Piezosurgery: A safe technique for inferior alveolar nerve mobilization in surgical correction of hemimandibular hyperplasia—Review of the literature and case report

Amel S. Eltayeb a,+, Abdelnasir G. Ahmad b

a Department of Oral and Maxillofacial Surgery, Khartoum Teaching Dental Hospital, Khartoum, Sudan
b Department of Oral and Maxillofacial Surgery, Khartoum Teaching Dental Hospital, Khartoum, Sudan

ABSTRACT

INTRODUCTION: Piezoelectric bone surgery is a relatively new alternative for bone-related procedures in oral and maxillofacial surgery. It represents an innovative technique as it offers the maxillofacial surgeon the opportunity to make precise bone cuts without damaging any soft tissue and providing a bloodless surgical field. Correction of facial asymmetries is still a major problem in need of an adequate solution. Neurosensory damage to the inferior alveolar nerve can be an adverse effect of surgical correction of hemimandibular hyperplasia. In this case report, piezoelectric cutting device was used to treat a hemimandibular hyperplasia with inferior alveolar nerve preservation.

PRESENTATION OF CASE: A 21-year-old female presented with lower facial a symmetry which was started when she was 16 years. Clinical and radiographic examination were done, the patient was diagnosed with hemimandibular hyperplasia. Bone scan revealed normal condylar activity. Piezoelectric device was used to split the lower border cortical plate where the inferior alveolar neurovascular bundle was found within the hyperplastic lower border. After dissection of the neurovascular bundle from the canal, resection to the inner border of the mandible continued. Inferior alveolar neurovascular bundle was secured safely on the lateral border of the mandible and wound closed. Patient had symmetrical facial appearance. Inferior alveolar nerve was intact intra-operatively and the patient didn’t report any paraesthesia with 6 months follow up.

CONCLUSION: The use of a piezoelectric device provides surgical results that would not be possible with traditional instruments, not only for the patient’s benefit but also for the surgeon’s.

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1. Introduction

Hemimandibular hyperplasia is a developmental asymmetry characterized by three-dimensional enlargement of half of the mandible [1]. The unilateral increase in height of the face on the affected side results in a sloping mouth and rotated facial appearance. The maxilla usually follows the mandible and grows downward on the affected side. As a result, the occlusal plane tilts and is at a lower level on the affected side [2].

Surgical correction for the mandible usually involves a bilateral sagittal split osteotomy procedure, which carries the risk of damage to the inferior alveolar nerve [3]. Also, maxillary surgery(efort 1 osteotomy) may be need in cases where maxillary compensatory growth resulted in occlusal canting [2].

Piezoelectric devices are innovative tools with extensive uses in dental implantology and oral and maxillofacial surgery [4]. Key features of piezosurgery include the selective cutting of bone without damaging the adjacent soft tissue providing a clear visibility in the operating field, and cutting without heat generation [4]. The aim of this case report is to present the peizo-surgical treatment of an adult patient having facial asymmetry with inferior alveolar nerve preservation.

2. Presentation of case

A 21-year-old female presented with lower facial a symmetry which was started when she was 16 years. The patient had no history of significant medical problems or any family history of hereditary disease. Her main complaint was the facial asymmetry. The occlusion was canted down on the left side but she did not complain of it. Clinical examination of the temporomandibular joint revealed no restriction of joint’s c movements, pain or clicking. In the radiographic evaluation, the condyle was elongated; the ramus height was increased with a downward bowed lower border of the
mandible. The distance between the teeth roots and the mandibular canal was increased on the affected (left) side. On the basis of these clinical and radiological findings, a diagnosis of hemi-mandibular hyperplasia was obtained. Bone scan was done and normal condylar activity was reported. Treatment plan was put to level the lower border of the mandible only since the patient wanted a minimal surgery and wasn’t concern about the occlusal canting.

Piezoelectric device was used to split the lower border cortical plate where the inferior alveolar neurovascular bundle was found within the hyperplastic lower border. After dissection of the neurovascular bundle from the canal; resection to the inner border of the mandible continued. Inferior alveolar neurovascular bundle was secured safely on the lateral border of the mandible and wound closed (Fig. 1).

The patient had symmetrical facial appearance (Figs. 2 and 3). Inferior alveolar nerve was intact intra-operatively and the patient didn’t report any paresthesia with 6 months follow up. A genioplasty operation to correct the remaining asymmetry of the chin was suggested to the patient, but she rejected it because she was satisfied with the treatment outcome.

3. Discussion

Piezoelectric surgery is based on the use of ultrasound for the cutting of bone. It represents an innovative technique as it offers the maxillofacial surgeon the opportunity to make precise bone cuts without damaging any soft tissue and providing a blood less surgical field [5].

The application of piezosurgery in oral and maxillofacial surgery includes: sagittal split ramus osteotomies, Le Fort I osteotomies, surgically assisted rapid maxillary expansion and minor microsurgical procedures [6,7]. Landes et al. in a study of 90 orthognathic patients compared between piezosurgery and conventional surgical methods and concluded that surgery time remained the same and the amount of blood lost was decreased in the case of Le Fort I osteotomies when piezosurgery used [6,7]. Ueki et al. did Le Fort I osteotomies to correct maxillofacial deformities using an ultrasonic bone curette to fracture the pterygoid plates on 14 patients with no damage to the surrounding tissue [8]. Albanese M et al., presented five cases of condyle hyperplasia where high condylectomy was done successfully by peizosurgery [9].

Neurosensory damage to the inferior alveolar nerve can be an adverse effect of surgical correction of hemi-mandibular hyperplasia. Assael et al. stated that damage to the mandibular nerve during surgery may result in neuroma-like changes [10]. Also, Eriksson et al. reported an interruption of the structures of a nerve would result in paresthesia, dysesthesia, allodynia, phantom pain and it might develop into severe disabling pain [11].

Many techniques were used in order to preserve the bundle such as intrusion of the mandibular posterior teeth, shortening the distance between the tooth roots and the mandibular canal and as a result shortening the vertical dimension of the mandibular body on the affected side [2]. It may not be possible to remove a sufficient amount of bone from the lower border of the mandible on the affected side when the inferior alveolar neurovascular bundle is positioned at a much lower level in the mandible. In such a case, using the conventional surgical technique would put the inferior alveolar neurovascular bundle at risk, however; in the present case we used piezosurgery device which has selective cutting of bone without damaging the adjacent inferior alveolar nerve [4].

Maxillofacial surgeons at Lyon assessed the inferior alveolar nerve in 20 patients with bilateral sagittal split osteotomy and found that it was not affected in all cases [12]. These results confirmed the findings of Metzger et al. who compared the use of piezoelectric devices with conventional burs on soft and hard tissue for transposition of the inferior alveolar nerve in sheep [13].

It should be stressed that ultrasonic osteotomy and conventional osteotomy demand quite different manual controls of the operator. Whereas exerting more pressure on a rotary bur placing excessive pressure on an ultrasonic tip can prevent its proper vibration, and experience with ultrasound suggests that this will result in overheating [14]. Although the use of appropriate pressure minimizes the risk of overheating, regular interruptions to prevent overheating are nevertheless advisable, especially during long or deep cuts [15].
4. Conclusion

Planning and selection of an appropriate surgical treatment is of paramount importance in hemimandibular hyperplasia treatment to avoid inferior alveolar nerve damage. The use of a piezoelectric device provides surgical results that would not be possible with traditional instruments, not only for the patient’s benefit but also for the surgeon’s.

Conflict of interest

The authors have no conflict of interests

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Ethical approval

Ethical approval was obtained from the research ethical committee of Khartoum dental teaching hospital.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Authors’ contributions

ASE analyzed and interpreted the patient data regarding the neof ormation and general diseases. ASE and AGA were major contributors in writing the manuscript. ASE and AGA did the critical review, corrected the intellectual content and gave final approval for submission. All authors read and approved the final manuscript.

Guarantor

Amel Salah Eltayeb.

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