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Int J Case Rep Images 2023;14(2):37–41.
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A piece of orthodontic archwire in the buccal mucosa

Takuma Watanabe, Atsue Yamazaki, Shizuko Fukuhara, Shigeki Yamanaka, Kazumasa Nakao

ABSTRACT

Introduction: Oral and maxillofacial surgeons often encounter foreign bodies, but they rarely find orthodontic appliances embedded in the soft tissue.

Case Report: Herein, a woman in her twenties was lacerated in the right buccal mucosa when the orthodontist cut the distal end of an archwire with end-cutting pliers. Although she was asymptomatic after healing, she reported discomfort where the wound had existed. Computed tomography images showed a high-density area beneath the right buccal mucosa, and she was referred to our department. We diagnosed an archwire fragment embedded in the buccal mucosa and successfully removed it using computed tomography images and without additional use of fluoroscopy or a navigation system.

Conclusion: Orthodontists should carefully consider other penetrative risks of orthodontic appliances. Oral and maxillofacial surgeons are often required to resolve these accidental events based on an adequate understanding of the clinical situation.

Keywords: Buccinator muscle, Foreign body, Orthodontic archwire

How to cite this article

Watanabe T, Yamazaki A, Fukuhara S, Yamanaka S, Nakao K. A piece of orthodontic archwire in the buccal mucosa. Int J Case Rep Images 2023;14(2):37–41.

Takuma Watanabe[1], Atsue Yamazaki[1], Shizuko Fukuhara[1], Shigeki Yamanaka[1], Kazumasa Nakao[1]

Affiliations: [1]DDS, PhD, Assistant Professor, Department of Oral and Maxillofacial Surgery, Graduate School of Medicine, Kyoto University, Kyoto, Japan.

Corresponding Author: Takuma Watanabe, 54 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto 606-8507, Japan; Email: takuma@kuhp.kyoto-u.ac.jp

Received: 13 June 2023
Accepted: 14 July 2023
Published: 10 August 2023

Article ID: 101407Z01TW2023

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doi: 10.5348/101407Z01TW2023CR

INTRODUCTION

Oral and maxillofacial surgeons often encounter foreign bodies, usually due to injuries or operations [1]. A variety of foreign bodies impacted in the maxillofacial region have been reported, such as metallic objects, broken wood, and glass particles [2]. In dentistry and clinical orthodontics, there is a potential risk that any dental instrument, including orthodontic brackets and wires, can become lodged into the aerodigestive tract [3], and many complications regarding ingestion or aspiration of foreign bodies have been documented [4–8]. In contrast, to the best of our knowledge, there are fewer reports of orthodontic appliances that have become embedded in the soft tissue [3, 9–12].

Depending on the site and composition of the objects, foreign bodies can be detected and localized by plain radiographs, computed tomography (CT), magnetic resonance images (MRI), and ultrasound [1]. Among these, a preoperative CT scan is invaluable before surgical exploration because it can provide an accurate position of the foreign body relative to adjacent structures and help the surgeon to identify potential structural difficulties in retrieving it [13]. Particularly, the type and size of the object or the proximity of the object to vital anatomical structures can present challenges to the surgeon [14]. In such cases, fluoroscopy can also be a useful technique when the foreign body is in a complicated area of the maxillofacial region [15]. Furthermore, the use of a surgical navigation systems is becoming more widely used in a variety of surgeries involving the head and neck [13, 16].

We report a case in which an orthodontic archwire fragment became embedded in the buccal mucosa and was successfully removed by adequate interpretation of CT images, without additional use of fluoroscopy or a navigation system.

CASE REPORT

The patient was a woman in her twenties with no previous medical history, who had been treated at an orthodontic clinic. During the placement of a rectangular stainless steel 0.016 × 0.022-inch maxillary archwire, the orthodontist cut the distal end of the archwire with end-cutting pliers and immediately noted a laceration in her right buccal mucosa. However, the orthodontist did not realize that there was a wire fragment inside the laceration at that time. The patient temporarily demonstrated typical symptoms of inflammation, but as there were no unusual findings (such as abnormal bleeding in the wound), she went home without further treatment. After complete healing of the wound, she was asymptomatic and continued to undergo routine orthodontic treatment. However, she gradually complained of discomfort in the right buccal mucosa where the wound had existed. Four months after the injury, a CT image taken at the orthodontic clinic showed a high-density area beneath the right buccal mucosa. Subsequently, she was referred to the Department of Oral and Maxillofacial Surgery at Kyoto University Hospital to determine if the archwire fragment had penetrated the buccal mucosa.

She reported discomfort but no pain, swelling, or trismus. Intraoral examination revealed no inflammation or palpatory findings near the archwire fragment, from the buccal mucosa posterior to the right maxillary second molar. Additionally, there was no swelling or redness around the right parotid papilla, and salivary secretion was uneventful (Figure 1). Panoramic radiography showed a linear radiopacity in the posterior region of the right maxillary second molar (Figure 2). A CT image taken at our hospital also showed a linear high-density area in the buccinator muscle approximately 7 mm in length, which was located 13 mm posterior to the distolingual cusp of the right maxillary second molar and 8 mm superior to the occlusal plane of the maxilla (Figure 3A–C). We diagnosed an archwire fragment embedded in the buccal mucosa and chose to remove it because of the patient's request and reports of discomfort in the buccal mucosa, the possibility of migration into pterygomandibular space, and potential medicolegal implications.

Five months after the penetration, the archwire fragment was retrieved under local anesthesia based on the surgeon's interpretation of CT imaging. Avoiding the right parotid papilla, a vertical incision was made in the pterygomandibular raphe posterior to the right maxillary second molar, and the fragment was identified and retrieved by blunt dissection of the buccinator muscle in front of the medial pterygoid muscle (Figure 4A and B). Stensen's duct did not appear in the surgical field. The postoperative course was uneventful, and postoperative panoramic radiography showed the linear radiopacity had disappeared (Figure 5). The patient continued to undergo further treatment at the orthodontic clinic.

Figure 1: An intraoral photograph showing no inflammation or palpatory findings around the right parotid papilla and the buccal mucosa posterior to the right maxillary second molar.

Figure 2: Panoramic radiography imaging showed linear radiopacity on the posterior region of the right maxillary second molar (red arrow).

Figure 3: (A) Axial, (B) coronal, and (C) sagittal computed tomography images showed a linear high-density area approximately 7 mm in length, which was located 13 mm posterior to the distolingual cusp of the right maxillary second molar and 8 mm superior to the occlusal plane of the maxilla (red arrows).

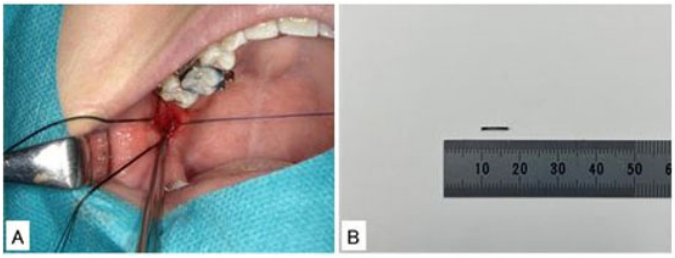

Figure 4: (A) Intraoperative photograph after retrieving the fragment and (B) the archwire fragment that measured approximately 7 mm in length.

Figure 5: Postoperative panoramic radiography imaging showed no remaining linear radiopacity.

DISCUSSION

The patient's course provided important clinical insights. Orthodontic appliances can occasionally become embedded in a patient's soft tissue [3, 9–12], although an orthodontist may not show concern until faced with evidence of such a foreign body [6]. Therefore, orthodontists should handle these appliances carefully, especially when cutting orthodontic archwires (as in the present case) or managing other small and sharp pieces. Oral and maxillofacial surgeons can remove these foreign bodies using minimally invasive procedures (and without using fluoroscopy or a navigation system), provided that the object is in a relatively shallow position and able to be localized by adequate interpretation of the CT images.

Several cases of orthodontic appliances accidentally becoming embedded in the soft tissue have been reported [3, 9–12], as well as various cases of ingestion and aspiration of orthodontic appliances [4–8, 17]. Most orthodontic components are small, and when combined with saliva, they can become difficult to handle [5, 8]. Additionally, orthodontists often clip off orthodontic wire ends (which are quite sharp) during appliance adjustment; with sufficient force, this can propel them to penetrate the oral mucosa and become embedded [3]. Given this patient's timeline and records, this is the most likely explanation for the present case. Since end-cutting pliers sometimes fail to contain the cut fragments, a cotton wool roll placed over the end of the archwire before it is cut will prevent the fragment from becoming displaced in the mouth or embedded in the patient's soft tissue [4]. Umesan et al. [17] similarly reported that use of a gauze pad as protection against the archwire or appliance can trap any stray wires that fail the "safety hold" of the pliers, as well as prevent injury to the mucosa; they further recommended that the cutter tips be visually inspected for trapped wires and wiped with sterile gauze after every cut. Routine protection of archwire tips or other appliances is recommended during orthodontic treatment because the end-cutting pliers can often fail to control the cut wire, owing to its small size, the presence of saliva, and limited maneuverability inside the oral cavity.

In similar cases regarding management of embedded dental needles, some clinicians advocate for leaving the needle fragment in place as long as the patient is asymptomatic because the surgical exploration to retrieval the fragment can itself lead to additional neurologic and tissue injury [13]. Metallic objects and glass splinters are frequently embedded as foreign bodies and are relatively well-tolerated by the body, while embedded organic materials cause more inflammation and can lead to anatomical alteration or serious complications [1, 18]. In contrast, others believe that an embedded dental needle should be removed because of the risk that needle migration could damage vital structures in the head and neck, the psychological effect on the patient of a having sharp foreign object inside them, and medicolegal implications [13, 19]. Tissue spaces such as the pterygomandibular space consist of loose connective tissue, and chewing and swallowing movements could cause migration of lost needles or embedded fragments [20, 21]. In the present case, the embedded archwire fragment was a metallic object that caused no remarkable inflammation. However, the patient requested removal of the sharp fragment due to discomfort of the buccal mucosa and the psychological distress associated with an embedded foreign object. Furthermore, we were concerned that the archwire fragment may migrate to a pterygomandibular space and damage vital structures due to persistent chewing and swallowing movements. For these reasons, we chose to remove the archwire fragment lodged in her buccinator muscle.

The standard approach of intraoperative fluoroscopic imaging can be used to provide optical feedback to the surgeon, and the immediate viewing of the images at various angles allows an operator to perform stereotaxic navigation [15]. However, fluoroscopy shows images in two dimensions and is unable to provide an accurate position of a foreign body in a three-dimensional space [13]. Additionally, there is a risk of low-level radiation exposure to the patient and operating room staff from the image intensifier used [15]. The use of a navigation system can facilitate the rapid, minimally invasive, and safe removal of a foreign body in patients with difficult anatomy [1, 22]. Eggers et al. [1] reported four preoperative circumstances that could benefit from use of a navigation system: failure of previous attempts to remove a foreign body without a navigation system; the presence of multiple foreign bodies; the presence of vulnerable anatomical structures near the foreign body or in the surgical path toward it; and the desire to achieve minimally invasive access. Since the CT scan is usually completed several days before the surgery, the foreign body may migrate during this time; therefore, it is important to minimize the time between the preoperative CT and the actual surgery [13]. In navigation systems, preoperative imaging becomes unreliable when the

location of the foreign body might suddenly change within the soft tissue [23]. In the present case, the use of fluoroscopy or navigation system was not considered necessary for this removal because this was the initial surgery, only a single fragment was present, and its three-dimensional location in the buccinator muscle was adequately determined based on interpretation of the CT images alone. Surgery to retrieve the fragment was performed approximately four weeks after the CT scan at our hospital. If the initial surgery had not been successful due to a change in position between the preoperative CT and actual surgery, fluoroscopy would have been used to identify the position of the object in real time. However, we successfully removed the fragment after discerning its location by adequate interpretation of CT images and sufficient knowledge of anatomical structures in the oral region.

CONCLUSION

An accidental injury event sustained during treatment and involving a foreign body may cause a patient to develop a phobic attitude toward continued treatment, and possibly loss of trust in the orthodontist as well. Therefore, orthodontists should carefully consider the risk of accidental ingestion, aspiration, or penetration of any orthodontic appliances while providing treatment, especially since many such appliances are small and difficult to handle in the presence of saliva and within a confined space. Such an injury may have a considerable psychological impact on patients and their family members, and an oral and maxillofacial surgeon is often required to resolve these accidental events based on an adequate understanding of the clinical situation.

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Author Contributions

Takuma Watanabe – Conception of the work, Design of the work, Acquisition of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Atsue Yamazaki – Conception of the work, Design of the work, Acquisition of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Shizuko Fukuhara – Conception of the work, Design of the work, Acquisition of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Shigeki Yamanaka – Conception of the work, Design of the work, Acquisition of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Kazumasa Nakao – Conception of the work, Design of the work, Acquisition of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

Source of Support

None.

Consent Statement

Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.