



Image Guided Prognosis Values Analyzing Intrabony Defect Healing after Guided Tissue Regeneration surgical procedure.

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Abstract

Aim: to monitor the healing process after guided tissue regeneration (GTR) specifically by using Image guided prognosis (IGP) values of digital panoramic radiograph.

Material and methods: All cases of 29 patients with 124 teeth were indicated initially for the treatment by GTR endodontic surgery with adjunctive Alpanthaprovitamin. All selected cases subjected to this radiological analysis of radiolucent intrabony periapical lesion (more than 5 mm * 5 mm) anterior region of both jaws for both sexes. By using IGP values of both Gray Scale Mean for lesion size (GSM) and (HU) Index values for analyzing bone resorption (demineralization) initially and formation (mineralization) of the new osseous matrix after 12 month of endodontic surgery (GTR).

Results: This study findings showed a significant improvement radiologically of Ma-HU index (268.68-1105.36) rather than Max-HU index (283.95-996.11). Whereas a high GSM difference appeared in female group (9.21(0.36) - 6.25(0.50)) than male group (6.84(0.85) - 5.49(0.53)) with high HU index significant differences ($p < 0.001$) between the preop and postop period. However, there were no significant difference of male group either between Max-HU value index or GSM lesion diameter any time.

Conclusions: Both GTR procedures with adjunctive Alpantha are effective in the treatment of intrabony defects. Although, there is no significant differences between age in acceleration period of bone healing but, it could be demonstrated significantly for both sexes by Digital Imaging Guided values.

Key words: Image Guided Prognosis IGP, GSM lesion size, Endodontic GTR Surgery, HU Index value.

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The success of periodontal regeneration can be assessed by clinical, radiographical and

Introduction



This study data was collected from 29 (12 males and 17 females) patients indicated for Endodontic surgery GTR of minimally invasive anterior segments in maxilla and mandible with intrabony defect of more than 5*5 mm² in size. All patient database collected from private specialized clinic of Oral and Maxillofacial Surgery unit over a one-year period in Baghdad provenance/ Iraq.

As exclusion Patients criteria with immunocompromised medical status, including diabetes, chronic steroid use and immune deficiencies, and active smokers were excluded from this study analysis. Additionally, the doubtful sites with compromised periradicular bony structure with multilayer bone absorption according to Arx and Cochran 2001 classification (e.g. periapical lesion not endodontic related lesion or a site fracture line lesion) were not included in the study. (Table 1)

A panoramic digital imaging scan was taken where OPG images obtained with a Kodak 8000C digital machine set at 73 kVp, 12 mA, and 13.9 seconds of exposure, while CBCT exams were realized with a Kodak 9500 scanner set at 0.3 mm voxel and 15 × 9 cm FOV sizes, with a slice interval of 1 mm for all these patients prior to surgery for initial selection of cases and then finally after one year for follow up estimation.

All patients matched to the study group from both sexes of (16-27) years old had A panoramic imaging initially for selective clinical and radiological criteria of analysis performed before and after GTR procedure. All surgical sites were grafted using RegenOss cortical and cancellous xenogeneic bone graft plus Bioteck collagen membrane (®finceramica company, Italy) where Xenogenous bone chips were gently packed into the apical area and the buccal cortical side then an absorbable collagen membrane matrix was secured. The flap was repositioned and secured with 4-6 single interrupted sutures with gentle application of adjunctive Alpanthaprovitamin (®kintha company Lab, Barcelona, Spain). (Figure. 1^{a, b})

Post-operative instructions were given, which included one-week course of amoxicillin 1 g, Metronidazole 400 mg twice a day and 0.12 %

histological evaluations. The measurements of clinical improvement by observational methods such as imaging are the most frequently used examinations to assess the outcomes of regenerative procedures in a clinical practice.¹⁻³

The direct measurement of bone sounding has therefore been used to assess bone healing using radiographical examination providing a non-invasive, well-established method for the assessment of bone changes and also for monitoring outcomes following periodontal regeneration.^{4,5} Although Radiographic assessments of periodontal regeneration compare changes in bone support from the time of surgery to the post-treatment intervals determined by individual studies.⁶⁻⁹

In order to detect changes in bone support over time, two or more radiographs must be compared. Sequential radiographic assessments can be used to determine the regeneration of alveolar bone over time by measurements of bone gain/loss with quantification of the amount (densitometry) of alveolar bone.¹⁰ Serial radiographs, however, may indicate apparent differences that reflect a true degree of regeneration of new tissues or by digitizing the corresponding radiographs and analysis with computer software.¹¹ Although both analytical techniques tend to underestimate the true linear distances, the computer assisted analysis has been found to have a lesser extent of discrepancy than the direct conventional measurements.^{12,13}

This present study reports the radiographic analysis of a randomized controlled cases indicated for endodontic surgery which compared the clinical outcomes at 12 months following GTR surgical procedure with or without placement of a bioresorbable adjunctive in anterior esthetic zone. The digital panoramic imaging, which appears to be superior in relevance of bone filling opacity resolution OR indicating about healing success ratio of intrabony defect clinically.

Materials and Methods



Remarkably, there were no significant differences in female Max-HU Index and male GSM prognostic values pre and post operatively with a P value of more than 0.013 and 0.213.(Table 3 and 4)

Discussion

Digital panoramic radiography has recently been developed and is now used worldwide since computer-assisted diagnosis systems would be helpful in determining the hard tissue prognostic indices on digital panoramic radiography.¹⁴⁻¹⁷

A number of clinical studies on periradicular surgery performed with the use of microsurgical endodontic instruments have been published. The overall success rate of such procedures is generally high.⁴⁷⁻⁴⁹ Nevertheless, many variables, such as clinical procedure, materials, radiographic and clinical outcome assessment, site of operation, may affect the prognosis of the surgical treatment. Furthermore, different criteria for the evaluation of the treatment prognosis have been adopted.²²⁻²⁴

Delays or alterations in healing have been reported when lesion size was greater than 5 mm.^{14,40,41} Several authors showed that the prognosis for smaller lesions after periradicular surgery is better than the prognosis for larger ones.^{18,19,43-46}

A predictable analysis study by Palma et al.,³⁴ and a similar study Xu et al.,³⁵ found that after two weeks post grafting with an-organic bovine bone mineral, the augmented space was almost completely obliterated by both newly formed bone and fibrous cancellous tissue in the sinus of rabbits. We have related and confirmed our radiological findings with the histological reports on the bone forming potential of an-organic bovine bone graft.

The most commonly used product that has been reported in literature comes under the proprietary name of Bio-Oss[®] (GeistlichPharma Switzerland) which is considered to be a highly biocompatible and osteoconductive material which leads to appropriate osseointegration of dental implants.^{24,30-32,39}

Pecora et al¹⁰ showed that large periapical lesions healed more rapidly and with better quality bone when an adjunctive material [e-

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Kincarechlorhexidine mouth rinse. After two week the sutures were removed. One year follow up examination presented a clinically significant reduction of tooth mobility and the periodontal recession. (Figure 2^{a, b})

The final cohort of all patients' data were divided into two stages: initially the preoperative stage consisted of 19 surgical sites of 124 teeth and finally the follow up period were assessed periodically at 12 months for better prognostic value measurements were analyzed independently. The findings obtained from these sites were analyzed by the statistical analysis Using the Statistical Package for Social Sciences (SPSS) version 20.0 (International Business Machines Corp. Armonk, NY, USA). The Intragroup variability was assessed utilizing standard deviation and standard error of the mean by Intergroup differences were evaluated using unpaired t-test.

Results

One hundred twenty-four teeth of all included 29 (12 male and 17 female) patients respectively. patients were analyzed in the study for prognosis estimation after GTR surgical endodontic procedure. The mean age of the Control group was 23.8 years for both sexes. (Table 2)

In all patients, Image prognostic values IGP values measured for both anterior regions of maxilla and mandible initially and after 12 months follow up periods. The average Mean (SD) GSM lesion size was in maxilla and mandible 6.84(0.85) mm - 5.49(0.53) mm successively for male and 9.21(0.36) mm - 6.25(0.50) mm for female. While the Max- HU were 283.95- 996.11 -101.3 and Ma- HU index was 268.68- 1105.36 with a high significance of a (p <0.001) value between preop and postop periods successively.(Table 3 and 4) (Fig 1^{a, b} and Fig 2^{a, b})

Bone Hu measurements as Image Guided prognostic values for healing response revealed that high significant differences between Max-HU and Ma-Hu indices in males and females and significant differences between initial time of diagnosis and after treatment within follow up period of 12 month (P value of <0.001). (Table 4 and 5) (Fig 1^{a, b} and Fig 2^{a, b})



especially reported by Hallman et al.³¹ This study provided similar radiologic results comparable with those gathered through experimental studies in animals.^{27-32,35,37} Also in this study, it was judged that there was no difference according to the age or gender postoperatively since the study subjects were relatively young patients undergoing an endodontic surgical treatment.

Mischet al reported that the mandible had a higher efficacy bone density than the maxilla, as a result of measuring the higher bone density based on Hounsfield unit measurements.³³ He also reported that bone densities tended to decrease from the anterior to posterior in both the maxillary and mandibular trabecular bones when analyzed by the Hounsfield unit. In this study, the GSM and HU Indices values showed higher values in the anterior base of the maxilla than in the mandibular body. As it seemed in previous studies, there have been studies that use CT to analyze the structure of the second cervical vertebra.

Finally, even this study findings presented a beneficial effect of GTR procedure prognosis over one-year period and was seen with through-and-through lesions but, it restricted to small study sample and widely exclusion criteria findings. The present study suggests that additional quantitative radiological studies with larger sample sizes and longer recall rates are needed to confirm these results.

Conclusion

This study findings emphasize the relevance of radiological prognostic values of digital imaging which reveal the success rate of GTR techniques healing response with satisfactory non-invasive procedure especially for esthetic zone area of both maxilla and mandible successively.

PTFE] Gore-Tex) was used. In 2001, they conducted a clinical randomized study to evaluate the adjunctive effects of calcium sulphate grafts on the surgical treatment of patients with through and-through periradicular lesions. Results of this study demonstrate that the addition of Alpanthaprovitamin as a bone graft during conventional surgical treatment improves clinical outcomes.

Parsa et al.⁽²²⁾ Nomura et al.⁽²³⁾ and Wallace⁽²⁷⁾ reported similar findings of their study, which analyzed guided bone regeneration for bone width preservation using histomorphometry and 3D CT evaluations 12 weeks after the procedure. Beck et al.⁽²⁶⁾ previously compared healing in grafted bone sites after 6 months and undisturbed sockets after 3 months and reported no statistically significant differences in the amount of newly formed bone or residual graft particles between the two groups. When these findings and the natural healing process are taken into consideration, we believe that the healing time allowed in our study (ranging from 6-12 months, an average of 9 months) is adequate for the assessment of bone density in surgical site.

In our study, we compared HU values from surgical GTR sites of both sex study groups to determine if there was a difference in bone density between surgical sites postoperatively like that reported by Shapurian et al.³⁹ When averaged between two period was estimated, HU Index values in the postoperative period was significantly higher than those in the preoperative initial time group especially in Mandible value of Ma-HU (269.65-1182.81) with (P <0.001) and mostly in male group.^{22,24} The predictability of clinical prognosis, radiographic, and histologic healing over outcomes with conventional techniques improved the prognostic value of the treatment plan procedure clearly⁴⁰⁻⁴⁶

Table 1. Classification of bony defects in endodontic surgery from Von Arx and Cochran 2001

<p>Class 1: Intra Bony defects localized to periapical area</p>	<p>1a: Lingual/Palatal cortex is not eroded 1b: Erosion of buccal and lingual/palatal cortex (through-through lesions).</p>
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Class 2: Apico-marginal lesions	2a: Periapical and marginal lesions without communication 2b: Periapical and marginal lesions with communication
Class 3: Lateral juxta radicular lesion	3a: Without communication to alveolar crest 3b: With communication to alveolar crest

Table 2. Characteristics of the samples.

Group characterization	Male	Female	Total
Number of Tooth measured	52	72	124
Number of the Patient	12	17	29
Mean Age (SD)	23.8 (6.5)	19.5 (7.0)	22.0 (7.0)

Table 3. Bone Hu measurement in the Preop and Postop and the differences between Maxilla and Mandible regions.

Time healing process	Max- Hu value Index	P value	Ma- Hu value Index	P value
Pre-op value	283.95	0.024	268.68	<0.001
Post-op value	996.11		1105.36	

HU: Hounsfield Unit Value Index; Max: Anterior region of the maxilla; Ma: Anterior region of Mandible.

Table 4. Bone Hu measurement in males and females and the differences.

Group healing process	Max- Hu value Index		P value	Ma- Hu value Index		P value
	Preop	Postop		Preop	Postop	
Male	234.83	1081.03	<0.001	269.65	1182.81	<0.001
Female	213.89	956.87	0.013	304.60	1146.83	<0.001

HU: Hounsfield Unit Value Index; Max: Anterior region of the maxilla; Ma: Anterior region of Mandible.

Table 5. Comparison of the intrabony parameters among regions

Group	Lesion Diameter (GSM) Mean (SD)		P value	Hu value Index		P value
	Max	Mandible		Max (Preop-postop)	Mandible (Preop-postop)	
Male	6.84(0.85)	5.49(0.53)	0.213	234.83-1081.03	304.60-1182.81	<0.001
Female	9.21(0.36)	6.25(0.50)	<0.001	213.89-956.87	269.65-1146.83	<0.001



HU: Hounsfield Unit Value Index; GSM: Gray scale mean (lesion diameter) Max: Anterior region of the maxilla; Ma: Anterior region of Mandible.



Figure 1a. Mandibular Preop Ma-HU Index value at the Center of Bone resorption demineralization radiolucency (Intrabonyperiapical defect)

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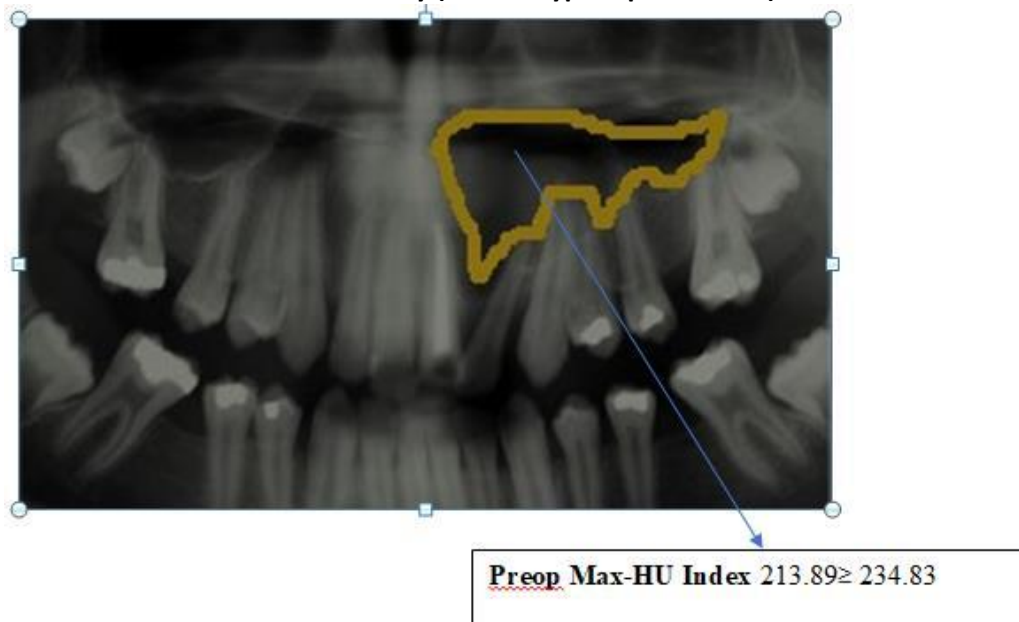


Figure 1b. Maxillary Preop Ma-HU Index value at the Center of Bone resorption demineralization radiolucency (Intrabonyperiapical defect)



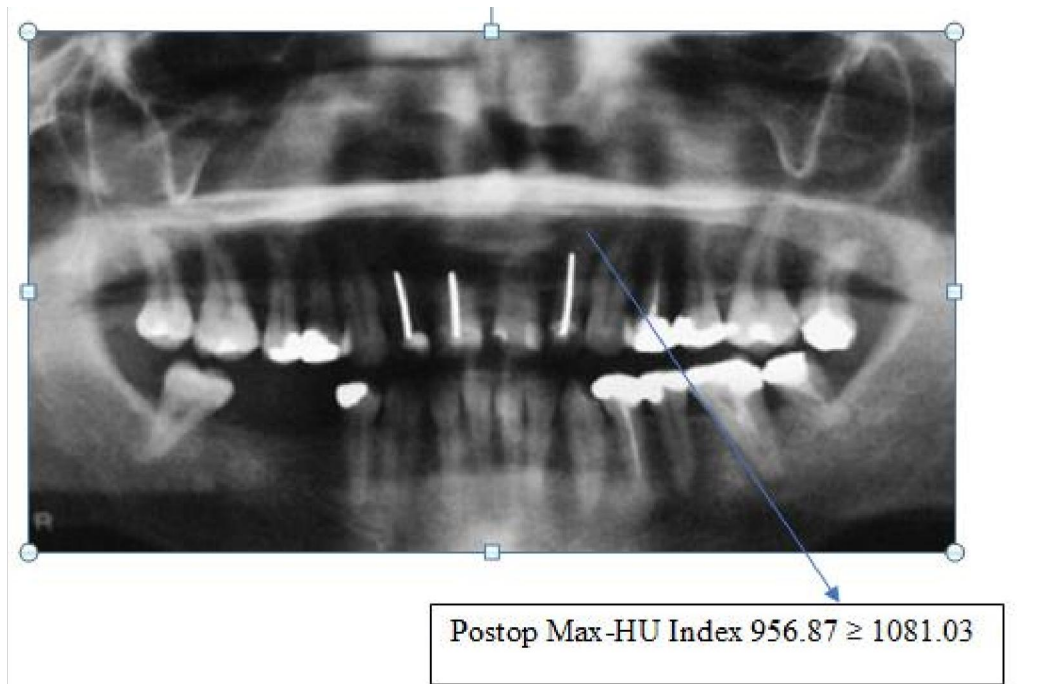


Figure 2a. Maxillary Postop Max-HU Index value at the Center of Bone reformation remineralization radio-opacity (GTR site)

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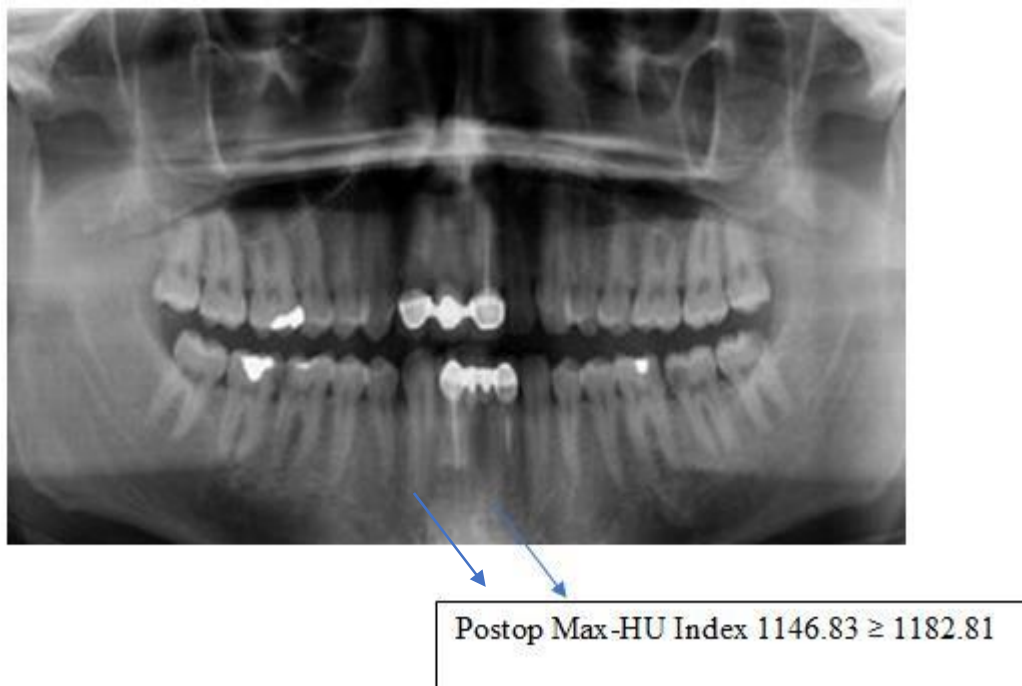


Figure 2b. Mandibular Postop Ma-HU Index value at the Center of Bone reformation remineralization radio-opacity (GTR site)



Figure 3. Serial clinical photographs of GTR procedure for patients at Preoperative and postoperative stages.

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Figure 4. GTR used material in surgical endodontics procedure.

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