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The effect of a platelet-rich fibrin conduit on neurosensory recovery following inferior alveolar nerve lateralization: a preliminary clinical study☆

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Abstract. This retrospective study aimed to assess the recovery of neurosensory dysfunction following modified inferior alveolar nerve (IAN) lateralization surgery compared to the conventional approach. Data from two groups of patients who underwent IAN lateralization in 2014 were included in this study. In one group, platelet-rich fibrin was placed over the IAN and this was protected with a collagen membrane conduit; the other group underwent the conventional IAN lateralization procedure. Implants were placed immediately. Neurosensory dysfunction was evaluated at 3, 6, and 12 months post-surgery. Demographic, neurosensory disturbance (NSD), subjective two-point discrimination test (TPD), and static light touch test (SLT) data were obtained. Twenty-three IAN lateralization procedures with the placement of 51 implants were performed in 14 patients. At the 6-month follow-up, the number of patients experiencing normal sensation was greater in the modified surgery group, but the 12-month follow-up results were the same in the two groups. More precise sensation was observed with the TPD in the modified group at 6 months, and the modified group demonstrated better SLT scores at 6 months. Although the two groups had comparable results at the 12-month follow-up, it was observed that the modified technique accelerated neural healing within 6 months and reduced the length of the discomfort period.

Key words: mandibular nerve; alveolar bone loss; somatosensory disorders; dental implants.

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Severe resorption in the posterior mandible can occur as a result of tooth loss. When this happens, standard dental implants will encroach on the inferior alveolar nerve (IAN).[1] There are several approaches for localized bone augmentation,[2] namely guided bone regeneration,[3,4] inlay and onlay grafts,[1,5] bone tissue engineering,[6–8] and nerve lateralization.

Nerve lateralization is a practical technique in posterior atrophic ridge augmentation of the mandible.[9] In IAN lateralization, the nerve is freed from the IAN canal and is retracted laterally and placed on the lateral surface of the implants. A modification of this technique is IAN transposition, in which the IAN is cut anterior to the mental foramen and is freely displaced.[10] However, these approaches are frequently accompanied by post-surgical neurosensory disturbance (NSD), with some studies estimating 30–75% nerve damage following surgery.[11,12] This complication may overshadow the benefits of the surgery and this has led to debate over its application.[13] As a result, several modifications have been made to IAN lateralization in order to decrease the post-surgical NSD, such as replacing the use of a bur with a piezoelectric surgery device for osteotomy,[14] performing two osteotomies,[15] and simultaneous bone expansion with expanders.[16]

The positive effects of growth factors on accelerating nerve healing and regeneration has recently been reported in the literature.[17–19] Platelet-rich fibrin (PRF) is composed of platelet concentrates on fibrin membranes.[20] It possesses high regenerative potential due to the slow release of growth factors, such as transforming growth factor β1, platelet-derived growth factor β, and vascular endothelial growth factor.[21] PRF has been used widely in oral and maxillofacial surgery and regeneration.[22,23] A study on the healing potential of PRF on rat sciatic nerve defects demonstrated promising results, comparable in some aspects to those of the gold standard treatment – the autologous nerve graft.[19]

Despite the vast literature on surgical approaches for minimizing post-surgical neural disturbance following IAN lateralization, no regenerative technique has yet been established for this purpose. The current retrospective cohort study aimed to assess the efficacy and post-surgical neural disturbances following a modified technique of IAN lateralization surgery.

A

B

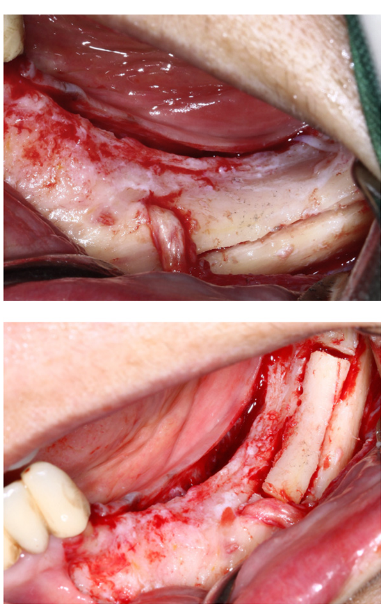

Fig. 1. Thin box osteotomy design created with the piezoelectric surgery device. The bone block harvested with this method can be used as a barrier between the dental implant and the IAN or for possible simultaneous augmentation.

Materials and methods

Patients

This retrospective cohort study evaluated the records of two groups of patients who had randomly received either conventional IAN lateralization surgery or the modified IAN lateralization surgery for implant treatment between January 2013 and January 2014. Eligibility for IAN lateralization surgery was confirmed by panoramic radiographs and cone beam computed tomography (CBCT) scans. The patients were eligible for enrolment if there was no systemic disease, no history of jaw trauma or oral surgery, and if there was less than 5 mm of bone height above the IAN to the bone crest. Patients were excluded if they had untreated periodontal disease, bisphosphonate use, knife edge alveolar ridges, parafunctional habits, unstable posterior occlusion, or signs of active or acute abscess. None of the patients were smokers. Written informed consent regarding the possibility of paresthesia following surgery was obtained from the patients. Due to the retrospective nature of this study, an exemption in writing was granted by the institutional review board. Demographic data, the surgical technique used, and postoperative follow-up results were extracted from the files. Patient records that lacked follow-up data or neurosensory assessments were excluded.

PRF preparation

Venous blood (20 ml) was obtained from the patient and placed in a sterile tube; this was centrifuged (EBA 20, Hettich, Tuttlingen, Germany) for 14 min at 2800 rpm (approximately 400 *g*). Following centrifugation, there were three separate layers in the tube: cellular plasma at the top, a PRF clot in the middle, and red blood cells at the bottom. The PRF clot was separated and obtained using a sterile pincette.

Surgical procedure

Prior to surgery, the patients were given antibiotic prophylaxis comprising 2 g amoxicillin (Farabi Pharmaceutical Co., Isfahan, Iran) or 600 mg clindamycin in the case of a penicillin allergy. A non-steroidal anti-inflammatory agent (400 mg ibuprofen; Rouz Darou Pharmaceutical Co., Tehran, Iran) and a steroidal anti-inflammatory agent (5 mg oral dexamethasone; Iran Hormone Pharmaceutical Co., Tehran, Iran) were also given. All surgeries were performed under local anaesthesia by an experienced surgeon (A.K.).

The precise location of the mental foramen was determined using panoramic radiographs for all patients. A crestal incision was made distal to the canine tooth and extended to the anterior border of the mandibular ramus. Anterior releasing vertical incisions were made and a full thickness mucoperiosteal flap was elevated. An osteotomy was made from 3–4 mm distal to the mental foramen to 4–5 mm distal to the most distal planned implant position. The external outer cortical border of the mandible was removed either with a small round bur or as a thin block using a piezoelectric surgery device (Fig. 1). In the case of a modification in the mental foramen area, a circular osteotomy was performed around the mental foramen with anterior extension beneath the canine tooth root. The incisive branch was also exposed and minimally displaced. Small round-edge smooth curettes were used to remove cancellous bone in order to gain access to the IAN. The neurovascular bundle was freed and moved laterally with a nerve hook and preserved by placing an elastic band (lacrimal probe; Katena Products, Inc., Denville, New Jersey, USA) below the nerve. During bone drilling and implant insertion, the nerve was retracted to reduce the risk of nerve damage (Fig. 2).

A collagen membrane (Jason membrane; Botiss Biomaterials GmbH, Berlin, Germany) was positioned beneath the nerve, the PRF was placed over the IAN, and then the collagen membrane was sutured with a resorbable suture (6–0 Vicryl; Ethicon Inc., Sint-Stevens-Woluwe, Belgium) (Figs 3 and 4). After creating the conduit around the laterally

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