Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jobcr

Review Article

Tentpole technique for bone regeneration in vertically deficient alveolar ridges: A review

Dipti Daga [a,*], Divya Mehrotra [b], Shadab Mohammad [c], Geeta Singh [d], S.M. Natu [e]

[a] Junior Resident, Department of Oral and Maxillofacial Surgery, King George's Medical University, Lucknow, India
[b] Professor, AO Fellow, UICC Fellow, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, King George's Medical University, Lucknow 226003, India
[c] Professor and Head, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, King George's Medical University, Lucknow 226003, India
[d] Associate Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, King George's Medical University, Lucknow 226003, India
[e] Professor, Department of Pathology, Faculty of Medical Sciences, King George's Medical University, Lucknow 226003, India

ARTICLE INFO

Article history:
Received 17 February 2015
Accepted 4 March 2015
Available online 3 April 2015

Keywords:
Tentpole technique
Ridge resorption
Alveolar ridge augmentation

ABSTRACT

Background and objectives: Vertical augmentation is necessary in cases of extensive resorption of alveolar ridge for dental implants placement and esthetic prosthetic rehabilitation. Several surgical techniques have been used to increase bone height including distraction osteogenesis, and particulate or block bone graft.

This study was done to describe the evolution of "tentpole technique" and to review the literature related to this technique and thus evaluate its effectiveness to augment large vertical alveolar ridge defects for implant placement.

Material and methods: The evidence was obtained by PubMed and Google search using **key words**: ***tentpole technique, ridge resorption, and alveolar ridge augmentation***. The years of search included from 2002 till 2013.

Results: The technique was described as effective on review of outcome of existing studies. It was found that considerable and stable increase in alveolar ridge height was achieved using tentpole technique.

Conclusions: Tenting of periosteum and soft tissue matrix maintains space and enhances the effectiveness of bone graft. This technique offers predictable functional and esthetic reconstruction of large vertical alveolar defects.

* *Corresponding author*. Tel.: +91 7054395864.
E-mail address: diptidaga10@gmail.com (D. Daga).
http://dx.doi.org/10.1016/j.jobcr.2015.03.001

1. Introduction

Extraction of teeth can result in loss of alveolar ridge width and height within first one to three years. This bone loss is exacerbated if the tooth is removed traumatically or if there are pre existing endodontic or periodontal pathologies. These often require bone augmentation to create ideal gingival contour and aesthetics.

Different surgical approaches have evolved to treat resorbed mandible. These include mandibular augmentation with rib grafts, iliac grafts, and visor osteotomy, combination of bone grafts with alloplastic materials, transosseous and transmucosal implants.

Tent pole technique has also been used for bone regeneration. It is a safe and effective method for augmentation of bone height in resorbed ridges. The main advantages of tent pole technique are stable gains in vertical alveolar bone height, successful retention of implant prosthesis associated with the procedure.

The aim of this paper is to describe the evolution of tent-pole technique from when the concept was first reported in 2002 by Marx et al. till the present scenario with its modifications and use of different bone graft materials with this technique for augmentation of bone height. Since this technique is a safe and effective method for augmentation of bone height in vertically deficient alveolar ridges so it is of interest to review the scientific data of this specific technique.

2. Material and methods

The evidence was obtained using PubMed and Google search. Articles were searched from 2002 till 2013. PubMed and Google search included keywords: ridge resorption, tentpole technique, alveolar ridge augmentation. References in relevant publications were also examined for clinical trials on this technique. These articles were thoroughly reviewed and those that fulfilled our criteria were included.

3. Review on ridge resorption

Following tooth removal varying amounts of bone resorption take place due to qualitative and quantitative changes that occur at the alveolar bone around the extraction site. Alveolar bone is a tooth dependent structure and, therefore, after a tooth is extracted dimensional bone reduction takes place both, horizontally and vertically resulting in changes that may lead to esthetic and functional problems. A deficient alveolar ridge fails to provide sufficient support and retention for dentures. This will not only compromise the soft tissue support and lower anterior facial height but also preclude dental implants placement.[1] Such deformities of the alveolar ridge may compromise future implant placement as well as esthetic results when a fixed partial denture is constructed in a visible area.[2,13]

Alveolar ridge atrophy may cause severe alveolar ridge deficiency in horizontal and vertical direction. In cases of severe atrophy of edentuluous maxilla maxillary retrognathism may result.[3] Ridge atrophy after tooth loss has been shown to follow certain patterns. The bundle bone appears the first bone to be absorbed whereas alveolar bone is gradually absorbed throughout life. The remodelling process results in ridge morphology reduced in vertical height and more palatal in relation to original tooth position.[4] In the maxilla, the labial wall of the alveolar socket tends to resorb more rapidly after dental extraction and the ridge gradually becomes represented by the previous palatal wall (centripetal resorption. In the mandible, however, the lingual wall tends to resorb before the buccal (centrifugal resorption). This discrepancy in the resorption pattern frequently compromises the sagittal and axial intermaxillary relationship. In both jaws, the thickness of the alveolar bone ridge is compromised earlier than its height. Nonextraction etiologies of alveolar bone loss include denture-induced atrophy, trauma, periodontal disease, congenital alveolar defects, and tumor resection.

3.1. *Classifications of alveolar ridge*[5]

A. In 1963, Atwood described 6 classes of alveolar ridge atrophy[6]
   - I. Preextraction normal bone.
   - II. Post extraction normal bone: after extraction and before resorption started.
   - III. High well rounded, adequate in height and width.
   - IV. Knife-edge, adequate height, inadequate width.
   - V. Low, well rounded, inadequate height and width.
   - VI. Depressed ridge.

B In 2004, Juodzbalys and Raustia, using panoramic x-ray, computerized tomography, and ridge-mapping calipers with 347 patients, classified alveolar ridge atrophy into 3 types:[7]

   Type I: Alveolar height is $\geq$ 10 mm and width is $\geq$ 6 mm and the vertical defect in the anterior region is $\leq$ 3 mm, which is optimal for implant placement.

   Type IIA: The height is $\geq$ 10 mm and the width is 4–5 mm: narrow edentulous jaw dental segment (narrow eJDS).

   Type IIB: The height is 4–9 mm and the width is $\geq$ 6 mm (shallow eJDS).

   Type IIC: The height is 4–9 mm and the width is 4–5 mm (shallow and narrow eJDS).

   Type IID: The height is $\geq$ 10 mm and the width is $\geq$ 6 mm, the vertical cosmetic defect in an anterior region is > 3 mm from the crest of the alveolar bone to the necks of adjacent teeth.

   Type III: The height is < 4 mm and the width is < 4 mm (too shallow and too narrow for implantation).

C According to its density, alveolar bone has been classified into 4 types by Misch (2008):
   1. D-1 bone: *Dense compacta*; almost entirely composed of cortical bone, it is found in the anterior mandible, and this can withstand substantial loads because of its highly mineralized matrix.
   2. D-2 bone: *Porous compacta* and coarse trabecular bone; it is commonly located in the posterior mandible and sometimes in anterior maxilla.