CASE REPORT

Alveolar bone exostoses subsequent to orthodontic implant placement

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SUMMARY

Alveolar bone exostoses (ABE), also known as a buttress bone formation, are not uncommon to the literature. Although, exostoses in response to the trauma from occlusion are a popular concept proposed more than 45 years ago, still the aetiological factors behind this development are unclear. Various risks and complications associated with orthodontic implants have been published, but buttress bone formation subsequent to this procedure has not been reported till date. This article describes a case of ABE, subsequent to the placement of orthodontic mini implants, where after careful evaluation, resective osseous surgery was performed.

BACKGROUND

Alveolar bone exostoses (ABE) were defined as benign localised convex outgrowths of buccal (or lingual) bone, which could be delineated from the surrounding cortical plate. These are commonly found as a nodular growth of lamellar bone with a central core of cancellous bone in larger lesion. Different exostoses variants can be found during routine dental examination, for example, mandibular tori, palatal tori, palatal alveolar exostoses and multiple exostoses.¹ Although, the aetiology behind the development of such nodular growths are not clear in the literature, many clinicians believe in the concept of buttress bone formation in response to trauma from occlusion, as proposed by Glickman and Smulow² in 1965. Few cases have been reported where exostoses developed subsequent to the placement of free gingival graft.^{3–5}

Mini-screw implants, often referred to as temporary anchorage devices, have become an accepted component of orthodontic treatment. The risks involved with mini-screw placement must be clearly understood by both the clinician and the patient.⁶ There are many complications mentioned in the literature, for example, complications during the insertion of mini-screws, complications under orthodontic loading, soft tissue complication, complication during the removal of mini-screws, etc.⁷ But till date there has been no reported case of ABE developed subsequent to the placement of orthodontic mini implants. This paper reports the formation of ABE during an active orthodontic treatment with mini implants, discussing some characteristics of this clinical condition along with the management.

Figure 1 Preoperative alveolar bone exostoses in relation to maxillary anterior teeth.

CASE PRESENTATION

A 16-year-old female patient was referred to the periodontist by her orthodontist for the management of bony hard swelling on the maxillary anterior region (figure 1). According to the orthodontist and the patient, these swellings were not present at the start of the orthodontic treatment (figure 2), but developed within a year of active orthodontic treatment. These were causing a hindrance in further orthodontic tooth movement and were of aesthetic concern to the patient. According to her orthodontic case history, she had an Angle's class-I malocclusion with bimaxillary dentoalveolar proclination and a deep overbite due to vertical maxillary excess. The orthodontic treatment formulated included the extractions of all the first premolars to retract the maxillary and mandibular anterior teeth and to intrude the maxillary anterior segment using orthodontic mini implants to reduce the gummy smile due to vertical maxillary excess. A 0.022" slot McLaughlin–Bennett–Trevisi appliance was placed and the initial levelling and aligning was achieved

Figure 2 Photograph showing orthodontic implants, placed between the upper central and lateral incisors, before the development of alveolar bone exostoses.

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Figure 3 Intraoral periapical radiograph of the patient prior to intraoral implant placement and after creating a sufficient root divergence.

on a 0.016" nickel titanium (Niti) archwire. Subsequently, the teeth were aligned on a 0.019"×0.025" Niti followed by retraction on a 0.019×0.025" stainless steel (SS) archwire. After alignment, an orthodontic mini implant (1.2 mm diameter and 8 mm length) was placed between the roots of the maxillary central and lateral incisors on both sides (figures 3 and 4). Intrusive force was applied to the anterior segment by attaching a Niti closed coil spring (medium force) from the mini implant to the rigid 0.019"×0.025" SS archwire. After about 4 months of intrusion, bite opening was achieved and there was reduction

Figure 4 Intraoral periapical radiograph of the patient, after the insertion of mini implant.

in the amount of gingiva visible on smile. However, intraoral examination revealed the presence of bony hard, painless swellings on the buccal surface of the attached gingiva of the upper anterior teeth (figure 1). Mini implants were removed and patient was referred to the periodontist for evaluation and management of the condition. After evaluating the patient (case history, clinical and radiological examination) a provisional diagnosis of ABE was made.

INVESTIGATIONS

Presurgical routine haemogram was done, which was not significant.

DIFFERENTIAL DIAGNOSIS

- ▶ Gingival enlargement
- ▶ Osteomyelitis
- ▶ Osteoma
- ▶ Osteosarcoma

TREATMENT

Resective osseous surgery was planned for the patient. Her medical history was not significant and haemogram was also within a normal limits. After removing her upper archwire, local anaesthesia was given to the patient. Sulcular incision was given from the right first premolar region to the left first premolar region. Elevation of full thickness mucoperiosteal envelop flap revealed the nodular osseous area (figure 5). Following all the principles of osteoplasty, flattening of the bony growth was done with profuse irrigation. Resected bone was sent for histopathological examination. It was a dense lamellar bone and compatible with the provisional diagnosis. Flap was trimmed

Figure 5 Marked alveolar bone exostoses after elevation of the full thickness flap.

Figure 6 One month postoperative frontal view showing no recurrence of the exostoses.

and repositioned with sling sutures. Haemostasis was achieved. Postoperative instructions were given to the patient and medications were also prescribed.

OUTCOME AND FOLLOW-UP

After 7 days, the patient was evaluated for postoperative discomfort and healing, which were uneventful. Oral hygiene instructions were reinforced and 1 month of supportive periodontal therapy was scheduled. After 1 month, active orthodontic therapy was continued and no recurrence was noted thereafter (figure 6).

DISCUSSION

Buttress bone formation has been known as the development of the thickened or exostotic buccal alveolar bone in response to heavy occlusal forces. This popular concept was given by the Glickman and Smulow² in 1965. They described new bone formation on external surface of alveolar ridge on both the tension and compression sides of occlusally traumatised teeth of three specimens (two rhesus monkeys and one human), and suggested that such bone formation occurs with the purpose of reinforcing bone trabeculae. This concept is reinforced by others also by observing the clinical association between heavy occlusal forces, thick masseter muscles, powerful chewing forces, occlusal wear facets and buccal alveolar exostoses as well as palatal and mandibular tori.⁸

Such types of exostoses need to be differentiated from pathology arising from the gingiva (gingival enlargement) or from the bone (osteomyelitis, osteoma and osteosarcoma).

Absence of signs of inflammation excluded inflammatory gingival enlargement and osteomyelitis. Osteoma, osteosarcoma and other intra bony pathology were to be ruled on the basis of radiological and histopathological findings.

ABE, subsequent to the placement of orthodontic mini implants are rare and probably this is the first reported incidence of exostoses. Although the pathogenesis behind this development is unclear, there are many possible ways in which it may develop.

There are numerous case reports published in the dental literature regarding ABE subsequent to placement of free gingival grafts (FGG).^{3–5} Otero-Cagide *et al*⁹ speculated that the bone formation after an FGG may be the result of a combination of periosteal trauma during site preparation and the activation of osteoprecursor cells contained in the connective tissue of the graft. Svinland *et al*¹⁰ suggested vascular disruption as a consequence of the surgical trauma results in transient ischaemia in

the periosteum, which would produce hypertrophy and hyperplasia of the periosteal cells, with an osteogen differentiation. Among the related reports, all the authors suggest that the periosteal trauma seemed to be the main aetiological agent associated with the exostosis development.^{3–5} While placing orthodontic mini implants, there may be trauma to the periosteal bone, which may cause ABE.

Another possible mechanism suggested by Marx and Garg¹¹ is the mechanical factor of ministrain could have a significant effect on bone modelling. When mechanical loads are low (less than 0.2% deformation), bone atrophy occurs; when higher mechanical loads occur (0.25–0.40%), bone hypertrophy occurs with increased lamellar bone; and when pathologically higher loads are imposed (more than 0.40%), woven bone formation occurs. These findings are also consistent with the findings of Pietrokovski and Massler¹² who observed that following extractions, alveolar bone become atrophic and resorbs. Yeager¹³ in his study on rats also showed that the presence of excessive forces, in long run, would favour the formation of exostosis. This mechanical factor of ministrain during the placement of orthodontic implants and subsequently its role as an anchorage for the intrusion of the maxillary anterior teeth may cause bone hypertrophy. Hong-fei *et al* in 2012 in their experiment also found that mechanical strain can induce morphological change and a magnitude-dependent increase in the expression of bone morphogenic protein-2, alkaline phosphatase, and collagen type I mRNA in osteoblast-like cells, which might influence bone remodelling in orthodontic treatment.¹⁴ Benign osseous proliferation beneath posterior fixed partial denture pontics have also been reported in the dental literature.^{15 16} Another possible mechanism suggested by Chambrone and Chambrone⁵ is that genetic factors, functional stresses and chronic irritation may also act as aetiological factors for the development of exostoses.

In conclusion, the development of ABE subsequent to the placement of orthodontic implants is an infrequent side effect (has not been reported till date). Based on previous reports, periosteal trauma seems to be main aetiological agent. However, the mechanical factor of ministrain also cannot be ruled out. Thus, clinical studies with larger samples are needed to establish the etiopathogenesis of the exostosis.

Learning points

- ▶ The risks associated with mini-screw placement should be clearly understood by both the clinician and the patient.
- ▶ Alveolar bone exostoses subsequent to the placement of orthodontic implants could have been an infrequent, inevitable complication. Once developed, may pose functional as well aesthetic concern to both clinician as well as the patient and should be treated promptly.
- ▶ A thorough understanding of proper placement technique, bone density and landscape, peri-implant soft tissue, regional anatomic structures, orthodontic loading and patient home care are imperative for optimal patient safety and mini-screw success.

Competing interests None.

Patient consent Obtained.

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