as possible with systemic antibiotics administration [24], especially if pain, trismus, and swelling are present [25]. Delayed retrieval is mostly not recommended due to infectious etiology [13]. Others believed retrieval should be consider if the fragment is more than 5 mm as this is more likely to be symptomatic [14]. They also considered, if less than 5 mm, then initial management of the case should be conservative because the fragment might be too small to be palpated and extremely difficult to find within the soft tissue [13, 14, 23]. However, there is not enough evidence supporting this 5 mm theory. Out of six cases in the present study, three underwent removal within 3 days, however, other three cases had delayed retrieval (15, 36, and 61 days). Delayed referral by primary dentists might have resulted in delayed retrieval. Although delayed retrieval is not recommended, "unintentional" delayed retrieval may be selected in patients who are carefully informed about the risks of the procedure and motivated to reduce potential future infection, discomfort, or other complications.

*Diagnosis*

Majority of the previous reports used the term "submandibular space" or "sublingual space" to describe the location of the displacement into the floor, which is supposed to mean the space below or above the mylohyoid muscle [14,20]. In fact, it is extremely difficult in some cases to clearly differentiate whether the fragment is in the sublingual space or submandibular space during surgeries due to its depth, bleeding, and blinded surgical field. As a CT, especially CBCT, is not ideal modality to analyze soft tissues, e.g., muscle and connective tissue, those terms might have not been used correctly. As it is well known, there is no anatomical clear border between the submandibular and sublingual spaces posterior to the posterior border of the mylohyoid muscle so that there is no appropriate term for that area, although it could be an entrance of the pterygomandibular space or parapharyngeal space. However, we did not find any article that mentioned the fragment in that posterior area. Given consideration, it might be better to diagnose "displacement into the floor of the mouth" instead of "submandibular space" or "sublingual space."

Morphology of the mylohyoid muscle is also variable [26]. Herniation of the mylohyoid has been reported up to 53.3 % of the individuals and it might be a pathway of the fragment [26, 27]. This could lead the location of the fragment complicated and make locating the fragment difficult.

*Decision tree and surgical approach*

For surgical retrieval of the fragment or tooth, either intraoral or extraoral approach is performed. Adeyemi[18] and Oliveira [21] conducted the submandibular approach to remove a displaced entire tooth into the submandibular space. Whilst, in many cases of the intraoral approach, upward external pressure in the submandibular region was placed. However, it is less likely to be of help in an obese patient or if the

patient has swollen due to infection or hemorrhage[8]. Yeh [8] made a 4-mm skin incision and push upward along the lingual surface of the mandible by a hemostat to feel the fragment in addition to the lingual mucoperiosteal flap. Otherwise, most of the reported cases performed intraoral approach without skin incision. Intraoral approach can be classified into two techniques, i.e., direct approach or lingual mucoperiosteal flap.

Our institute experienced seven displacement during 2010 to 2020. As shown in our cases, the direct approach was used when the fragment was palpable superficially and the fragment was horizontally located away from the lingual plate (2 cases). While, when the fragment was not palpable (deep to the mucosa), or was palpable and adjacent to the lingual plate, the lingual mucoperiosteal flap was selected (4 cases) (Fig. 4). The lingual mucoperiosteal flap is anatomically considered safer than the direct approach when the fragment is in the submandibular space, although exact location of the fragment (whether in sublingual or submandibular space) is often unclear even after retrieval.

Also, wide-ranged periosteal elevation (from first premolar to anterior border of the ramus) may be required for a better visualization of the surgical field [15, 17], so that the mylohyoid muscle is detached to gain adequate access to the submandibular space [28]. Anatomically, the lingual nerve always run above the mylohyoid muscle [29]. So the lingual mucoperiosteal flap enables surgeon to access to the fragment without invasion of the lingual nerve when the submandibular space is directly accessed. However, in most cases, it is difficult to know the accurate location of the fragment preoperatively. When the fragment or tooth displaces, the lingual cortical plate often gets fractured, as seen in all 7 cases in this study, and the corresponding periosteum is damaged. The damaged periosteum is useful landmark to trace the displaced fragment.

While, when the fragment is palpated superficially and horizontally away from the lingual plate, direct approach may be performed. Even though this approach is the closest approach to the target, there is still a risk of LN injury. The mucosal incision has to be ended within the mucosa, never get deep to the mucosa. Therefore, the palpation and diagnosis with images preoperatively are significantly important to decide a better and most effective surgical approach.

*Perforation of lingual plate by nature*

Stacy [30] reported 2.5% of the human dry mandibles (5/200) had small lingual perforations in the lower third molar area. Perforation of the lingual plate (bony defect) at the lower third molar might increase the risk of the displacement although it is unclear.

*Lingual nerve paresthesia due to displacement*

There are only three reported cases that the patient had a lingual nerve paresthesia with the displacement of the tooth fragment before retrieval including our case 7 [3, 20]. Although those might be caused by wisdom tooth removal procedure itself, the common important findings in the three cases in CT images were that the lingual plate fracture was observed above the mylohyoid line (this means displacement happened in the sublingual space initially), and the fragment was detected at the level of or below the mylohyoid line. Given the course of the lingual nerve, the fragment could traverse the lingual nerve to reach below the mylohyoid line. This type of displacement might be a sign of "lingual nerve at a risk" (Fig. 5).

## Conclusion

Overall rate of lingual nerve injury caused by displacement of the lower third molar fragment was 1/7 in the patients who were referred to our institute during 2010 to 2020. Surgical removal of the fragment did not cause any LN injury (0/6). Selection of appropriate approach is very important for a better surgical removal.

## Acknowledgements

None

**Funding:** The authors received no funding or grants for this work from any organization or foundation.

**Conflict of Interest:** The authors declare that they have no conflicts of interest.

Ethical approval: The present study protocol was approved by Ethics Committee of Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences and Okayama University Hospital (No.2011-003). The study was performed in accordance with the requirements of the Declaration of Helsinki (64$^{th}$ WMA General Assembly, Fortaleza, Brazil, October 2013).

**Informed consent**: Ethics Committee also approved to waive to obtain written informed consent because of retrospective design.

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**Figure legends**

Fig. 1

a: tooth crown displacement

b: tooth root displacement

Fig. 2

CBCT images of case 7. Note the lingual plate fracture (red arrows) is seen above the mylohyoid line (doted lines) and displacement of fragment (white arrows) is below the mylohyoid line.

a: 3D reconstructed CBCT image

b: Coronal CBCT images

Fig. 3

a: Direct approach via mucosal incision of the floor of the mouth

b: Lingual mucoperiosteal flap

Fig. 4

Proposed decision tree for the treatment of displaced lower third molar into floor of mouth

Fig. 5

Schematic drawing of a sign of lingual nerve injury

a: In case of anterior area from posterior border of mylohyoid muscle

b: In case of posterior area from posterior border of mylohyoid muscle

Table 1

DA, direct approach; LMF, lingual mucoperiosteal flap; MH line, mylohyoid line

Fig. 1

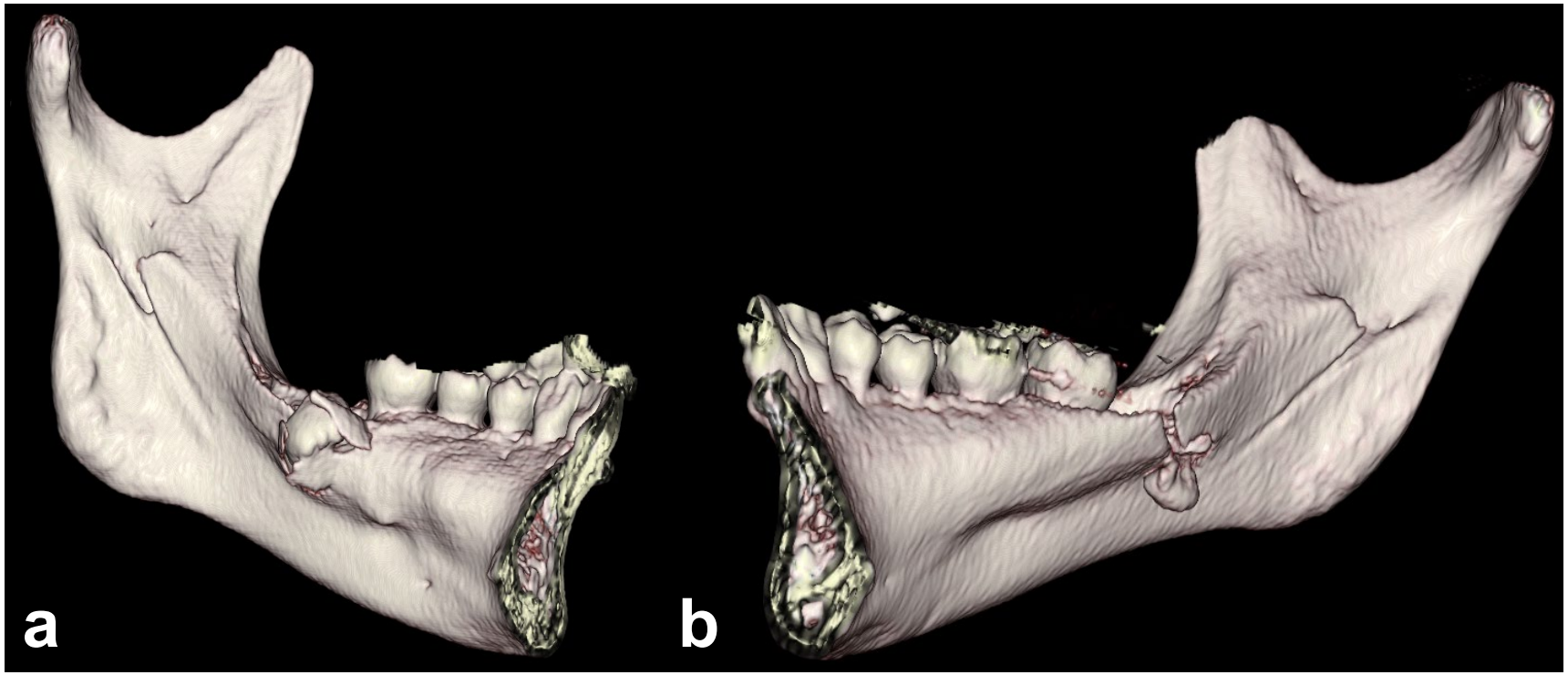

Fig. 2

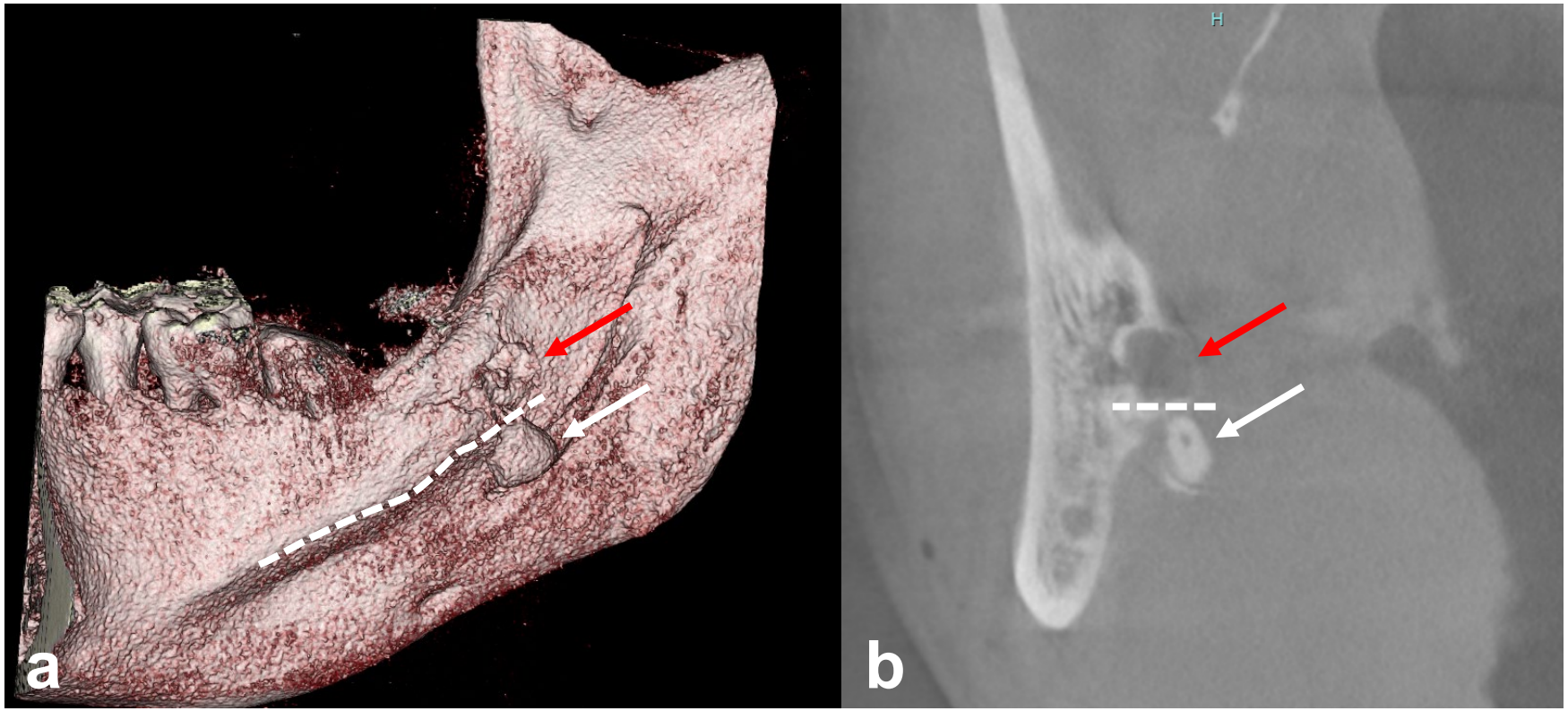

Fig. 3

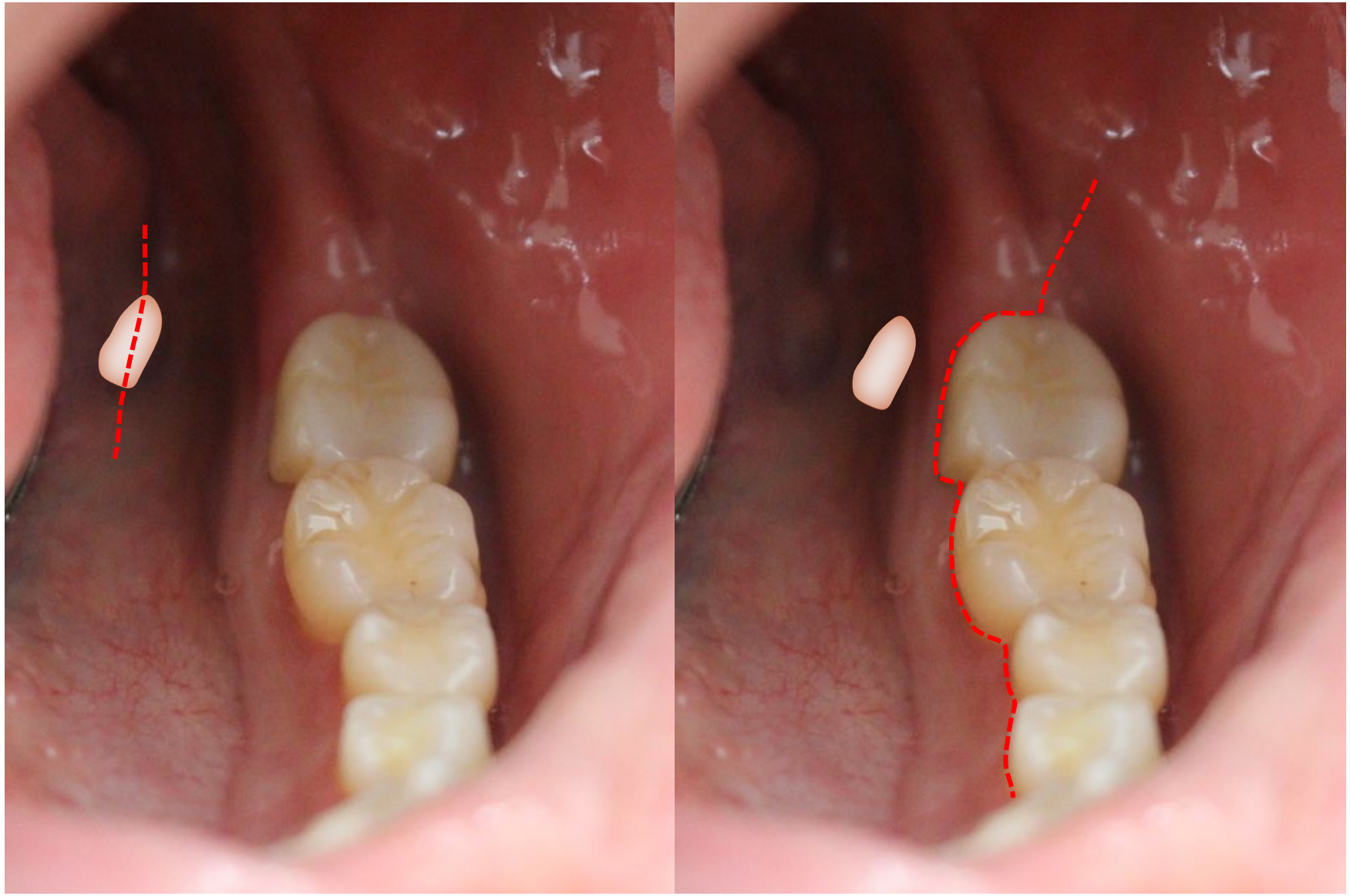

Fig. 4

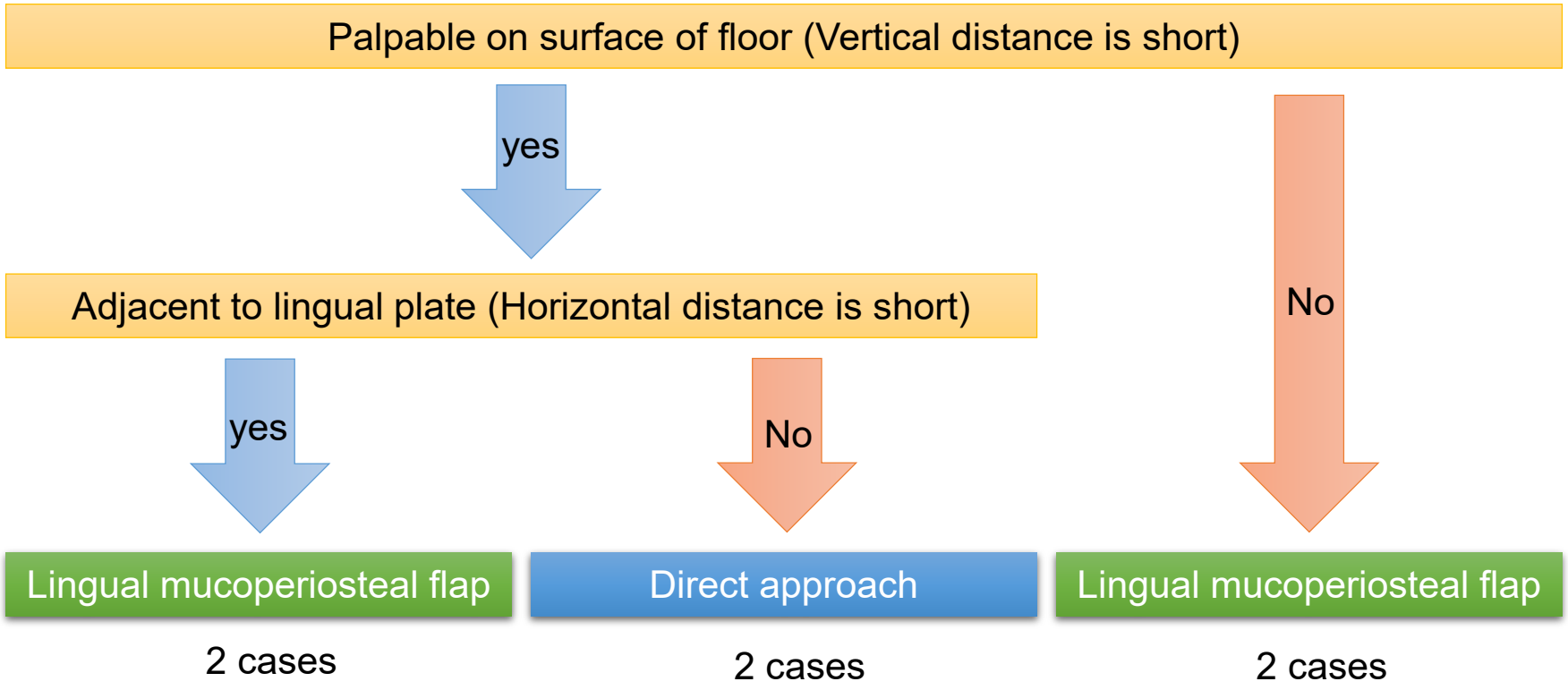
Palpable on surface of floor (Vertical distance is short)
yes
No
Adjacent to lingual plate (Horizontal distance is short)
yes
No
Lingual mucoperiosteal flap
Direct approach
Lingual mucoperiosteal flap
2 cases
2 cases
2 cases

Fig. 5

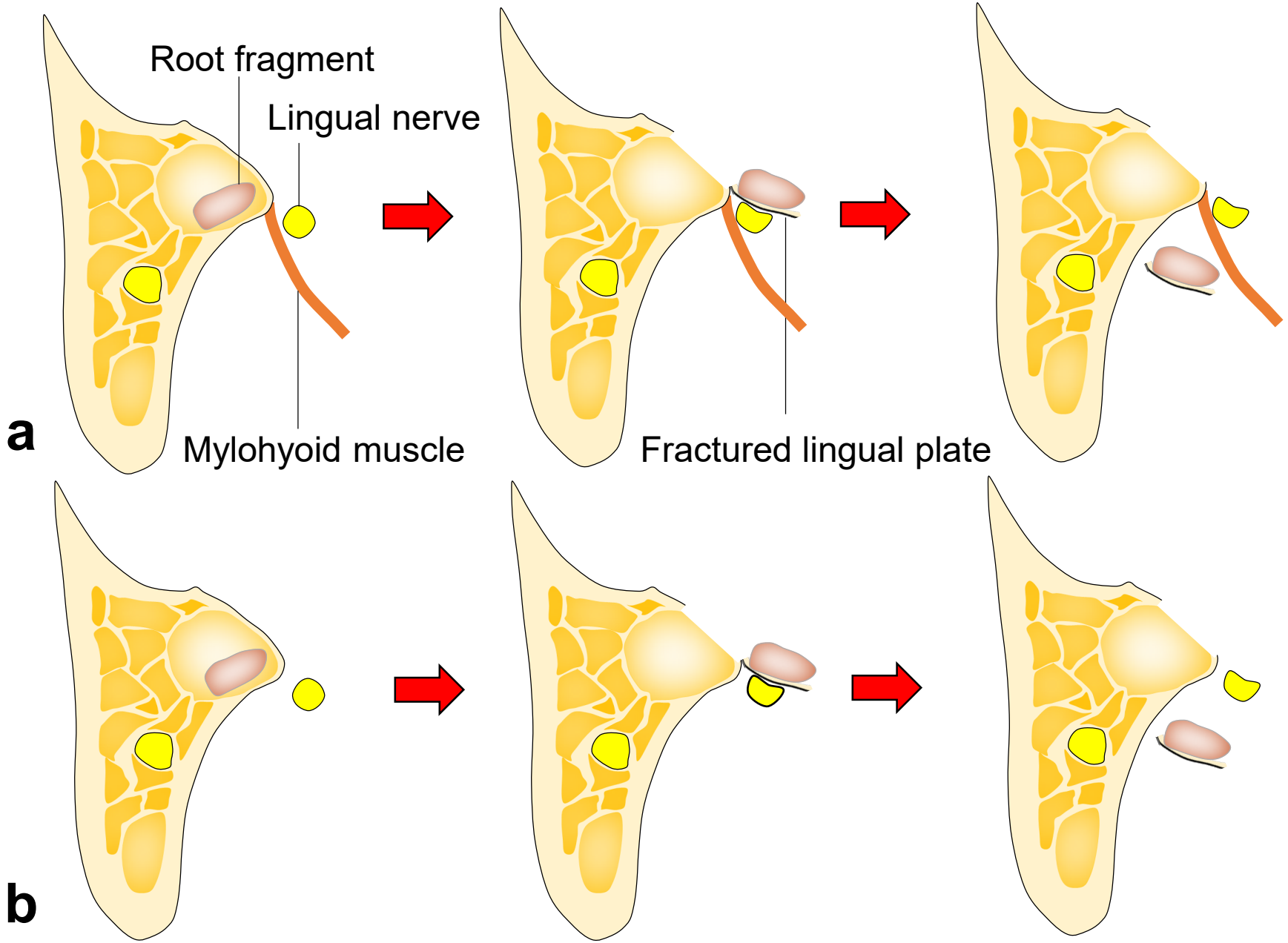
Root fragment
Lingual nerve
a
Mylohyoid muscle
Fractured lingual plate
b

**Table 1**

| | | | Diagnosis | | | | | | | Retrieval | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | Sex | Age | Side | Infection | LN injury | Fragment | Fragment location | Fracture /perforation | Fractured area | Duration (days) | Anesthesia | Approach |
| 1 | F | 38 | R | No | No | Root | Below MH line | Yes | Above MH line | 3 | General | LMF |
| 2 | M | 20 | R | No | No | Root | Below MH line | Yes | On MH line | 61 | General | LMF |
| 3 | F | 55 | R | No | No | Root | Below MH line | Yes | Below MH line | 36 | General | LMF |
| 4 | M | 22 | R | No | No | Root | Below MH line | Yes | Above MH line | 15 | General | DA |
| 5 | F | 39 | L | No | No | Root | Below MH line | Yes | Below MH line | 0 | Local | DA |
| 6 | M | 28 | L | No | No | Crown | Above MH line | Yes | Above MH line | 0 | Local | LMF |
| 7 | M | 62 | R | No | Yes | Root | Below MH line | Yes | Above MH line | | N/A | |