

## Factors influencing vertical ridge dimensions in mandibular molar edentulous site - An Observational study

Dr. Sangamithra Sidharthan<sup>1</sup>, Dr. SivaramGopalakrishnan<sup>2</sup>

<sup>1</sup>(Lecturer, Department of periodontics, Dr. D. Y.Patil Dental college &Hospital, Pune, India)

<sup>2</sup>(Professor, Department of Periodontics, Ragas Dental College &Hospital, Chennai, India)

---

**ABSTRACT:** The purpose of this study was to determine the influence of –“reason for extraction” and the “span of edentulousness” in the occurrence of vertical ridge deficiencies in mandibular molar region. A total of 71 patients with single molar edentulous sites were included in the study and the reason for extraction was obtained through a detailed case history. Intra oral periapical radiographs were obtained of the selected sites and the vertical distance measured from a line connecting the adjacent cementoenamel junctions to the crest of the remaining bone. The vertical ridge deficiencies were categorized as mild, moderate or severe. It was observed from our study that, severe vertical ridge deficiencies are mostly associated with extraction due periodontal disease and the keratinized tissue loss is in agreement with the severity of ridge deficiency. It was also inferred that the span of edentulousness is directly proportional to the loss of vertical bone height.

**KEYWORDS:** mandibular ridge resorption, periodontitis, vertical ridge deficiency, span of edentulousness

---

### I. INTRODUCTION

Tooth extraction is one of the most common dental procedures with dental caries (43.3%) and periodontitis (41.8%) being the major indications. [1] Alveolar defects that occur as a consequence of tooth removal become only partially restored even if healing is uneventful. It is an established fact that reduction in both buccolingual and apicocoronal dimensions of alveolar ridge occurs after tooth extraction. [2]

Loss of alveolar bone dimensions can be exacerbated in regions of the ridge with advanced periodontitis. Additionally, the duration of edentulousness has also been reported to be one of the most important factors contributing to the severity of bone loss. [3] Rapid residual ridge resorption has been shown to occur in the first 6 months following tooth extraction, although resorptive activity continues throughout life at a slower rate. [4]

The importance of presence of keratinized tissue around restorations and prostheses than natural tooth structures regardless of oral hygiene status has been described in various studies. [5] It can therefore be speculated that, an inadequate amount of keratinized tissue at the edentulous site negatively influences the long-term maintenance of marginal tissues of restored teeth/ dental implants.

The aim of the present study was to determine the influence of –“reason for extraction” and the “span of edentulousness” in occurrence of vertical ridge dimensional changes in mandibular molar region.

### II. MATERIALS AND METHODS

A total of 71 patients (40 male/31 female) in an age interval of 20-50 years with single tooth mandibular edentulousness were included in the study.

#### 2.1 Inclusion criteria:

- Mandibular single molar edentulous site.
- Bilateral single molar edentulous sites.
- Presence of adjacent teeth.
- No prosthetic replacements in the site.

#### 2.2 Exclusion Criteria:

- Multiple adjacent missing teeth
- History of smoking/ tobacco chewing.
- Patients under radiation therapy.
- Patients with history of systemic disease.

#### 2.3 Clinical assessments:

##### 2.3.1 Relative Vertical defect dimension (r VDD):

- rVDD's were assessed using Intra Oral Periapical radiographs.
- Vertical distance was measured from the line joining adjacent tooth CEJ to the crest of the bone.
- rVDD were categorized as < 3mm, 4-6mm, >7mm.

##### 2.3.2 Keratinized Tissue (KT) width :

- KT width was measured on the mid- buccal side of the edentulous site.
  - KT was categorized as > 3mm, 2-3mm, < 2mm.
- 2.3.3 Periodontal parameters:
- Periodontal probing depth, Clinical attachment level, bleeding on probing at the adjacent teeth.

### **III. RESULTS**

Data for vertical ridge deficiencies were retrieved from IOPAs of 71 selected patients ( 40males and 31 females;age range: 20-50 years). The number of edentulous sites suitable for analysis was 77(single mandibular edentulous site with adjacent teeth). All edentulous sites showed a radiographic appearance of healed sites. Keratinized tissue width was obtained at the mid-buccal side of the edentulous site. The reason for extraction and span of edentulousness was obtained through a detailed case history.

On the basis of the preliminary results of the present study, severe vertical ridge deficiency (>7mm) was observed in 6 subjects.This vertical loss was also in conjunction with a decrease in the keratinized tissue width. An average vertical deficiency of 4-6 mm was noted in 28 patients.

Sites with least vertical deficiency were observed in 43 patients. The keratinized tissue width was measured to be least in patients with less severe vertical ridge deficiency. The results are summarized in TABLE 1.

### **IV. DISCUSSION**

Alveolar bone is a tooth associated structure, thus the duration of edentulousness is directly associated with changes in dimensions of the alveolar ridge. Lack of stimulation to the residual bone result in decreased bone density and trabeculae, subsequently causing a loss of height and width of the ridge.[6]Span of edentulousness of more than 2 years without replacement may contribute to an average to severe vertical ridge deficiency.

The amount of bone damage that occurs during the removal of teeth may affect the subsequent remodeling of the bone. [7]Cardaropoli et al reported that raising mucoperiosteal flap and denuding buccal bone has detrimental effects on resorption process.[8] Similarly, Schropp et al stated that damage to bony tissue during tooth removal may result in additional bone loss. [9]In this study, traumatic extraction was reported in 20 grossly decayed teeth, in which bone loss of 4-6 mm was observed. This could be attributed to severing of buccal plate during extraction. Plaque-associated periodontitis is associated with reduction in the bony support around the teeth due to influences of microbial factors acting either directly or indirectly via the host's inflammatory responses. In this study, severe vertical ridge deficiency (>7mm) was observed in 6 subjects with mobility being the reason for extraction. This is in agreement with studies that describe early loss of bundle bone in periodontally affected teeth resulting in greater vertical ridge deficiencies. [10]These dimensional changes significantly limit the placement of implants of desired length and diameter.

In all conditions with greater vertical deficiencies, a notable decrease in keratinized tissue width was observed, affirming that soft tissue contour follows the underlying hard tissue component. Although the significance of specific dimensions of keratinized tissue is still controversial, it is certain that keratinized tissue provides increased resistance of the periodontium to external injury. This aids in dissipation of physiological forces that are exerted by the muscular fibers of the alveolar mucosa on the gingival tissues. [11]

Epidemiological studies have shown that mandibular first molars are the most commonly extracted teeth due to dental caries. [11] In this study, as the age group of subjects assessed was 25-50 years and mandibular molars being the most common site, presence of edentulous sites due to periodontal disease was lower. Additionally, pre-extraction site assessment was not done directly and only the history obtained from the patient was used as a tool for categorization. Furthermore, as intraoral periapical radiographs were used for ridge measurements, which allows only for a bi-dimensional evaluation some degree of magnification and distortion is inevitable and hence it must be emphasized that the measurements are approximated and not real size.

### **V. CONCLUSION**

In conclusion, the result of our pilot study indicates that, severe vertical ridge deficiencies are mostly associated with extraction due periodontal disease and the keratinized tissue loss is in agreement with the severity of ridge deficiency. The span of edentulousness also was directly proportional to the amount of both hard and soft tissue loss.However epidemiological studies with a larger sample size would be needed to validate our findings.

Improvement of quality of life by restoration of function and esthetics is the primal goal in rehabilitation. Since the presence of an adequate amount of alveolar bone is the primary requisite for placement of dental implants, vertical ridge deficiencies provide a hindrance for the same. Vertical ridge deficiencies are critical since vertical ridge augmentation procedures have unpredictable outcomes.[12] Various ridge augmentation procedures like GBR (for average defects),alveolar distraction osteogenesis (for severe defects) can be carried out to achieve optimal vertical height before implant placement. Moreover we would like to add that alveolar ridge preservation procedures carried out at the time of extraction, potentially limits the extent of ridge alterations.[13]Since the span

of edentulousness also has a role in tissue loss, the earlier the replacement and functional load, better the preservation of the remaining bone. Nevertheless choice of procedure should be based upon the patients existing ridge anatomy, degree of vertical deficiency, and willingness to participate in treatment.

Table1. Reasons for extraction, span of edentulousness and keratinized tissue width in correlation with the relative vertical defect dimension.

No. of subjects	Relative Vertical Defect dimension (mm)	Reason for extraction		Span for edentulousness(years)			Keratinized Tissue width (mm)		
		Dental caries	mobility	≤1	2- 5	≥5	≥3	2-3	≤ 2
43	≤ 3	43	-	7	29	7	30	13	-
28	4-6	20	8	6	14	9	10	14	4
6	≥7	-	6	-	2	4	-	-	6

### References

- [1] Aida J, Ando Y, Oosaka M, Niimi K, Morita M. Contributions of social context to inequality in dental caries: a multilevel analysis of Japanese 3-year-old children. *Community Dent Oral Epidemiol.* 2008;36(2):149–156.
- [2] Lekovic V, Kenney EB, Weinlaender M, Han T, Klokkevold P, Nedic M, et al. Bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases. *J Periodontol.* 1997 Jun;68(6):563–70.
- [3] Carlsson GE. Clinical morbidity and sequelae of treatment with complete dentures. *J Prosthet Dent.* 1998 Jan;79(1):17-23. Review.
- [4] Jahangiri L, Devlin H, Ting K, Nishimura I. Current perspectives in residual ridge remodeling and its clinical implications: a review. *The Journal of prosthetic dentistry.* 1998 Aug 31;80(2):224-37.
- [5] Valderhaug, J. E. Ellingsen, A. Jokstad. Oral hygiene, periodontal conditions and carious lesions in patients treated with dental bridges. A 15-year clinical and radiographic follow-up study. *J ClinPeriodontol.* 1993 Aug; 20(7): 482–489.
- [6] Pietrokovski, Jaime The bony residual ridge in man. *Journal of Prosthetic Dentistry* , Volume 34 , Issue 4 , 456 – 46.
- [7] Sobolik, C.F. : Alveolar Bone Resorption, *J. Prosthet. Dent.* 10:612-619, 1960.
- [8] Stefan Fickl, Otto Zuhr, Hannes Wachtel, Wolfgang Bolz, Markus Huerzeler. Tissue alterations after tooth extraction with and without surgical trauma: a volumetric study in the beagle dog. *J ClinPeriodontol.* 2008 Apr; 35(4): 356–363.
- [9] Schropp, L., Wenzel, A., Kostopoulos, L. &Karring, T. (2003) Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12- month prospective study. *The International Journal of Periodontics and Restorative Dentistry* 23, 313–323.
- [10] JeffcoatMK. Bone Loss in the Oral Cavity. *J Bone Miner Res* 8 Suppl 2, S467-S473. 12 1993.
- [11] Lang N, Loe H. The relationship between the width of keratinized gingival and gingival health. *J Periodontol* 1992; Oct: 623-628
- [12] Simion M, Trisi P, Piattelli A. Vertical ridge augmentation using a membrane technique associated with osseointegratedimplants. *Int J Periodontics Restorative Dent.* 1994 Dec;14(6):496-511.
- [13] GianlucaVittoriniOrgeas, Marco Clementini, Valeria De Risi, Massimo de Sanctis. Surgical techniques for alveolar socket preservation: a systematic review. *Int J Oral Maxillofac Implants.* 2013 Jul-Aug; 28(4): 1049–1061.