



ISSN Print: 2394-7489  
ISSN Online: 2394-7497  
IJADS 2021; 7(1): 104-107  
© 2021 IJADS  
[www.oraljournal.com](http://www.oraljournal.com)  
Received: 16-11-2020  
Accepted: 19-12-2020

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## Vascular-nerve complications following oral surgery: hematoma and neuroma: A literature review

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DOI: <https://doi.org/10.22271/oral.2021.v7.i1b.1124>

### Abstract

**Introduction:** Oral traumas and surgery frequently lead to injuries such as neuromas and hematomas.

**Materials and Methods:** PubMed was searched up using the keywords: “oral traumatic neuroma”, “neuroma dental implant” and “oral hematoma”. Works about oral surgery were considered.

**Results:** In some of the studies included in this review, traumatic neuroma was found following dental extraction; others following chin augmentation and sagittal osteotomy of the mandible. Implant surgery also appears to be linked to the development of traumatic neuromas.

Bilateral bifid mandibular canal is a rare anatomic variation which, if present, can lead to the neuroma following surgery of the lower third molar and the placement of dental implants. The vast majority of cases of hematoma are consequent to oral surgery (rarely have spontaneous hematomas have been described in patients taking antiplatelets or anticoagulants).

**Conclusion:** The literature shows a concrete risk of hematoma and traumatic neuroma following oral or maxillofacial surgery. Particular attention should be paid to patients with coagulation abnormalities.

**Keywords:** Oral hematoma, oral post-surgical lesions, oral traumatic lesions, oral traumatic neuroma

### 1. Introduction

Oral vascular-nerve complications are an occasional finding in daily outpatient treatment [1]. This can lead to post-operative sequelae, sometimes very heavy for patients, with the development of traumatic neuromas [2] and hematomas [3]. Traumatic neuroma is a hyperproliferation of the nervous tissue that could cause pain and alteration of nerve transmission [4].

Particularly, regarding nerve injuries, they can be classified into:

- Neurapraxia: functional block of transmission without a physical injury to the nerve;
- Axonotmesis: it's a physical lesion of the nerve where the connective sheaths have not been damaged;
- Neurotmesis: it is a total lesion of the nerve and also of the connective sheaths [5]. This type of injury leads to the formation of the amputation neuroma, which is not properly a neoplasm but a vain attempt of the nerve to regenerate itself by a reactive hyperplasia of the nerve tissue itself [6]. Amputation or traumatic neuromas can cause neuropathic pain. Pressure on the suspicious area induces pain and localized analgesia relieves pain [7].

In the oral cavity the main sites of onset are the mental foramen, the lower lip and the lingual mucosa [8]. Intraosseous neuromas, on the other hand, are rare, and this seems to be due to the fact that the typical hyperproliferation of the neuroma does not occur because of the unexplained surrounding bone tissue [9]. The oral hematoma is blood collection within the oral mucous tissue usually caused by surgery or accidental trauma. This postoperative complication occurs after late bleeding: if the bleeding is not adequately controlled there is a risk of developing hematomas of such magnitude as to occlude the upper respiratory tract and cause secondary infections due to bacterial proliferation at the site of blood collection [10]. The increased risk of oral hematomas associated with the use of oral anticoagulants is well known and reported in the literature [11].

These injuries can obviously be induced by orofacial trauma [12]. The aim of the present work is to provide an overview of these specific oral surgical complications with a focus on the clinical features and the diagnostic approach.

## 2. Materials and methods

We investigated PubMed by researching:

- “oral traumatic neuroma” obtaining 57 results;
- “neuroma dental implant” obtaining 10 results;
- “oral hematoma” obtaining 7855 results;
- “oral hematoma dental implants” obtaining 96 results (Fig. 1).

Only 30 of these articles have been selected.

Except for the work of Seddon on the classification of nerve lesions (1942) published on the British Medical Journal, only articles from the last 40 years have been included in this review.

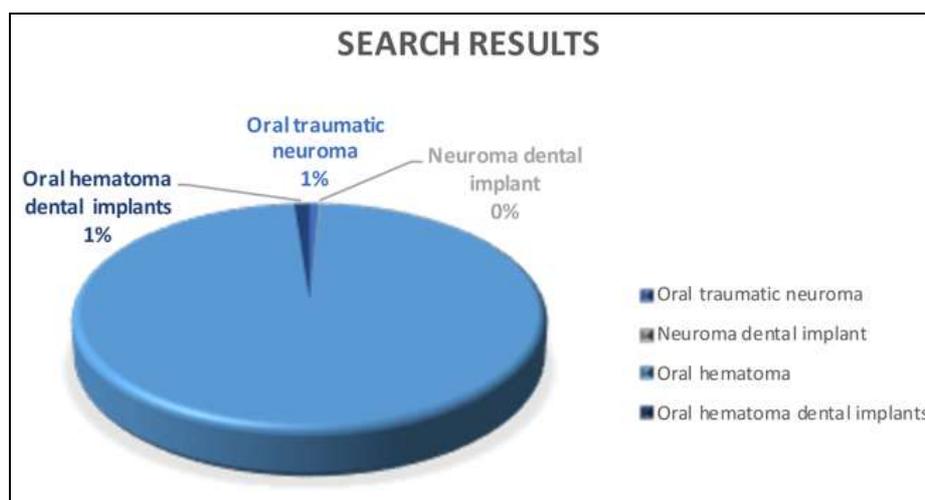
The inclusions criteria used for this article were the selection, when possible, of recent articles, with well-structured experimental designs and systematic reviews.

## 3. Results & Discussion

Traumatic oral neuromas are rare lesions of the oral cavity. According to the work of Jones *et al.* [13] and Salla *et al.* [14] the cases of atraumatic neuroma between oral and maxillofacial lesions are less than 0.5%. The most affected subjects are young and middle-aged adults [13, 15] and women seem to be more interested than men with a ratio of 2:1 [13]. Traumatic intraosseous neuromas are even rarer, due to bone density as previously mentioned [15]. Tooth extraction appears to be the most frequent cause of oral traumatic neuromas according to the literature. Peszkowski *et al.* [15] compared the characteristics of 45 oral traumatic neuromas founding that 4 of these were associated with tooth extractions and all four cases were accompanied by pain. Moreover, in just over half the cases of all painful neuromas, an inflammatory infiltrate was present histologically. In a case report by Garcia *et al.* [16] a 56-year-old patient complained of hyperesthesia and paresthesia in the region of the lower lip and of the lower left third molar, where in the second decade of life he had undergone the extraction of the same tooth. Radiological examinations showed the presence of an osteolytic lesion in the mandibular canal. Histology confirmed the diagnosis of traumatic neuroma after incisional biopsy. The lesion was then removed with an intraoral approach and after three years of follow-up the full remission of the symptoms occurred. A work by Jham *et al.* [6] reports the case of a 22-year-old girl with neuroma following extraction of a third unerupted left lower molar two years earlier. During the follow-up period, spontaneous and complete remission of the lesion was observed. Another cause of the onset of traumatic neuroma seems to be the insertion of dental implants [17-19]. Lower alveolar nerve lesions during posterior mandibular implantology surgical procedures occur in 5-15% of cases, with permanent sensory alterations of 8%. Compression of implants and perforations during preparation may induce the development of traumatic neuromas and in some cases result in centralized pain syndrome [17]. Chau *et al.* have reported a case of traumatic painful neuroma of the inferior alveolar nerve following a sagittal osteotomy of the mandible [20]. Two other case reports show the appearance of an asymptomatic traumatic neuroma after bilateral sagittal osteotomy of the mandible [21, 22]. Some other cases of traumatic neuroma due to oral and maxillofacial surgery were recorded following

chin augmentation (mental nerve) [23], after laser cryosurgery for treatment of a recurrent mucocele [24] and subsequent to inferomedial orbital decompression surgery in Graves' orbitopathy (infraorbital nerve) [25]. As for the clinical features, this lesion most commonly appears as a non-ulcerated lump with a smooth surface [26]. However, in a very recent literature study, Ribeiro *et al.* described a traumatic neuroma that clinically simulated a vascular lesion, in fact the diagnosis was made thanks to histological examination [27]. Differential diagnosis includes other neural lesions including neurofibroma, traumatic neuroma, schwannoma, and encapsulated palisade neuroma [26]. Regarding the treatment of these lesions, many authors agree that when the conservative maneuvers and the pharmacological support with anti-inflammatories, narcotics and anti-convulsants cannot lead to a resolution of the symptomatic presentation then surgical excision of the lesion is indicated [7, 17]. Microsurgical repair is indicated when functional impairment and pain persists, and in any case, it's the elective approach to be implemented early in lesions of the lingual nerve [28]. In the case of injuries due to implant insertion the best approach consists in analgesic therapy and also in placing implants with a shorter length in the absence of remission [18]. Also for oral hematomas the most frequent causes seem to be teeth extractions [29] and dental implants insertion [3, 30-33], where the perforation of the lingual cortex and the resulting hematoma may necessitate tracheotomy in severe cases. Post-extraction bleeding is a frequently observed complication [34] and can generally be justified by the exhaustion of the effect of the vasoconstrictor contained in the local anesthetic [10]. In lower molars this complication occurs in 0.6% of cases, while for those in the upper arch in 0.4% [35]. However, it's interesting to report that cases of idiopathic oral hematomas are described in the literature [36]. Late hemorrhage may develop into large hematomas within intraoral soft tissues [37]. Clinically, an oral superficial hematoma may appear as a wine-red lesion of varying size. The treatment of late bleeding consists in compressive maneuvers, which if ineffective make it necessary to reopen the surgical access and identify the origin of the bleeding in order to carry out the appropriate hemostatic maneuvers. Prevention is based on the local prophylaxis of intraoperative hemorrhage, on the knowledge of the local anatomy and obviously on an accurate anamnesis aimed at understanding if congenital or acquired coagulopathies are present [10]. In fact, treatments with oral anticoagulants are associated with even severe hematomas following oral surgery. A work by Puri *et al.* [38] reports the case of a 73-year-old patient in oral anticoagulant therapy who presented a massive sublingual hematoma complicated by an incongruous prosthesis. The study authors also state that this condition was seen to be the result of a high INR at the time of the visit. Another case report by Ghosh *et al.* [39] even presents the case of a 47-year-old patient on anticoagulants with a spontaneous sublingual hematoma since the patient did not report any history of trauma or external bleeding to the anamnesis. Once again, the clinical picture is associated with a high INR at the patient's presentation (4.8). We would like to underline how anatomical variations of the lower alveolar nerve canal can increase the risk of injury to the vasculo-nervous bundle contained inside too if an adequate preoperative planning is not carried out. For example, variants such as the bifid mandibular canal may lead to complications such as bleeding and traumatic neuroma during surgery of the lower third molar, orthognathic or reconstructive mandibular surgery or placement of dental implants and prosthesis [19].

### 3.1 Figure



**Fig 1:** Distribution expressed as a percentage of the results obtained.

### 4. Conclusions

In oral and maxillofacial surgery, the risk of injury to important anatomical structures is particularly high when:

- a careful preoperative evaluation of the case is not carried out;
- there is not an adequate knowledge of loco-regional anatomy;
- no collection of the patient's relevant medical data is performed;
- atraumatic surgical procedures are not performed and soft tissues are not adequately protected, for example, by the action of rotating instruments or by the uncontrolled use of sharp instruments.

In the specific case of dental implants in the vicinity of vasculo-nervous structures, an evaluation using CBCT can protect from even fearful postoperative sequelae<sup>[40]</sup>. About amputation neuromas following neurotmesis, spontaneous nerve recovery is extremely rare and is practically impossible if it does not occur within 12 months of the trauma<sup>[10]</sup>. The prevention of oral hematomas is carried out by adopting local hemostatic measures: tranexamic acid mouthwashes, gelatin sponges and cellulose gauzes' application<sup>[41]</sup>. Despite the cases reported in the literature of hematomas also spontaneous, cited in this review, the international literature is in agreement that oral anticoagulant therapy should not be stopped in view of minor oral surgery to prevent thromboembolic complications<sup>[41]</sup>. However, the patient's INR must be monitored and maintained in the therapeutic range (2-4) as it has been seen that it does not appear to have an influence on postoperative bleeding<sup>[42]</sup>, in order to avoid oral hematomas. Contacting the attending physician should however be the best choice if the patient is suffering from severe coagulopathies, congenital or not, in order to understand whether they should be referred to hospital facilities.

**5. Acknowledgments:** No Acknowledgments.

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