

Analysis of Retained Foreign Bodies in the Maxillofacial Region: A Retrospective Study

Kadriye Ayça DERE 

ABSTRACT

Aim: Retained foreign bodies in the maxillofacial region are caused by trauma, therapeutic procedures, or previous surgeries in which the broken instruments were left behind. They can usually be asymptomatic, but can also cause infections, be swallowed, or block the airway, leading to vital problems. Despite the complications they can cause, one-third of foreign bodies are overlooked during initial clinical and radiographic examinations. Therefore, the presence of foreign bodies and the symptoms they cause will be studied in patients examined during a specific time period.

Material and Methods: From December 2020 to August 2022, 6 624 radiological data were collected and retrospectively analysed. The number, characteristics, location of foreign bodies, age, and sex of patients were recorded.

Results: Radiologic data from 6624 patients who presented to the oral and maxillofacial clinic between the dates included in the study were reviewed, and 48 patients were found to have retained foreign bodies at a frequency of 0.77%. Of these patients, 22 were male and 26 were female. It was found that most of the retained foreign bodies were located in the mandible (80.85%). The foreign bodies detected were filling materials, canal sealers, drills, bein elevator pieces, buckshots, and dental forceps pieces, with filling materials being found significantly more often than other detected retained foreign bodies ($p<0.05$).

Conclusion: Although most foreign bodies are asymptomatic and may go unnoticed, removal of foreign bodies after their discovery with a careful clinical and radiological examination in the maxillary region is important to prevent possible complications.

Keywords: Foreign bodies; radiography; jaw.

Maksillofasial Bölgede Yer Alan Yabancı Cisimlerin Analizi: Retrospektif Çalışma

ÖZ

Amaç: Maksillofasial bölgede yer alan yabancı cisimler travma, terapötik müdahaleler veya ameliyatlarda sırasında kırılan aletlerin geride bırakılması sebebiyle izlenirler. Etraflarındaki kemik, yumuşak dokuda veya antral boşluklarda asemptomatik olarak yer alabilirlerken; enfeksiyona, yer değiştirerek solunum yollarında hayati problemlere de neden olabilmektedirler. Bu sebeple, bu çalışmada belli bir zaman aralığında Ağız, Diş ve Çene Kliniğinde muayene edilen hastalarda yabancı cisim varlığı ve yarattıkları semptomların araştırılması amaçlanmıştır.

Gereç ve Yöntemler: Aralık 2020- Ağustos 2022 tarihleri arasında tek hekim tarafından tedavi edilen 6 624 hastanın radyolojik verileri incelenmiştir. Yabancı cismin sayısı, karakteristiği, yeri, hastaların yaş ve cinsiyet bilgileri kaydedilmiş ve değerlendirilmiştir.

Bulgular: Çalışmaya dahil edilen tarihler arasında Ağız, Diş ve Çene Kliniğine başvuran 6 624 hastanın radyolojik verileri incelenmiş ve 48 hastada, %0,77 sıklıkta yabancı cisim tespit edilmiştir. Bu hastaların 22'si erkek, 26'sı kadındır. Tespit edilen yabancı cisimlerin çoğunun mandibulada (%80,85) yerleştiği görülmüştür. Dolgu materyalleri, kanal patı, frez, bein elevator parçası, saçma ve presel parçaları yabancı cisim olarak saptanmış ve dolgu materyalleri tespit edilen diğer yabancı cisimlere göre anlamlı derecede daha sık izlenmiştir ($p<0,05$).

Sonuç: Çoğu asemptomatik olmasına ve fark edilememesine rağmen, maksillofasial bölgede yer alan yabancı cisimler yapılacak dikkatli klinik ve radyolojik muayene ile tespit edildikten sonra çıkarılması veya düzenli aralıklarla takip edilmeleri olası komplikasyonların önlenmesi açısından önem taşımaktadır.

Anahtar Kelimeler: Yabancı cisimler; radyografi; çene.

INTRODUCTION

Retained foreign bodies (RFBs) are microscopic or macroscopic objects introduced into the human body at the time of a surgical procedure, iatrogenic intervention, or accidental injury (1). RFBs in the maxillofacial region are commonly observed by leaving structures such as glass, wood, metal objects, shrapnel, and sand in the tissues after motor vehicle accidents, injuries, trauma, assaults, and gunshot wounds (2,3). In addition, residues of filling materials such as canal sealer, calcium hydroxide, amalgam, orthodontic bands, needles, and root canal instruments are less frequently observed in the hard and soft tissues in this region as an undesirable consequence of therapeutic procedures on the jaws and teeth. Broken parts of dental and surgical instruments, as well as drills made of materials such as stainless steel and tungsten carbide used in several sterilization procedures, are also seen as RFB in the region, but very rarely (4,5).

In general, RFBs in the jaw are small, relatively inert in structure, and asymptomatic. They usually present a challenge to oral and maxillofacial surgeons because of many factors, such as finding RFBs, determining their location, access, and close anatomical relationship to vital structures and deep spaces of the maxillary region (6,7). The literature indicates that approximately one-third of foreign bodies are missed during routine clinical and radiographic examinations (8). When they are noticed or show symptoms and need to be removed, imaging techniques such as panoramic radiography, computed tomography, magnetic resonance, ultrasound, and an electromagnetic metal detector are used to determine their location and reach the area where they are located (9-12). In addition, navigation systems and augmented reality technologies, which have become popular nowadays, are used to access and remove these objects, and the literature states that they provide more successful results than traditional surgical methods (13-15).

The aim of this study is to investigate the prevalence of RFBs in the maxillary region in patients treated by a single physician in the Department of Oral and Maxillofacial Surgery, Pamukkale University, and to evaluate the etiology, characteristics, and pathologies that cause them.

MATERIAL AND METHODS

The study was approved by the Ethics Committee of Pamukkale University (No: 60116787-020 / 73421) and conducted in accordance with the World Medical Association Declaration of Helsinki Principles.

This study was planned to detect retained foreign bodies in the radiographic data of patients who presented to Pamukkale University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery for routine dental examinations and were treated by a single clinician (K.A.D.) between December 2020 and August 2022. To obtain patient data between the indicated dates, the Dentistry Project Management System (TRtek Medical Software, Turkey) was scanned, 6 649 patients were identified, and patient radiographic data were collected using Cliniview (Instrumentarium Dental, Finland). 25 Radiographic data with insufficient visibility for diagnosis due to low resolution and artifacts were excluded from the

study, and 6 224 radiographic data were included in the study for analysis.

All radiographs were reviewed, and the diagnosis of RFBs was made by evaluating radiolucent or radiopaque abnormalities in the radiographic data along with the patient's dental history. Information such as patient age, sex, number, characteristics, and location of RFBs was recorded.

Statistical Analysis

All descriptive and comparative statistical analyses were performed using the IBS SPSS software package (Statistical Package for Social Sciences, version 23.0, SPSS Inc., Chicago, USA). Descriptive statistics of the data n(%) values were calculated. Chi-square analysis was used to examine the distribution/localization of RFBs in the maxillofacial region and to compare the frequency between them. $P < 0.05$ was considered significant.

RESULTS

Forty-eight RFB impactions were detected in 6 224 patients who visited the Oral and Maxillofacial Surgery Clinic of Pamukkale University during the study period, corresponding to a prevalence of 0.77%. Females predominated (22 males and 26 females), and the age of the patients ranged from 18 to 78 years with a mean of 45,04(SD±17,49; min-max:12-78) years (Figure 1). While one foreign body was observed in 22 patients, 2 or more foreign bodies were observed in 26 patients.

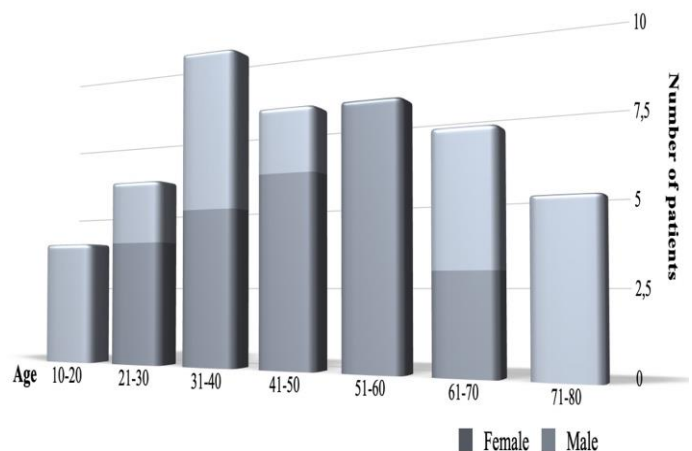


Fig. 1 Age and gender distribution of patients with Retained Foreign Bodies

While more foreign bodies were observed in the mandible than in the maxilla, the total number of foreign bodies was found to be higher on the left side than on the right side in both jaws (Table 1). In the study group, filling materials, canal sealers, buckshot, drills, bein elevator pieces, and dental forceps pieces were detected as foreign bodies (Table 2 and Figure 2,3), and filling materials were found significantly more frequently than other detected RFBs ($p = 0,037$). There is a statistical correlation between the location of the foreign body and the property of the foreign body ($p = 0.001$). The frequency of canal sealers in the left maxilla and filling material in the right mandible is higher (Table 2).

Table 1. Jaw and side distributions of RFBs

Side/Jaw	Maxilla n(%)	Mandible n(%)	Total
Right	4(23,52)	13(76,48)	17(100)
Left	5(16,67)	25(83,33)	30(100)
Total	9(19,15)	38(80,85)	47(100)

Frequency percentage values were calculated by evaluating each line within itself.

Table 2. Characteristic and location distributions of RFBs in the maxillofacial region

Location	Retained Foreign Bodies						p
	Filling Materials n(%)	Canal Sealer n(%)	Bur pieces n(%)	Elevator pieces n(%)	Buckshot n(%)	Dental tweezer piece n(%)	
Right maxilla	1(2,1) ^a	1(2,1) ^a	0(0) ^a	1(2,1) ^a	1(2,1) ^a	0(0) ^a	>0.05
Left maxilla	1(2,1) ^a	3(6,3) ^b	0(0) ^{a,b}	0(0) ^{a,b}	0(0) ^{a,b}	1(2,1) ^b	= 0.037*
Right mandible	10(20,8) ^a	1(2,1) ^a	2(4,2) ^a	0(0) ^a	0(0) ^a	0(0) ^a	>0.05
Left mandible	20(41,7) ^a	2(4,2) ^a	0(0) ^a	2(4,2) ^a	1(2,1) ^a	0(0) ^a	>0.05
Zygoma	0(0) ^a	0(0) ^{a,b}	0(0) ^{a,b}	0(0) ^{a,b}	1(2,1) ^b	0(0) ^{a,b}	>0.05
Total	32(100)	7(100)	2(100)	3(100)	3(100)	1(100)	= 0.001**

Pearson's chi-square test: *p<0.05, **p<0.01.

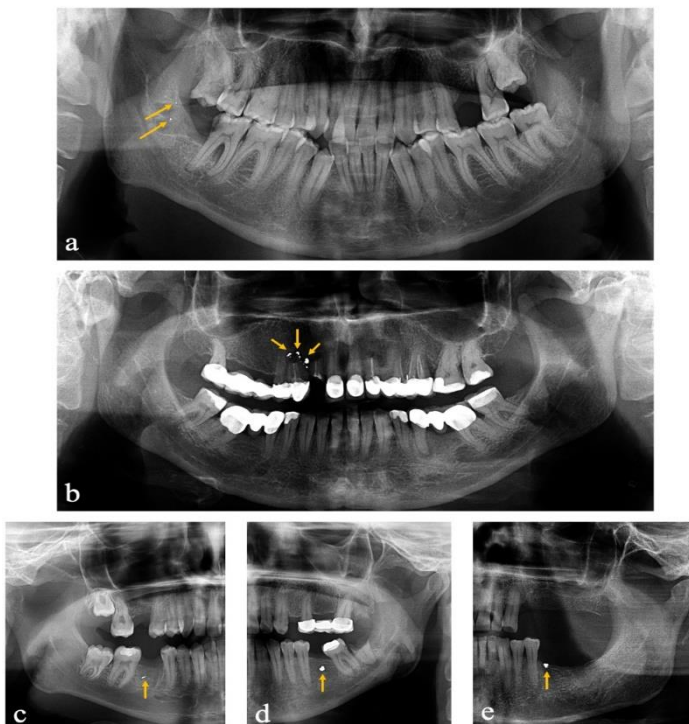


Fig. 2 (a) Scattering of drill pieces in the socket (b) Abnormal placement of amalgam used as retrograde filling in the cavity around the tooth root (c), (d), (e) Amalgam particles in extraction sockets of teeth

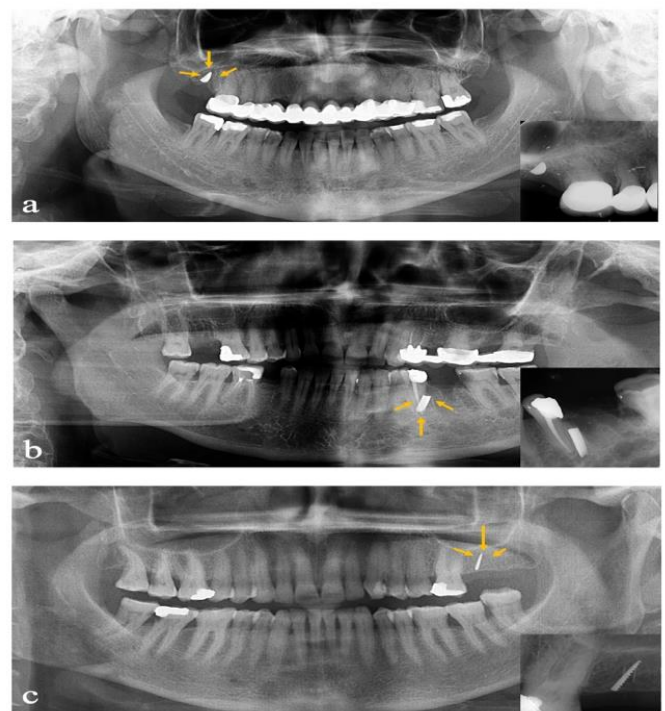


Fig. 3 (a), (b) Broken parts of bein elevators located in the jaw bones (c) Fractured fragment of dental tweezers located in maxilla posterior region

RFBs were observed in the edentulous region at 62.5 percent and around the roots of the teeth at 37.5 percent. There is a statistical relation between the characteristic of RFBs and their presence in the edentulous region or around the tooth roots ($p=0.017$). The proportion of filling material is higher in the edentulous area, while the proportion of sealant is higher around the roots of the teeth. The proportion of symptom-free patients was found to be statistically higher ($p < 0.05$). The vast majority of patients were asymptomatic (42 patients) and became aware of the presence of an RFB during a routine examination or an examination for another dental problem. A statistical association was found between the foreign body characteristic and symptoms ($p= 0.001$). A high rate of symptoms was noted in cases with bein elevator pieces.

DISCUSSION

The maxillofacial region has an anatomically complex structure and is closely related to various systems and organs. This region contains the external orifices of the respiratory and digestive systems, the orbits with the orbits and their surrounding tissues, as well as deep anatomical cavities and highly complicated vascular and nervous structures. Mastery of this anatomy is important to know these potential complications of RFBs and to resolve these serious situations. The fate of a foreign body should be determined, as it can be a source of persistent pain, infection, and suppuration in the area, migrate to deeper regions of the body, and damage anatomic structures. A review of the literature on this topic reveals that, unlike other medical specialties, most previous studies of foreign bodies in the maxillofacial region have been case reports(3,5,8,14,16). Despite this anatomical complexity, which is a trauma-prone region and encompasses the oral cavity where dental procedures are performed with many materials and tools, the prevalence of foreign bodies in this region is not high in research articles on this topic (17). The literature reports that the prevalence of foreign bodies in panoramic films ranges from 0.3% to 2.8% (18). In our study, the prevalence of foreign bodies was also 0.77%, and this low rate in the literature and our study may be related to the sensitivity of the imaging techniques used, whether foreign bodies can be visualized by these techniques because of their structure, the difficulty of detecting them, and that they are asymptomatic.

Foreign bodies in the maxillary region range widely, from debris caused by accidents, trauma, and gunshot wounds to materials and tools used in treatments in the region (2,3). Eggers et al. reported that the most common foreign bodies in the jawbone are metallic substances (11). In our study, 41 of 48 patients with foreign bodies (85.4%) were also found to have a metallic structure. Amalgam particles were detected in the jawbones of 32 of these 41 patients (RFB), and significantly more frequently than other RFBs detected. This high rate can be attributed to the fact that amalgam is still used as a filling and retrograde filling material in routine dental practice because of its efficacy and cost, as noted in previous studies (19,20). In addition, amalgam particles were found in the mandible of 30 of 32 patients. This can be attributed to the fact that the teeth in the molar region of the mandible are more frequently affected by caries (21) and the restoration of these caries is done with amalgam due to some advantages

In dental and surgical procedures, some problems may occur depending on the material property, quality, faulty manufacturing, service life, fatigue and corrosion of the instruments used. In addition to disposable materials, metal dental and surgical hand tools are sterilized after use and reused in procedures. Therefore, depending on the reuse, chemical cleaning, and sterilization procedures, the instruments experience fatigue, corrosion, and rust, and the sharp and fine tips may break during use for these reasons (16,22). In parallel with this information, our study found the fracture of materials that are used repeatedly in dental practice, such as bein elevators, dental forceps, and drills. Evaluation of the breakage rate of instrument fragments yielded a value of 0.096%. Similarly, instrument fracture is a rare intraoperative complication reported sporadically in the literature for dental extractions (23). In orthopedic studies on this topic, the rate of intraoperative instrument fracture was reported to be 0.35% and 0.18% in two different studies (24,25). It is suggested that this difference may be due to regional bone density, the structure of the instruments used, the amount of force and torque applied in the use of the instruments used, and the sample size of the studies. While there are only 5 cases of bein elevator fractures in the literature (5,22,23), 3 bein elevator fragments were found in our study group. One of the bein elevator fractures was performed by our student who was completing his internship in the clinic, and this situation once again shows us the importance of using hand tools with proper technique and force, as well as paying attention to material deformation.

RFBs are generally small, inert, and asymptomatic structures, but the literature reports that they can present with pain, infection, synovitis, paresthesias in the peripheral nerves, cystic lesions, eczematous symptoms due to metal allergy, and dysplastic transformation in the area where they are located during retention (6,7,26,27). Despite these serious complications they can cause, it is known that one third of foreign bodies are missed during routine clinical and radiological examinations (8). In order to avoid these symptoms and conditions in patients, it is important to choose the right clinical examination and, especially, the right radiographic method to detect these structures. In our study, only 6 of the patients with RFB presented to the clinic because of symptoms, and the other patients presented because of other dental or orthodontic problems. This situation raised the concern that there might be individuals in the study group who were asymptomatic but had RFB maxillofacial problems that could not be detected by the radiographic method used, and that these individuals might have serious symptoms. Conventional radiographs, CT, MRI, USG, and CBCT can be used to detect these objects (2). The conventional radiographs commonly used can identify the location of a RFB and help assess whether the object is in a critical position. However, because of the overlap of RFBs implanted in soft tissue with bone, additional imaging techniques are needed to determine the correct position. The CT examination is a useful method for determining the position of RFBs, assessing the size and width of the object, and its relationship to surrounding structures. However, the resulting metal artifacts are a major obstacle to detecting these structures with CT imaging. In general, CBCT is reported to have the highest diagnostic sensitivity

for detecting RFBs and therefore can be used as the first imaging modality for foreign body detection in trauma patients, but metal artifacts also occur with this technique. MRI is superior to CT when nonmagnetic foreign bodies such as wood are suspected, but metallic foreign bodies should be ensured to be nonmagnetic. USG is useful in locating superficial foreign bodies, but is not always suitable for assessing objects in deep and air-filled spaces. USG is more effective than CT and conventional radiography in detecting and localizing superficial foreign bodies with low tissue X-ray density. However, for imaging airborne foreign bodies, CT is more useful than USG and conventional radiography (11,12). Patients included in the study were evaluated using panoramic radiographs routinely taken at presentation to the clinic. Panoramic radiographs of patients who presented with symptoms also showed the cause of the problem and did not require advanced imaging. For this reason, structures of organic origin such as wood, glass, plastic, and RFB could not be detected. This is a limitation of this study.

CONCLUSION

Foreign bodies in the maxillofacial region are of great concern to both clinicians and patients because they migrate into the anatomical region and interstitial spaces and cause complications in the patient. Apart from the medical problems caused by them, the popularity of malpractice and related cases is increasing day by day, so clinicians are also facing legal problems. It should not be forgotten that to avoid this situation, it is also important to pay attention to the clinician, the medical tact, as well as the preoperative and postoperative control of the instruments, the materials from which the instruments are made, the duration of their use, the number of sterilizations, the surface deformation and their maintenance.

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