

# Development of peripheral ossifying fibroma following micro-osteoperforation

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*Background:* Micro-osteoperforation (MOP) is a newly developed technique reported to accelerate orthodontic tooth movement.

*Case presentation:* The following case report discusses a peripheral ossifying fibroma (POF), as a reactive gingival nodule that developed eight weeks after a patient underwent transmucosal MOP at multiple sites in the mandible during orthodontic treatment.

*Conclusion:* The MOP procedure is a relatively new approach applied to orthodontics that may induce gingival reactive nodules. Clinicians should be aware of this possible sequela and inform patients of the potential risk.

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## Introduction

Micro-osteoperforation (MOP) is a newly-developed procedure intended to accelerate the movement of teeth during orthodontic treatment. MOPs are performed under local anesthesia without reflecting mucoperiosteal flaps. Manual drivers are used to penetrate through the oral mucosa and the cortical bone. The generated holes extend for a few millimeters, passing through the buccal cortex and proximal to the root in the area being targeted.

MOP of the alveolar bone has been shown to induce osteogenic inflammatory markers during orthodontic movement.<sup>1,2</sup> Tooth movement and bone resorption is a cycle that is associated with reactive osteoclastic/osteoblastic activities in the PDL and periosteum. Inflammatory markers such as chemokines and cytokines are up-regulated in response to conventional orthodontic forces. Furthermore, gingival crevicular fluid sampling has measured a significantly increased inflammatory stimulation after micro-osteoperforations have been performed.<sup>1,3,4</sup>

A peripheral ossifying fibroma (POF) is a common benign reactive gingival nodule with a slight female

predilection and incidence rates reported to vary between different ethnic populations.<sup>5,6</sup>

POFs are believed to result from gingival injury and/or chronic irritation of the periosteal and periodontal cells.<sup>7-9</sup> To the best of current knowledge, POFs have yet to be reported developing in possible association with stimulation via MOP.

## Case report

A 29-year-old male undergoing orthodontic treatment developed an asymptomatic mandibular gingival mass and was referred to a private practice in Boston, MA for periodontal evaluation. On examination, the patient reported that the lesion had developed over a period of four weeks. Two months prior to that, he underwent MOP (PROPEL Orthodontics – Ossining, NY, USA) as a part of his orthodontic treatment plan (Invisalign, CA, USA). The MOP was performed at several sites in the mouth, including between the maxillary (bilaterally) and mandibular (left) first and second premolars and between all of the second premolars and first molars. The patient was instructed not to use non-steroidal anti-inflammatory



Figure 1a. Well-circumscribed firm mass at the interdental papilla between the first and second mandibular molars.

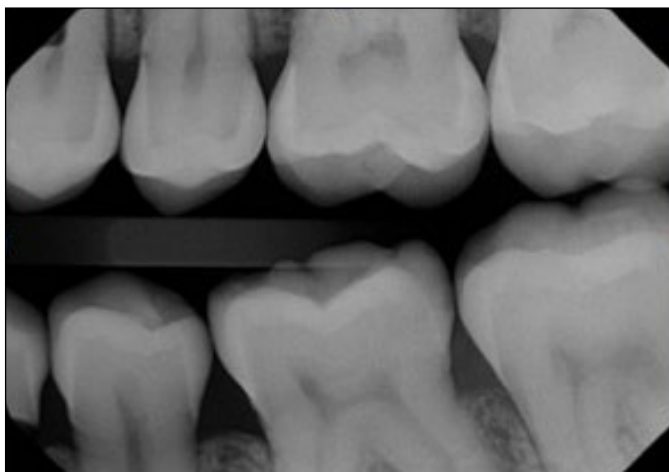


Figure 1b. Bite-wing radiograph of the area showing normal radiographic findings.

drugs (NSAIDs) during treatment to avoid reducing the amount of inflammation, which could inhibit orthodontic movement.

An intraoral assessment identified a well-circumscribed firm mass located on the buccal gingiva of the mandibular left posterior dentition, between the first and second molars. It was painless, pink-red in color, measured 8 mm in diameter and therefore spanned the width of the interdental papilla (Figure 1A). The buccal aspects of the first and second molars had attachments for the sequential aligners the patient was wearing as part of the clear aligner treatment.

The patient maintained good oral hygiene with no history of trauma or other dental or medical concerns. There were no deep probing depths or periodontal attachment loss. Endodontic vitality tests were within normal limits and a bite-wing radiographic evaluation was unremarkable (Figure 1B). An extra-oral examination was negative with no palpable submandibular/cervical lymphadenopathy or muscular involvement.

Based on the history and clinical findings, differential diagnoses of a pyogenic granuloma (PG), a peripheral giant cell granuloma (PGCG), or a peripheral ossifying fibroma (POF) were considered. The patient consented to an excisional biopsy and related treatments. The excised specimen was preserved in 10% formalin and sent for histopathologic processing and examination, which revealed a nodule surfaced by focally ulcerated stratified squamous epithelium exhibiting mild acanthosis (Figure 2A). Within the subjacent fibrous connective tissue, there was an

unencapsulated proliferation of fibroblastic spindle cells producing variably calcified osteoid material and interconnecting trabeculae of bone (Figure 2B). Extravasated erythrocytes and dilated vascular

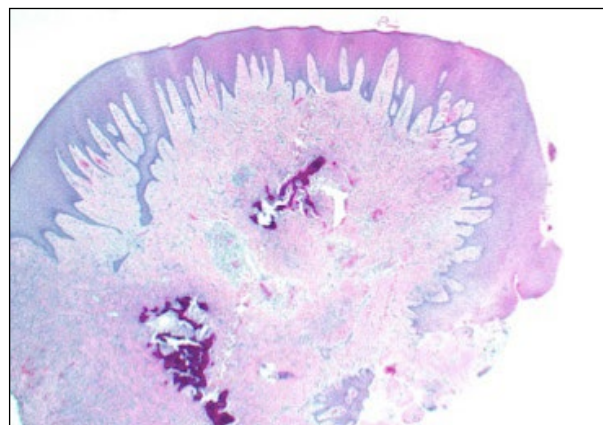


Figure 2a. Nodule surfaced by parakeratinized epithelium (hematoxylin and eosin, magnification  $\times 20$ ).

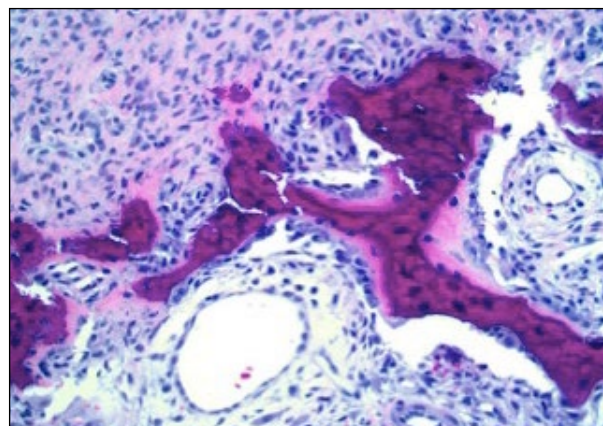


Figure 2b. Spindle cells, mineralised tissue, and dilated vascular channels (haematoxylin and eosin, magnification  $\times 200$ ).

channels were also present. These findings were consistent with a diagnosis of POF. At four months follow-up, there was no clinical evidence of recurrence (Figure 3).



Figure 3. Biopsy site at four months follow-up. Healing at the site of concern seemed to occur uneventfully.

## Discussion

POF is noted as a common reactive nodule of the gingiva. Clinically, the differential diagnosis for POFs also includes other tumour-like hyperplastic growths such as fibromas, PGs, and PGCGs.<sup>5,6,10</sup> Any of these reactive lesions may present as sessile or pedunculated growths of variable size. Most develop in response to local irritants or chronic low-grade trauma and rarely present with radiographic findings.<sup>5,6,11</sup>

MOP is a traumatic procedure that could synergise with the inflammatory process of tooth movement. The up-regulation of inflammatory chemokines and cytokines has been demonstrated in association with tooth orthodontic-movement.<sup>3,4</sup> Previous studies have shown that performing alveolar bone osteoperforation (decortication) can increase the expression level of inflammatory markers in a process intended to accelerate tooth movement by increasing osteoclastic activity.<sup>1,2,7</sup> A recent prospective controlled clinical trial investigated the effect of MOP on root resorption during orthodontic treatment. The split mouth study showed that the teeth (premolars) that received MOP had approximately 42% more root resorption than the contralateral side after 28 days of treatment.<sup>12</sup> It was reflected upon as the result of an amplified inflammatory process that led to a significantly greater resorptive effect.<sup>12</sup>

Upon immunohistochemical examination, reactive gingival nodules including POF have been shown to express osteopontin (OPN).<sup>7,13</sup> OPN is a matricellular

protein expressed in various cells, tissues, and physiological processes that play a critical role in inflammatory disorders. Furthermore, numerous studies have shown that OPN is expressed in inflammation by macrophages and is also activated at sites of ectopic pathologic calcification.<sup>7,13,14</sup> It is possible that inflammation associated with MOP induced the development of the POF described in the present study.

The development of the POF occurred proximal to a site of MOP trauma. It is difficult to discern why the lesion occurred at that specific location. However, it may be speculated that the POF was attributed to the amount/type of pressure exerted by the buccal attachments on the first and second molars while the aligners were worn. The amount of movement generated at that site, and the presence of plaque that may have accumulated during healing may be additional contributing factors.

## Conclusion

This is the first reported case of a POF arising in a patient having experienced transmucosal/gingival MOP. As the procedure is relatively new, further prospective studies are needed to evaluate the potential association between MOP and the formation of reactive gingival nodules including POFs. Clinicians should be aware of the possible development of these lesions and the iatrogenic factors that may play a role.

## Conflict of interest

The authors declare no conflict of interest.

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