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Evaluating Piezoelectric Versus Conventional Osteoplasty in The Management of Alveolar Bone Exostosis: A Case Report

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Abstract

Alveolar bone exostoses (ABE) are benign bony outgrowths that may develop post-orthodontic treatment, occasionally causing aesthetic and functional concerns. This case report presents the management of buccal ABE in a 31-year-old female, comparing piezoelectric-assisted osteoplasty in the mandibular arch with conventional carbide bur osteoplasty in the maxillary arch. Postoperative outcomes revealed superior wound healing and reduced pain levels with piezo surgery, attributed to its selective bone cutting and minimal soft tissue trauma. While these initial results are encouraging, further clinical studies are required to validate the advantages of piezoelectric osteoplasty and establish its definitive role in managing alveolar exostoses.

Keywords: Alveolar Bone Exostoses, Piezoelectric Osteoplasty, Torus Palatinus

Introduction

An exostosis is a benign, peripheral bony growth with an unknown etiology. It typically appears as an enlargement on the alveolar surface and may present in nodular, flat, or pedunculated forms. In the jaws, these lesions are classified anatomically as torus palatinus (TP), torus mandibularis (TM), and alveolar bone exostoses (ABE).[1] Alveolar bone exostoses (ABE) are benign, localized, convex bony outgrowths on the buccal or lingual alveolar surfaces, clearly distinguishable from the adjacent cortical bone. [2] Glickman and Smulow [3] categorized such enlargements into two types: *exostoses*, referring to discrete bony projections, and *lippings*, representing marginal thickening of the alveolar crest. In contrast, buccal lippings referred to are noticeable thickened areas of alveolar bone located directly along the crestal margin.[4] Alveolar bone exostosis is an uncommon yet significant complication that may develop during or following orthodontic therapy. It involves the formation of a benign bony projection on the bone surface. These growths are generally non-cancerous and can differ in their size and appearance, influenced by factors like mechanical forces, inflammation, and genetic susceptibility.

Buccal exostoses are benign, smooth, bony outgrowths typically found bilaterally on the facial surfaces of the maxillary and mandibular alveolar bone, most often in the premolar-molar regions. Clinically, they present as hard masses beneath stretched but healthy mucosa, with occasional ulceration from trauma. These growths usually begin in adolescence and gradually enlarge over time. Although generally asymptomatic and self-limiting, larger lesions may contribute to periodontal problems by retaining food during chewing. Alveolar bone exostoses typically do not require intervention unless their size leads to periodontal complications, creates a visible swelling of the lip, or results in pain or discomfort for the patient.

Although alveolar bone exostoses generally do not require treatment, osteoplasty is indicated in certain situations. These include cases where the bony enlargements interfere with periodontal health by contributing to plaque accumulation, impede proper oral hygiene practices, or create food traps. Surgical correction is also considered when the exostoses cause discomfort, pain, or mucosal trauma, produce noticeable facial or lip bulging affecting aesthetics, or when they obstruct planned prosthetic or orthodontic procedures. In such instances, conservative osteoplasty can be performed to contour the bone and improve both function and appearance.

Alveolar bone exostoses (ABE) can be managed through conventional osteoplasty or piezoelectric-assisted techniques. Conventional osteoplasty uses rotary burs, chisels, and bone files to reshape bone but carries risks of soft tissue trauma and heat generation. Piezoelectric-assisted osteoplasty, on the other hand, employs ultrasonic vibrations for selective bone removal, offering greater precision and soft tissue protection with improved postoperative comfort. The choice of technique depends on the size, location, aesthetic concerns, and clinical requirements

Case Presentation

A 31-year-old female patient, with no significant systemic health issues, presented to the Department of Periodontology with the primary concern of swelling in the gums of both the upper and lower front teeth. She also reported occasional bleeding from the gums while brushing. Her dental history indicated that she had been undergoing orthodontic treatment for the past six months.

Clinical examination and Radiographic evaluation

Intraoral examination showed the presence of orthodontic brackets on both the maxillary and mandibular teeth. There was diffused gingival enlargement involving the marginal, papillary, and attached gingiva in both arches. The overgrowth was more pronounced in the anterior regions, particularly along the labial aspects of the maxillary and mandibular teeth. The gingival tissue appeared soft and oedematous, and bleeding on probing was observed throughout the dentition. Hard-tissue bony enlargements were observed on the buccal aspects of the attached gingiva in the anterior regions of both the maxilla and mandible. These lesions were firm, oval in shape, and covered by pale, thinned gingival tissue, suggestive of buccal alveolar bone exostoses. The patient additionally reported experiencing traumatic ulceration while brushing the upper anterior teeth. Based on these findings a provisional diagnosis of Alveolar Bone Exostoses (ABE) was made.

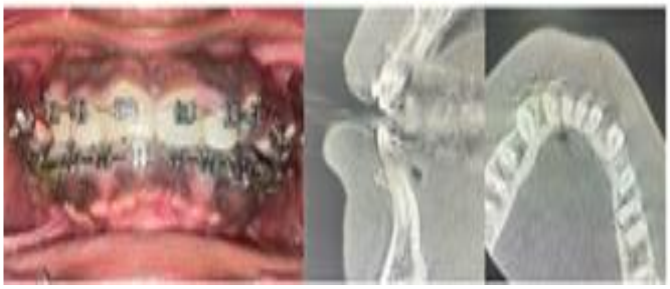

Figure 1: Pre-operative clinical photograph and corresponding sagittal and axial CBCT sections demonstrating gingival overgrowth clinically and prominent buccal alveolar bone exostoses in the anterior maxillary region, identified 18 months after completion of orthodontic treatment in a 31-year-old female patient.

To further evaluate the extent and characteristics of the bony overgrowths, a cone-beam computed tomography (CBCT) scan and a lateral cephalogram were obtained for the patient. The CBCT images revealed well-defined, convex, bony protuberances along the labial surfaces of the alveolar bone in both the maxillary and mandibular anterior regions. These exostoses presented as well-defined, dense cortical outgrowths, projecting from the facial surface of the alveolar bone and clearly distinguishable from the adjacent structures. On the lateral cephalogram, the labial exostoses were visible as radiopaque, oval-shaped elevations on the facial surfaces of the anterior alveolar bone, more prominently noted in the maxilla.

Non Surgical Periodontal Management and Laser assisted gingivectomy

Initial management involved comprehensive full-mouth scaling and root planing using both hand and ultrasonic instruments (Gracey Curettes, Hu-Friedys®, Hu-Friedy Inc., Leimen, Germany), along with reinforcing oral hygiene instructions to the patient. To support improved oral hygiene maintenance and facilitate the resolution of inflammation, diode laser gingivectomy using an 810 nm wavelength was carried out in the affected areas as an adjunct to non-surgical periodontal treatment. This intervention also aimed to enhance tissue healing and patient comfort.

To assess the potential for spontaneous regression of the alveolar bone exostoses (ABE), orthodontic forces were first withdrawn from the mandibular arch, followed subsequently by the maxillary arch. After a three-month observation period without any notable changes, surgical intervention was planned. The patient's medical history was non-contributory, and blood investigations, including the haemogram, were within normal limits.

In this case, the objective was to compare healing outcomes and patient-reported pain levels between piezoelectric-assisted osteoplasty and conventional rotary instrument osteoplasty. This approach aimed to assess differences in soft tissue response, postoperative discomfort, and overall recovery between the two techniques."

Piezo assisted Osteoplasty in the Mandible

The patient's lower arch wire was taken out, and then local anaesthetic was administered. A sulcular incision was performed from the right first premolar region to the left first premolar region. Upon elevation of the full-thickness mucoperiosteal envelope flap, the nodular bony prominence became clearly visible. The bone growth was smoothed in line with all of the osteoplasty principles using the saw tip of a piezoelectric unit to precisely contour the labial alveolar bone exostoses. Sling sutures were placed to secure and reposition the flap.

Figure 2: Pre-operative intraoral view showing visible mandibular buccal exostoses. Intra-operative view following reflection of a full-thickness mucoperiosteal flap and piezo assisted osteoplasty being performed.

Figure 3: Immediate post-operative intraoral view following osteoplasty, showing placement of sling sutures for flap stabilization. Two-week post-operative view demonstrating satisfactory soft tissue healing and resolution of inflammation

Postoperative medication to help in healing included 0.2% chlorhexidine mouthwash thrice a day, analgesics (aceclofenac 100 mg, paracetamol 325 mg), and serratiopeptidase (15 mg), and antibiotics (amoxicillin 500 mg) thrice daily for a week. . The patient's postoperative healing and discomfort levels were evaluated after 10 days, with recovery reported as uneventful.

Conventional Osteoplasty in the Maxilla

Surgical osteoplasty using carbide burs was performed in the maxillary arch 3 weeks after mandibular osteoplasty, following complete healing of the initial surgical site.

Figure 4: Intra-operative intraoral view showing prominent maxillary buccal exostoses following reflection of a full-thickness mucoperiosteal flap. Rotary-assisted osteoplasty being performed using a carbide bur to recontour the excessive alveolar bone.

After achieving local anesthesia, a full-thickness mucoperiosteal flap was reflected to provide clear access to the operative site. The bony enlargement was carefully reduced using a bone-cutting carbide bur with continuous saline irrigation, and the bone margins were refined with a bone file. The surgical site was carefully irrigated with sterile saline, following which the flap was repositioned and stabilized using sling sutures. Similar postoperative care was advised as above. The patients' postoperative pain and recovery were assessed after 10 days and found to be uneventful.

Figure 5: Immediate post-operative intraoral view following osteoplasty, showing placement of sling sutures for flap stabilization. Two-week post-operative view demonstrating satisfactory soft tissue healing with minimal residual inflammation persisting in the lateral incisor and canine region of the second quadrant.

Pain levels were recorded immediately post-procedures on the seventh day using a 10 cm horizontal Visual Analog Scale (VAS). Patients marked their pain perception on the line, where the left end indicated 'no pain' and the right end indicated 'worst possible pain.'

Pain severity was classified as follows: 0 for no pain, 1–3 for mild, 3.1–6 for moderate, and 6.1–10 for severe pain.

Landry's Wound healing index was taken 3rd, 7th, 14th and 21st day to assess healing based on tissue colour, granulation tissue, bleeding on palpation, suppuration, and epithelialization, with scores ranging from 1 (very poor) to 5 (excelle The piezo-assisted osteoplasty group showed better post-operative outcomes, with a mean VAS score of 30 mm compared to 55 mm in the conventional group. Wound Healing Index scores were *very good* in the piezo group (less than 25% gingival redness, no bleeding or granulation tissue) versus *good* in the conventional group (25–50% gingival redness, no bleeding or granulation tissue), indicating improved healing and patient comfort with piezo surgery.

Figure 6: Six-month post-operative intraoral view following osteoplasty, showing complete soft tissue healing with no evidence of exostoses regrowth in the treated region.

Discussion

Although the exact mechanism behind the development of alveolar bone exostoses following orthodontic treatment remains unclear, some studies suggest a possible association with labial alveolar bone thickening resulting from rapid retraction of the upper incisors. The application of orthodontic forces may trigger the release of bone morphogenetic proteins, leading to localized bone deposition and the formation of exostoses at areas of mechanical stress. [5,6,7]

Yodthong et al [8] examined the relationship between alveolar bone thickness and variables such as the extent of intrusion, angulation, inclination, and the speed of tooth movement.

The texture, contour, colour, and overall architecture of gingival tissues play an important role in smile aesthetics, particularly in females, and can positively influence self-confidence.[9] In this case, the patient presented with prominent buccal alveolar bone exostoses after undergoing orthodontic treatment, which affected her smile. While such bony outgrowths typically do not warrant intervention, minor osseous recontouring can be performed to re-establish proper gingival contours, alleviate lip tension, prevent food entrapment, and minimize the risk of traumatic ulceration during oral hygiene practices [10]

Piezo surgery is a modern bone-cutting technique that utilizes piezoelectric ultrasonic vibrations for performing osteotomies. The primary advantage of piezo surgery lies in its ability to selectively cut mineralized bone without affecting soft tissues. Since soft tissue requires frequencies above 50 kHz for incision, piezoelectric units operate at lower frequencies of 25–30 kHz, generating ultrasonic micro vibrations between 60 and 210 µm. This makes them distinctly different from conventional rotary instruments and micro saws, as they precisely target mineralized structures. [11,12,13] As a result, piezo surgery significantly reduces the risk of injuring surrounding soft tissues such as nerves, blood vessels, and mucosa during osteotomies. Additional benefits include minimized heat generation through cavitation and improved intraoperative visibility owing to reduced bleeding [14]

Studies by some researchers comparing piezo surgery with conventional rotary instruments for impacted mandibular third molar removal reported that the piezo surgery group experienced less postoperative pain, swelling, and trismus, although the procedure duration was longer than with traditional methods. [15,16]

The clinical hypothesis in this case proposed that piezo surgery, owing to its precise, minimally invasive bone cutting, would demonstrate superior wound healing outcomes and reduced postoperative pain when compared with traditional rotary osteoplasty technique.

Conclusion

In this case, piezoelectric-assisted osteoplasty demonstrated superior wound healing and reduced postoperative pain compared to conventional rotary osteoplasty. The minimally invasive and selective bone-cutting nature of piezo surgery contributed to these favourable outcomes. However, while these findings are encouraging, larger clinical studies with long-term follow-up are necessary to validate these results and establish definitive clinical guidelines for the management of alveolar bone exostoses.

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