Volume 8, No. 5 September 2016

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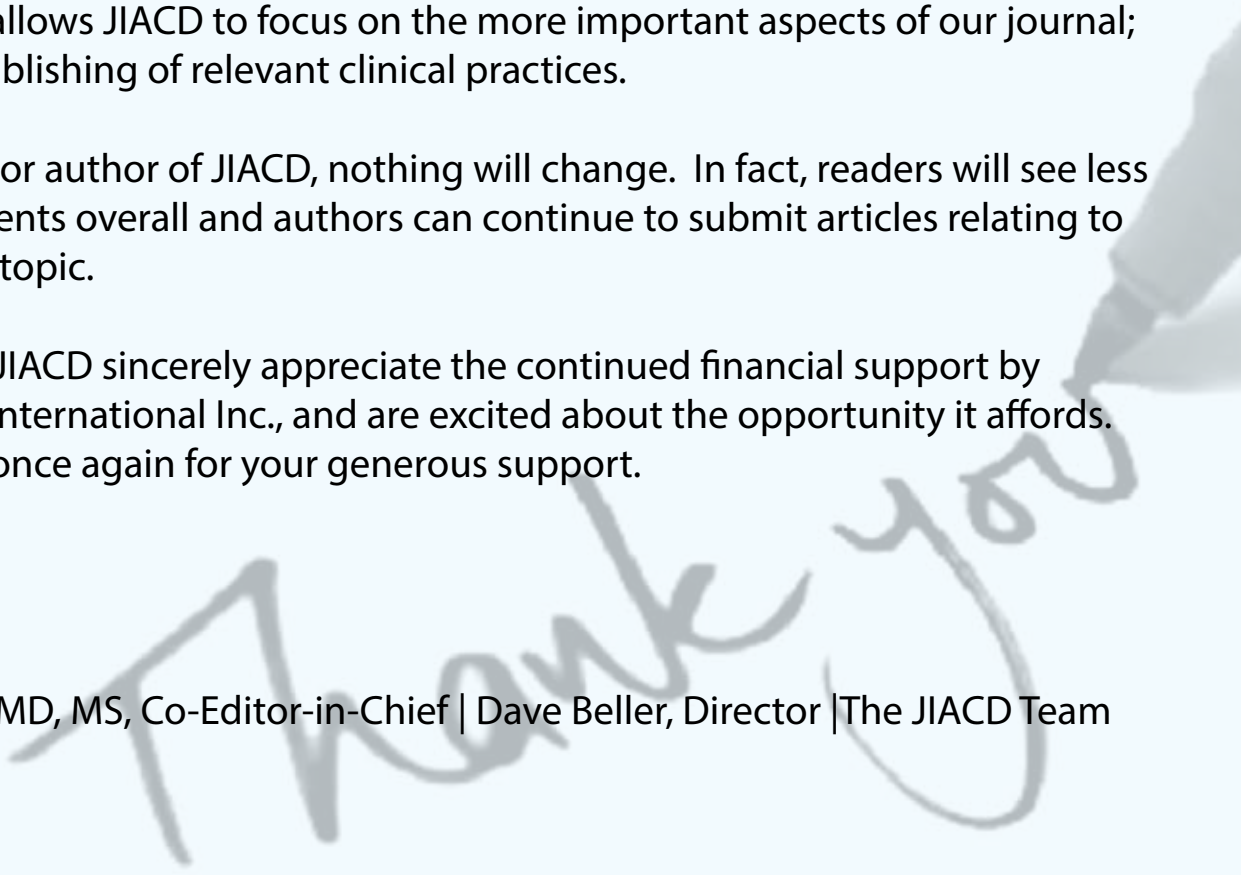

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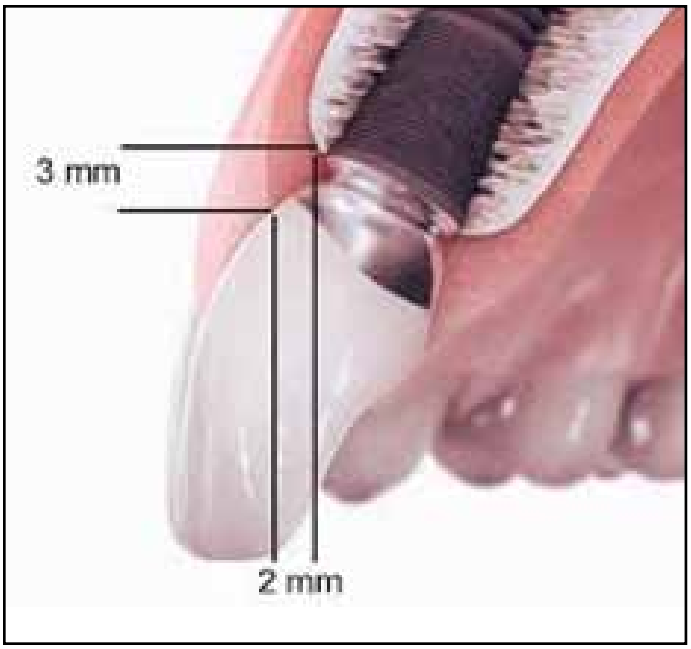

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# Horizontal Augmentation of the Deficient Alveolar Ridge Associated with Concurrent Implant Placement: A Retrospective Analysis of Outcomes

**Dr. Edward Ruvins[1] • Dr. Mark Stein[2] • Dr. Susanna Kayserman[3]**

## Abstract

**Background:** The challenges of many clinical cases lie in difficulty of managing severely compromised ridge defects. History of previously sustained alveolar trauma, past surgical procedures and variable pathologic developments cause substantial alteration of normal bone structure requiring osseoregenerative procedures to restore an adequate volume and architecture of alveolar structure needed for implant placement. The objective of this retrospective study was to measure and analyze clinical benefits gained by completion of guided osseous tissue regeneration treatment with utilization of "Tunnel Approach" completed concurrently with dental implant placement.

**Materials and Methods:** This study included 46 patients diagnosed with alveolar ridge deficiency impeding on adequate implant placement. Lateral ridge augmentation completed concurrently with implant placement was completed on 79 surgical implant placement sites. Out of 79 implant fixtures 41 were maxillary and 38 mandibular. All 79 implants were placed with utilization of flapless technique and subsequent "Tunnel Approach" Guided Tissue Regeneration. All surgical sites were evaluated at 6 months after implant placement and concurrent surgical ridge reconstruction.

**Results:** Clinical analysis of the pre-augmentation and post-augmentation measurements established that in all augmented sites a consistent and statistically measurable increase of the bone structure was achieved. The data collected from the clinical group of patients included in the clinical group demonstrated 1.6mm +/- 0.72mm (23.4%) gain.

**Conclusion:** This clinical "Tunnel Approach" to Guided Tissue Regeneration utilized for the lateral ridge augmentation delivers consistently positive and statistically significant alveolar bone regeneration.

**KEY WORDS:** Dental implants, bone grafting, ridge augmentation, guided bone regeneration

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## INTRODUCTION

The routine placement of a single or multiple implant fixtures in edentulous areas is frequently associated with difficulties in the management of severely deficient alveolus. Moreover, the demands for predictable surgical, restorative and esthetic outcomes caused a paradigm shift in our approach to case planning and esthetic expectations. This study was designed to demonstrate the clinical ease and versatility of the "Tunnel Approach" technique that allows successful and predictable regeneration of osseous defects of small and large volumes without significant postoperative complications and elimination of the need for secondary surgical procedures to remove non-resorbable barrier membranes. Historical methods of regenerative treatment have been mostly limited to Guided Bone Regeneration (GBR) that has proved to be a predictable mode of therapy. GBR has been indicated for correction of volume deficiency of the residual alveolar ridge that would traditionally limit implantation and optimal esthetic and functional outcomes. The "Tunnel Approach" technique of GBR to bone grafting was developed as an alternative modification to the traditional open flap surgical approach to the conventional GBR technique. Lastly, this research was designed to quantitatively assess the longitudinal osseous gain of the alveolus after completion of the Guided Tissue Regeneration with the "Tunnel Approach" technique completed with concurrent implant placement.

## MATERIAL AND METHODS

This study included 46 patients diagnosed with alveolar ridge deficiency impeding adequate implant placement. Lateral ridge augmentation completed concurrently with implant placement was achieved on 79 surgical implant placement sites. Distribution of the fixtures by site and type is summarized in the Tables 1 and 2. Following implant fixtures were used in

**Table 1: The Summary of the Distribution of the Implant Fixtures by the Site Characteristics**

| | |
|---|---|
| **Total Number of Implant Fixtures** | **79** |
| **Partially Edentulous Areas** | **34** |
| **Fully Edentulous Areas** | **36** |
| **Single Tooth Replacement** | **9** |

**Table 2: The Summary of the Distribution of the Implant Fixtures by the Replacement Type**

| | |
|---|---|
| **Total Number of Implant Fixtures** | **79** |
| **Maxillary Implants** | **41** |
| **Replacing Molars** | **11** |
| **Replacing Premolars** | **15** |
| **Replacing Anterior Teeth** | **15** |
| **Mandibular Implants** | **38** |
| **Replacing Molars** | **14** |
| **Replacing Premolars** | **15** |
| **Replacing Anterior Teeth** | **9** |

**Figure 1:** Clinical Measurements of the Ridge at the Reference Points with Ridge Caliper (ACE Surgical).

**Figure 2:** An assessment of the Maxillary Ridge Deficiency Prior to the Vertical Incision. Punch Soft Tissue Preparation were Used for a Flapless implant Placement.

this study: 19 Biohorizons Internal Implants / Laser Lock (Biohorizons Inc.,), 8 Implant Direct / Legacy 3 (Sybron Dental), 4 ISI (OCO Biomedical), 45 Prima Internal Implants (Keystone Inc.,) and 3 Genesis (Keystone Inc.,) All 79 implants were placed with utilization of flapless technique and subsequent "Tunnel Approach" Guided Tissue Regeneration. All surgical sites were evaluated at 6 months after implant placement and concurrent surgical ridge reconstruction. The study was conducted between January 2008 and February of 2013.

## Study Protocol

The study included patients demonstrating characteristic alveolar ridge deficiency of the buccal / facial aspect regardless the extent of edentulism. Although the deficiency existed, implant placement with initial stability was still possible. Additional inclusion criteria assumed the ability of the surgeon to place the implant into the alveolus without perforation of the buccal cortical plate. Guided Tissue Regeneration in all sites included in this study was completed under local anesthesia in an office setting. Pre-operative work up included initial diagnostic preoperative radiographs, ridge mapping and preoperative CT scan. All surgical procedures were completed by the same surgeon under local anesthesia. Initial one week follow up appointments were followed by monitoring appointments scheduled at one, three, five and six month's intervals.

## Patient Selection

The subjects for this study were screened and selected according to the following inclusion criteria: manageable medical conditions, controlled oral hygiene and the absence of non-healing oral lesions, adequate vertical dimension of alveoli to subsequently place implant fixtures of at least 8mm in length and adequate volume of soft tissue to complete flapless approach to the recipient site. None of the surgical sites

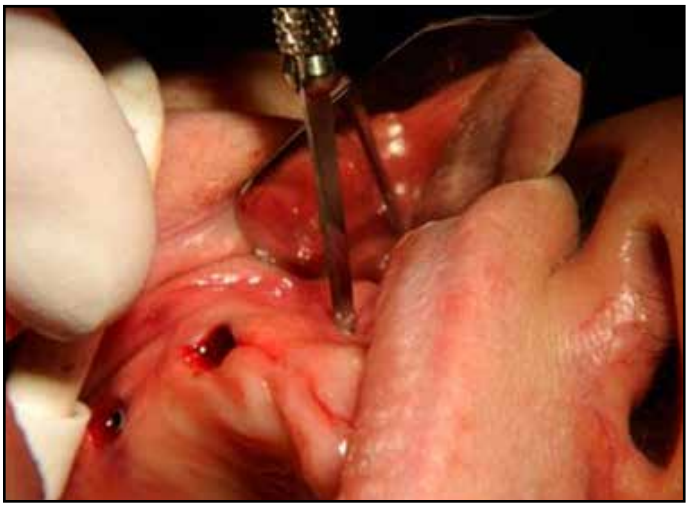

**Figure 3:** Initial Vertical Incision and Gingival Tissue Elevation for a Concurrent Implant Placement Protocol.

**Figure 4:** Strap Suture Preparation for Membrane Placement after Decortication of the Recipient Site with Bone Scraper (ACE Surgical).

had a history of previous bone augmentation. All subjects had GBR procedure with "Tunnel Approach" completed concurrently with and immediately after implant placement. All osteotomies and all implant fixtures were placed with flapless approach. All implants were covered with a cover screw without utilization of healing abutments or any types of gingival formers.

All selected patients were informed on the nature of the study, presented with alternatives and had consented to the treatment and postoperative follow up protocol.

Prior to surgery, in an attempt to achieve optimal oral health, all patients (excluding fully edentulous subjects) underwent a pre-treatment phase consisting of dental prophylaxis, limited or complete scaling and root planning (when needed) and postoperative oral hygiene instructions. All subjects included in this study demonstrated adequate abilities to maintain sufficient level of oral health.

## Surgical Protocol

The following surgical principles were applied and followed in the course of the study:

- Minimal surgical incision associated with "Tunnel Approach" in the immediate proximity of the grafting site
- Preservation of critical gingival - cortical bone seal
- Partial decortications with micro osseous scraper Thorough and diligent isolation of the grafting site with resorbable collagen membrane and fixation of the latter with resorbable sutures
- Strategic placement of allograft bone particles in a mixture with autogenous bone and adequate saturation of the graft with blood
- Maintenance of the space above basal cortical level to allow for bone re- contouring and healing.

**Figure 5:** Membrane Placement and Fixation.

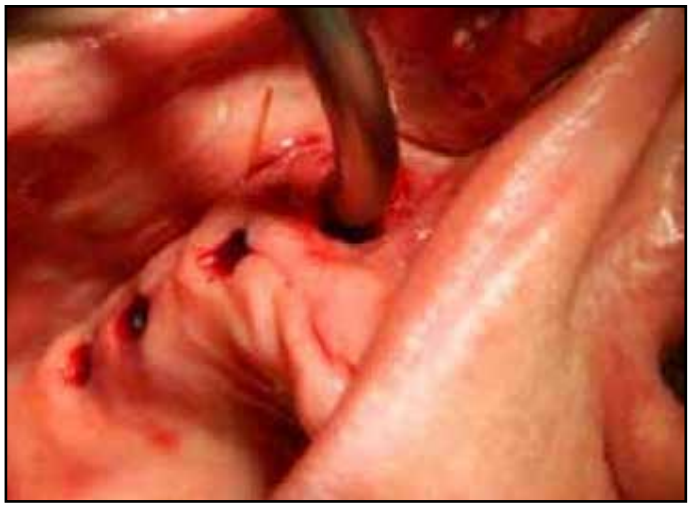

**Figure 6:** Allograft / Autograft Mixture Placement with Bone Syringe (ACE Surgical).

**Figure 7:** Postoperative View.

## Surgical Technique

Preparation of the surgical field was achieved with 2 min. continuous intraoral rinse with 0.12% Chlorhexidine Gluconate was followed by local administration of anesthetic (Lidocaine HCL 2% with Epinephrine 1:100,000, Henry Schein Medical). All implant fixtures were placed though flapless osteotomy prior to the ridge augmentation. Ridge assessment and site selection were completed before the incision was made (Figure 2). A vertical alveolar incision (mesial to the recipient site) was completed and followed by the elevation of mucoperiosteal tissue. No additional releasing incisions were made (Figure 3). Graft recipient site was prepared. The goal of cortical bone preparation was to partially decorticate recipient site, collect autograft particles and induce localized bleeding into the area of allograft placement. Decortication was achieved by utilization of standard bone scraper with subsequent utilization of autogenous bone particles (collected during the osteotomy preparation) into the allograft / autograft mixture. Resorbable collagen membrane was utilized in all cases to contain newly placed graft. The membrane was placed with utilization of resorbable chromic gut "strap" sutures (Figure 4) to pull the membrane into the site and fix it in place prior to the delivery of the graft mixture into the recipient site (Figure 5). Subsequently, placement of allograft / autograft mixture into the recipient site was accomplished with bone grafting syringe (ACE Surgical) and light digital pres-

sure for primary stabilization. It was important to assure that the graft was completely saturated with blood prior to the closure (Figure 6).

Edges of the membrane were placed under the mucosa and closed tension-free with 4.0 chromic gut suture. No fixation screws were used for membrane stabilization (Figure 7). All implant placement sites were completely covered with bone allograft/autograft mixture on the buccal side of the implant fixture. All implants were placed either slightly (within 1mm) subcrestally or equicrestally. Primary stability was achieved on all implants placed with a peak torque value equal or slightly higher than 25Ncm. measured by a standard toque wrench. All implants included in this study were covered with implant cover screw. No immediately loaded implants were included in this study.

## Data Collections and Methods

Initial measurement data was collected on the day of the surgery under local anesthesia (Figure 1). Three reference points were established at three (3), six (6) and nine (9) mm apically from the tip of the crestal bone respectively. Reference points were designated as A, B and C. The limitations of the caliper design forced the measurements to be rounded to the closest of 0.5mm value, for accuracy. Reference point of the crestal bone tip was established with trans-gingival application of periodontal probe under local anesthesia. Crestal bone reference point was designated as [T]. Prefabricated surgical stents were used to establish initial reference point T and reliably used the same position at the crest of alveolar bone for 6 months follow up measurements. In all cases the 6 month measurements were taken at the most buccal diameter point of the implant fixture with implant platform level used as a reference point for three (3), six (6) and nine (9) mm apical measurements. Data collected was assembled in a summary table. Respective designations were assigned:

- [a], [b] and [c] points were designated for presurgical measurements at reference points preoperatively.
- [A], [B] and [C] points were designated for postsurgical measurements.

Postoperative control measurements were conducted utilizing the same measurement protocol at six months. Data collected was also assembled in a summary table. Assessment and analysis of combined data was conducted with utilization of Microsoft Office 2007 Excel (Microsoft©, Inc.) statistical functions. It is important to state that even though in all of the cases utilized for this study preoperative CT scan was conducted as a part of clinical protocol, it was clinically unfounded to expose patients to additional radiation of postoperative CT scan. The actual preoperative and postoperative measurements were conducted manually by the clinician conducting the study to preserve consistency of the statistical values. Additionally, postoperative measurements were conducted as close as possible to 6 month postsurgical time line established by clinical protocol to, again, preserve an adequate accuracy of the data.

## Statistical Analysis

Statistical data analysis was used to interpret results of this study. Mean and median statistical values were calculated and used for visual reconstruction of ridge map based on statistical mean of collected data.

| Table 3: Summary of Preoperative (a,b,c) and Postoperative (A, B, C) Site Specific Measurements Values (Mean) | | | | |
|---|---|---|---|---|
| D(A) Value | Mean (mm) | St. Deviation | Maxilla (mm) | Mandible (mm) |
| Preoperative Measurements (a) | 5.2 | 1.65 | 3.3 | 3.8 |
| Postoperative Measurements (A) | 7 | 1.55 | 4.6 | 5.1 |
| Gain/Loss | 1.8 | | 1.3 | 1.3 |
| D(B) Value | Mean (mm) | St. Deviation | Maxilla (mm) | Mandible (mm) |
| Preoperative Measurements (b) | 6.3 | 1.74 | 4.0 | 4.7 |
| Postoperative Measurements (B) | 7.7 | 1.69 | 5.0 | 5.7 |
| Gain/Loss | 1.4 | | 1.0 | 1.0 |
| D(C) Value | Mean (mm) | St. Deviation | Maxilla (mm) | Mandible (mm) |
| Preoperative Measurements (c) | 7.7 | 2.32 | 5.0 | 5.7 |
| Postoperative Measurements (C) | 9 | 1.92 | 5.8 | 6.7 |
| Gain/Loss | 1.3 | | 0.8 | 1.0 |

### Statistical Methods

Data evaluation was designed as a pair comparison of a mathematical difference between the values designated as D ([A – a=D(A)], [B - b=D(B)] and [C – c=D(C)]). Additionally, the final value of D was calculated as a mathematic mean of D(A), D(B) and D(C). For the purpose of statistical accuracy, numerical tests utilized in this study are based on the principle that each subject and each measurement was sampled independently of the rest. Any possible random factor in this study protocol could not affect more than one value preserving data independency. Statistical outcome of the research would not be compromised if any random factor would cause a value of numerical measurement obtained during the study to be too high or too low and consequently affect the rest of the values. All measurements obtained are summarized in Tables 3 and 4.

## RESULTS

All but four implant fixtures survived 6 month period established by the study protocol. The incidence of sudden failure of four implants was

observed in one patient included in this study. Regardless of successful postoperative augmentation in the delayed protocol and successful implant osseointegration, 4 fixtures failed 7 months after placement immediately after a sudden and short term inflammatory episode. The failure took place prior to final prosthetic restoration and could not be attributed to overloading. The patient was referred to a family physician and subsequently to an endocrinologist for further diagnostic tests and identification of possible systemic factors. Since this occurrence took place outside of the boundary of the study time limits and did not affect of the survival rate. Additionally, all pre- and postoperative inclusion criteria of the study were met within established time frame (6 months) this case was not excluded from the statistical analysis.

During the course of the study 2 implants presented with minor peri-implant bone resorption limited to mostly cortical bone and were successfully treated with localized lavage with 0.12% Chlorhexidine Gluconate; these fixtures met inclusion criteria and were included into the final data analysis as a success. Total number of implant fixtures included in the study was 79.

### Analysis of Measurements and Results

Clinical analysis of the data based on pre-augmentation and post-augmentation measurements established that in all augmented sites a consistent and statistically measurable increase of the bone structure was achieved. The data collected from the clinical group of patients included in the clinical group demonstrated 1.6mm +/-0.72mm (23.4%) gain. The average implant diameter used in this study was 3.96mm. Maxillary augmentation under concurrent placement protocol delivered 1.6mm of newly formed bone in comparison to 1.2mm of linear gain at mandibular recipient sites.

**Table 4: General Summary of Preoperative and Postoperative Mean Values (mm)**

| Summary of Measurements | |
|---|---|
| **Mean Initial Measurements/ Total Value** | **6.4** |
| **Mean Final Measurements/ Total Value** | **7.9** |
| **Gain/Loss** | **1.5** |
| **Mean Initial Measurements/ Maxilla** | **4.1** |
| **Mean Final Measurements/ Maxilla** | **5.7** |
| **Gain/Loss** | **1.6** |
| **Mean Initial Measurements/ Mandible** | **4.7** |
| **Mean Final Measurements/ Mandible** | **5.9** |
| **Gain/Loss** | **1.2** |

## DISCUSSION

The imperative goal of any bone regenerative and reconstructive procedure is that regenerated bone can in fact bear functional loads as well as maintain sustainable bone architecture around the implant fixture. The results of the study proved that the regeneration of the deficient

alveolar ridge with "Tunnel Approach" Guided Bone Regeneration technique generally produces statistically measurable positive outcomes.

Clinical protocol used in this study was based on clinical experiences reported in scientific literature including the following:

Buser et al.[1] stated ". . . the biological principle of GTR is highly predictable for ridge enlargement or defect regeneration under the prerequisite of a complication free healing." Rominger et al.[2] confirmed that ". . . 96.8% [of the augmentations] were found to be successful as determined by the clinical success of the implants and the presence of bone where there had been an osseous defect." Further, the study suggested that "although the early complications rate [is] relatively high, the long-term success of the augmentation usually is not affected."[1]

The majority of the published studies reported variable rates of complications and predictable soft tissue healing associated with utilization of the barrier membranes contributing to protection of the graft material from undesirable invasion of nonosteogenic soft tissue cells. As suggested by Barossa et al.[3] utilization of a barrier membrane creates a physical barrier to soft tissue cells possessing no osteogenic properties and protected autologous/allograft mixture against resorption. Similar results were reported by other clinicians[4] under comparable clinical conditions.

One of the most commonly reported complications associated with utilization of non-resorbable barrier membranes was early membrane exposure. Rominger et al.[2] report in their study of 63 sites of GTR with utilization of PTFE membrane a 14% of "postoperative infections," 14% "dehiscence with exposure of the membrane to the oral cavity" with 71% of "uneventful" healing.[2] The incidence of the exposure of 5% with titanium mesh was reported by von Arx et al.[5]

While many reported early post-operative membrane exposures with non-resorbable materials, placement of resorbable collagen membranes was not associated with significant post-operative complications. Proussaefs et al.[6] reported "no complications at the recipient sites" advocating use of the resorbable collagen membranes for GTR. Bornstein et al.[7] conducted on dogs compared resorbable collagen membrane to cross-linked collagen membrane (CCM). While traditional collagen membrane placement had not affected post-operative healing, CCM use was affected by "premature membrane exposures [resulting] in severely compromised amount of bone regenerate."

Chiapasco et al.[8] focused on GBR procedures for the correction of dehiscence/fenestration defects and established that "in the postoperative period, 20% of the non-resorbable membranes and 5% of the resorbable ones underwent exposure/infection." Report of the study conducted by Urban et al. emphasized utilization of collagen membranes after removal of e-PTFE membranes from previously augmented sites.[9]

Additional clinical concepts utilized in this study address the composition of the graft. As demonstrated by Lacerda et al.[10] the use of autologous bone in an augmentation mixture with allograft material stimulates more effective healing and assures adequate bone formation.

It is important to underscore and accentuate the process of decortication of the recipient site. According to Dahlin et al.[11] and Melcher et al.[12] additional decortications of the lamellar bone in the recipient site and complete blood saturation of the augmentation mass required by this

surgical protocol would result in concentration of cells with osteogenic potential in the areas of bony defects and potentially favorable outcomes.

The quantitative results obtained in this study with an average horizontal bone gain of 1.6mm are generally consistent with expectations of the clinician and related to the results reported by other practitioners. Clinical studies by Feuille et al.[13] reported a "formation of new bone ...in each graft site...The mean alveolar ridge width increased by 3.2 +/- 1.0mm ($P < .0005$) [with full thickness flap approach, use of mineralized freeze-dried bone allograft (FDBA) in conjunction with a titanium-reinforced expanded polytetrafluoroethylene (TR e-PTFE) barrier]."

Further research conducted by Buser et al.[14] based on the clinical results obtained after GBR treatment concluded that procedure resulted in significant bone formation reporting "between 1.5 and 5.5mm"14 of bone gain. The study conducted by Kfir[15] computed vertical and horizontal postoperative gains measured on computerized tomography 6 months after "Tunnel Approach" grafting as "the range of vertical gain [of] 2.4 to 5.1 mm, while horizontal gain [of] 1.3 to 3.9 mm."

The study of similar clinical scenarios conducted by Urban et al.[16] studied particulated autogenous bone grafts for lateral ridge augmentation and covered by resorbable membrane to treat knife-edged ridges in attempt to develop the sites for future implant placement. A study of 58 implants placed in 22 patients with 25 surgical sites in knife-edged ridges after full thickness flap elevation reported no complications were associated with the treatment. Postoperative clinical measurements revealed "an average of 5.56 mm (± 1.45 mm) of lateral ridge augmentation after an average of 8.12 months (± 2.32 months) of graft healing"[16] measured on CT scan images.

As many retrospective studies, this study has inherent limitations and disadvantages. Certain degree of variability may be present within the data due to the nature of data collection procedure especially in comparison to measurements on the CT Scan images. Subjective imperfection may, to a certain degree affect the data collected. Utilization of prefabricated intraoral surgical stent minimizes inaccuracies of the final measurements by re-establishing a reference position at the point of secondary measurement. In cases of concurrent implant placement, the measurements were taken at the maximum diameter point of the implant fixture with implant platform level used as a reference point for three (3), six (6) and nine (9) mm apical measurements.

While initial dimensions of the alveolar ridge in edentulous areas dictates the volume of allograft needed for regeneration, the type of protective barrier membrane has no effect on the volume or composition of the graft material. Currently, there is no clinical evidence presented in the literature suggesting different rate of allograft resorption adjacent to a barrier membrane, this theory may warrant additional research.

## CONCLUSION

The results of this retrospective study demonstrated a statistically positive degree of success of osseous regeneration of the deficient alveolar ridge achieved after "Tunnel Approach" GBR procedure associated with concurrent implant placement and augmentation with resorbable collagen membrane and autologous / allograft mixture. It is a safe and predictable treatment modality.

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**Disclosure**
The authors report no conflicts of interest with anything mentioned in this article.

**References**

1. Buser D, Bragger U, Lang NP, Nyman S. Regeneration and enlargement of jaw bone using Guided Tissue Regeneration. Clinical Oral Implants Research. 1990; 1:22-32.
2. Rominger JW, Tripplett RG. The use of Guided Tissue Regeneration to improve implant osseointegration. Journal of Oral and Maxillofacial Surgery. 1994 Feb; 52(2):106-112; discussion 112-113.
3. Barossa EP. Localized ridge maintenance using bone membrane. Implant Dentistry. 1999; 8:167-172.
4. Smukler H, Landi L, Setayesh R. Histomorphometric Evaluation of extraction sockets and deficient alveolar ridges treated with allograft and barrier membrane: A pilot study. International Journal of Oral Maxillofacial Implants. 1999; 14:407-416.
5. von Arx T, Kurt B. Implant placement and simultaneous ridge augmentation using autogenous bone and a micro titanium mesh: a prospective clinical study with 20 implants. Clinical Oral Implantology Research. 1999 Feb; 10(1):24-33.
6. Proussaefs P, Lozada J. The use of resorbable collagen membrane in conjunction with autogenous bone graft and inorganic bovine material for buccal/labial alveolar ridge augmentation: a pilot study. Journal of Prosthetic Dentistry. 2003 Dec; 90(6):530-538.
7. Bornstein MM, Bosshardt D, Buser D. Effect of two different bioabsorbable collagen membranes on guided bone regeneration: a comparative histomorphometric study in the dog mandible. Journal of Periodontology. 2007 Oct; 78(10):1943-1953.
8. Chiapasco M, Zaniboni M. Clinical outcomes of GBR procedures to correct peri-implant dehiscences and fenestrations: a systematic review. Clinical Oral Implantology Research. 2009 Sep; 20 Suppl 4:113-123.
9. Urban IA, Jovanovich SA, Lozada JL. Vertical ridge augmentation using guided bone regeneration (GBR) in three clinical scenarios prior to implant placement: a retrospective study of 35 patients 12 to 72 months after loading. International Journal of Oral Maxillofacial Implants. 2009 May-June; 24(3):502-510.
10. Lacerda SA, Lanzoni JFA, Bombonato-Prado KF, et al. Osteogenic potential of Autogenous Bone Associated with bone marrow osteoblastic cells in bony defects: A histomorphometric study. Implant Dentistry. 2009; 18:521-525.
11. Dahlin C, Gottlow J, Linde A, et al. Healing of maxillary and mandibular bone defects using a membrane technique. An experimental study in monkeys. Scandinavian Journal of Plastic Reconstructive Surgery Hand Surgery. 1990; 24:13-19.
12. Melcher A. Dreyer C. Protection of the blood clot in healing circumscribed bone defects. Journal of Bone Joint Surgery Br. 1962; 44:424-430.
13. Feuille F, Knapp CI, Brunsvold MA, et al. Clinical and histologic evaluation of bone-replacement grafts in the treatment of localized alveolar ridge defects. Part 1: Mineralized freeze-dried bone allograft. International Journal of Periodontics and Restorative Dentistry. 2003; 23:29-35.
14. Buser D, Bragger U, Lang NP, Nyman S. Regeneration and enlargement of jaw bone using Guided Tissue Regeneration. Clinical Oral Implants Research. 1990; 1:22-32.
15. Kfir E, Kfir V, Eliav E, Kaluski E. Minimally invasive guided bone regeneration. Journal of Oral Implantology 2007; 33(4):205-10.
16. Urban IA, Nagursky H, Lozada JL. Horizontal ridge augmentation with a resorbable membrane and particulated autogenous bone with or without anorganic bovine bone-derived mineral: a prospective case series in 22 patients. International Journal of Oral and Maxillofacial Implants. 2011 Mar-Apr; 26(2):404-414.

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# An Analysis of Negative Online Reviews for Dental Practices in Multiple Metropolitan Markets

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## Abstract

Modern consumers are increasingly relying on crowdsourced online reviews to assist with their purchasing decisions. This is especially true when evaluating intangible items such as services which cannot be physically evaluated by the consumer. A variety of factors such as Framing, Primacy Effect, and Valence of online reviews have significant impact on consumer perceptions of evaluated businesses. Negative reviews have been shown to have a dramatic impact on all of the factors that affect online reviews and thus, also impact business performance. Service based industries such as the hotel and hospitality sector have utilized analysis of online reviews to improve service performance by addressing service failures. As dentistry is a service based industry, the goal of this article is evaluate characteristics of negative online reviews for dental practices so that said businesses may utilize this information to make performance improvements.

**KEY WORDS:** Online advertising, dentistry, practice management

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## BACKGROUND

Because services are intangible products that cannot be evaluated prior to purchase, consumers have limited ability to assess whether or not such services will be able to meet their expectations.[1] Traditionally, consumers purchasing services have relied on word of mouth recommendations from friends/colleagues and advertising campaigns in print or television media to assist with these decisions.[2,3] Modern consumers, on the other hand, are increasingly utilizing the internet and crowdsourced reviews to assist them when making decisions about purchasing goods and services.[4,5] Although consumers are not intimately familiar with the posters of these online crowdsourced reviews, research shows that consumers put nearly as much faith in these electronic word of mouth evaluations as they do with suggestions that come from well-known friends and colleagues.[6,7] With nearly 100 million posted reviews, Yelp has proven to a popular electronic word of mouth website on which consumers can express their opinions about goods and services.[8,9] Unbeknownst to most viewers of these reviews, and the businesses for whom they are written about for that matter, characteristics of these reviews and the manner in which they are presented can have a significant impact on the decision making process of consumers.[1]

Framing refers to the manner in which information is presented within a review.[10] Prior research has shown that positively framed reviews can improve consumers' perception of service[11] while negatively framed reviews can do the opposite.[12] The order in which these framed reviews are presented, known as the Primacy Effect[13] also affects consumer confidence. When presented first, positively framed reviews have a beneficial Primacy Effect influence on consumer perception and the opposite is true when negatively framed reviews are presented first.[14] Because of this, online reputation management firms focus on increasing the number of positively framed reviews for their client businesses so that they have an increased likelihood of appearing first, thus improving the Primacy Effect. In addition to improving the Primacy Effect, the increased number of positively framed evaluations also affects the Valence of the reviews. Valence refers to the dominant tone of reviews.[15] Reviews with a positive Valence have been shown to have a positive effect on business outcomes[16] while negatively Valenced reviews may result in consumers developing an unfavorable opinion of the business.[17]

As Framing, Primacy Effect, and Valence have a significant influence on consumer perceptions, prior research has shown that negative reviews seem to have more impact than positive reviews.[18] This is especially true for services compared to products. Because products are tangible items that consumers can see and touch, they associate negative reviews with the product alone and not necessarily the organization that produces the product.[19] Conversely, negative reviews for intangible items such as services tend to be associated with personal loss and receive more weight from consumers.[20] Because negative reviews can have such a profound effect on service industry businesses, such as dentistry, the following article examines characteristics of negative Yelp reviews for dental specialties.

## MATERIALS AND METHODS

For the purpose of this study, the online review website Yelp was examined. In an effort to reduce population size bias, small (Austin),

| Table 1: Cumulative Negative Complaint Breakdown for all Dental Practices | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Complaint | Dentist Work | Upselling | Billing/ Insurance | Front Desks | Tardiness | Scheduling | ROH | Commun-ication | Staff | Facilities |
| % | 26.62 (197/740) | 16.62 (123/740) | 15.68 (116/740) | 13.38 (99/740) | 5.81 (43/740) | 5.68 (42/740) | 5.54 (41/740) | 5.0 (37/740) | 4.86 (36/740) | 0.81 (6/740) |

| Table 2: Negative Complaint Breakdown for General Dentists | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Complaint | Dentist Work | Upselling | Billing/ Insurance | Front Desks | Tardiness | Scheduling | ROH | Commun-ication | Staff | Facilities |
| % | 15.08 (60/398) | 29.65 (118/398) | 12.06 (48/398) | 10.55 (42/398) | 4.77 (19/398) | 7.29 (29/398) | 9.80 (39/398) | 5.28 (21/398) | 4.27 (17/398) | 1.26 (5/398) |

| Table 3: Negative Complaint Breakdown for Endodontists | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Complaint | Dentist Work | Upselling | Billing/ Insurance | Front Desks | Tardiness | Scheduling | ROH | Commun-ication | Staff | Facilities |
| % | 60.0 (39/65) | 0.00 (0/65) | 24.62 (16/65) | 15.38 (10/65) | 7.69 (5/65)) | 1.54 (1/65) | 0.00 (0/65) | 1.54 (1/65) | 4.62 (3/65) | 0.00 (0/65) |

medium (Seattle), and large (New York City) metropolitan areas were evaluated. Furthermore, these cities with separation distances of anywhere from 1,750 to 2,900 miles were selected to reduce both geographic and cultural bias. Specifically, search parameters were as follows: City – Austin; Category – Dentists; Category – Endodontists; Category – Orthodontists; Category – Oral Surgery; Category – Pediatric Dentists; and Category – Periodontists. For each query, the top 10 results were examined. The same category searches were also performed for the cities of Seattle, Washington and New York City, New York. In cases where general dentists appeared in query results for dental specialists, the General Dentist listings were ignored. Likewise, if dental specialists appeared in query results for general dentists, the dental specialist listings were ignored. Each result was examined for both "recommended" (non-filtered) and "not-recommended" (filtered) reviews. Each of these reviews was then further examined for star ratings. Star ratings of 2 or less were considered as "negative reviews" for the purpose of this study. The objects of negative reviews were broken down in 2 categories: 1) Negative reviews of Core Services; 2) Negative reviews of Customer Services. Core service focused on the Dentist and the performance or outcomes of his/her work. Customer services, on the other hand, focused on the following characteristics: 1) Billing/Insurance; 2) Front desk personnel; 3) Staff (other than Front Desk Personnel); 4) Dental Hygienists; 5) Scheduling; 6) Upselling of services; 7) Tardiness; 8) Communication errors; 9) Facility issues

| Table 4: Negative Complaint Breakdown for all Oral Surgeons | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Complaint | Dentist Work | Upselling | Billing/ Insurance | Front Desks | Tardiness | Scheduling | ROH | Commun-ication | Staff | Facilities |
| % | 27.62 (29/105) | 0.00 (0/105) | 25.71 (27/105) | 15.24 (16/105) | 8.57 (9/105) | 5.71 (6/105) | 0.00 (0/105) | 7.62 (8/105) | 10.48 (11/105) | 0.00 (0/105) |

| Table 5: Negative Complaint Breakdown for all Orthodontists | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Complaint | Dentist Work | Upselling | Billing/ Insurance | Front Desks | Tardiness | Scheduling | ROH | Commun-ication | Staff | Facilities |
| % | 52.94 (27/51) | 0.00 (0/51) | 19.61 (10/51) | 11.76 (6/51) | 5.88 (3/51) | 3.92 (2/51) | 0.00 (0/51) | 1.96 (1/51) | 1.96 (1/51) | 1.96 (1/51) |

| Table 6: Negative Complaint Breakdown for all Pediatric Dentists | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Complaint | Dentist Work | Upselling | Billing/ Insurance | Front Desks | Tardiness | Scheduling | ROH | Commun-ication | Staff | Facilities |
| % | 30.77 (20/65) | 3.08 (20/65) | 15.38 (20/65) | 23.08 (20/65) | 10.77 (20/65) | 4.62 (20/65) | 0.00 (20/65) | 7.69 (20/65) | 4.62 (20/65) | 0.00 (20/65) |

| Table 7: Negative Complaint Breakdown for all Periodontists | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Complaint | Dentist Work | Upselling | Billing/ Insurance | Front Desks | Tardiness | Scheduling | ROH | Commun-ication | Staff | Facilities |
| % | 40.48 (17/42) | 7.14 (3/42) | 11.90 (5/42) | 28.57 (12/42) | 0.00 (0/42) | 2.38 (1/42) | 4.76 (2/42) | 2.38 (1/42) | 2.38 (1/42) | 0.00 (0/42) |

(i.e. Practice location, cleanliness, etc.). Results were then compared and contrasted.

## RESULTS

A total of 6,559 reviews for 180 dental practices were reviewed. Of these reviews, 11.28% were considered "negative" as they rated only 1 or 2 stars. A breakdown of the combined data for negative reviews is presented in Table 1. Breakdown of data by dental specialty are presented in Tables 2-7. In examining cumulative data, General Dentists received both highest gross total of negative reviews and the most negative reviews in terms of percentage of total reviews (total 1-2 star reviews ÷ total reviews). While General Dentists had the highest number of negative reviews as a whole, they received the fewest number of complaints for Core Services. The exact opposite was true for all other dental specialties. For Endodontists, Oral Surgeons, Orthodontics, Pediatric Dentists, and Periodon-

tists, complaints about the actual dental provider and results of his/her work were the most common focus of negative reviews. For General Dentists, Customer service complaints were the focus of 84.92% of negative reviews with "Upselling of Services" accounting for nearly a third of these customer service complaints. For all evaluated dental practices, the most common complaints regarding customer service focused on front desk personnel being rude/unprofessional/unhelpful and billing/insurance problems.

## DISCUSSION

Evaluations of service oriented businesses can be divided into Core Service features and Customer Service features.[1] Core services represent the most basic reason for a company's existence in the market[21] while Customer Service represents the employee/consumer interactions that support the Core Services.[22] Prior research indicates that Core Services are of the utmost importance to consumer evaluations and that Customer Service plays a lesser, albeit an important supporting role, to the Core Services.[23] On this note, the data of the current study indicates that referral based dental practices such as Endodontists, Oral Surgeons, Orthodontics, Pediatric Dentists, and Periodontists receive the most complaints for Core Services while General Dentists receive the most complaints about Customer Service. The stark difference in negative review patterns for General Dentists versus all other dental specialties may lie in the inherent setup of these practices. Traditionally, General Dentists are the primary caregiver for the majority of their patients' dental needs. When general dentistry patients are referred to a specialty dental provider, they are being sent away to receive one particular Core Service that their General Dentist does not provide. As such, the referred patient's relationship to the specialty provider is quite different than their relationship to their General Dentist. While the patient typically has a longstanding relationship with their General Dentist and their staff, the patient has no relationship or connection to the dental specialty provider other than the need for a particular Core Service. Should the dental specialist not meet the expectations of the referred patient, they may see this as a Core Service failure and a personal loss. As indicated in prior research, this may likely lead to a negative review of service.[20] Evidence of this is supported by the findings of this study whereby negative reviews of Core Services provided by dental specialists were more than 2½ times greater than those of General Dentists (39.05% versus 15.08%). While failures of Core Services was the most common negative review of dental specialist, the most common complaint with General Dentists was upselling of services, which accounted for 29.65% of negative reviews. In general, both dental specialists and General Dentists received a relatively equal number of negative complaints regarding other customer service features. The most common customer service complaints for all offices, other than upselling of services in General Dentistry practices, were problems with front desk personnel and billing/insurance issues. Other Customer Services problems including issues with scheduling, non-front desk staff, scheduling, dentist tardiness, communication, and facility issues were also noted. Knowledge of these service failures, whether they be Core or Customer Service issues, is important

as they provide businesses the opportunity to take action in rectifying the service deficiencies.[1] By addressing these service failures quickly, dental offices increase the possibility of receiving more positive reviews while reducing the number of negative reviews. This can shift both the Primacy Effect and Valence of online reviews into the favor of the affected business.

## CONCLUSIONS

Evaluations of negative online reviews for dental practices reveal that the most common complaints about General Dentists are Customer Service failures while dental specialists receive more complaints about Core Service failures. By identifying these failures and making changes, dental practices can positively influence their online reputation and increase the probability of new customer leads from this source. Conversely, failure to address these issues may lead to a decline in both the dental practice's online reputation and new patient generation.

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**Disclosure**
The author reports no conflicts of interest with anything mentioned in this article.

**References**

1. Browning V, So K, Sparks B. The Influence of Online Reviews on Consumers' Attributions of Service Quality and Control for Service Standards in Hotels. J Travel Tourism Marketing 2013;30:23-40.
2. Brown J, Broderick A, Lee N. Word of mouth communication within online communities: Conceptualizing the online social network. J Interactive Marketing 2007;21(3):2-20.
3. Murphy L, Mascardo G, Benckendorf P. Exploring word of mouth influences on travel decisions: friends and relatives vs. other travelers. Int J Consumer Studies 2007;31(5):517-527.
4. Sridhar S, Srinivasan R. Social Influence Effects in Online Product Ratings. J Marketing 2012;76:70-88.
5. Schuckert M, Liu X, Law R. Insights Into Suspicious Online Ratings: Direct Evidence from TripAdvisor. Asia Pacific J of Tourism Res 2015;Ahead of print:1-14.
6. Hennig-Thurau T, Gwinner K, Walsh G, Gremler D. Electronic word of mouth via consumer opinion platformsL what motivates consumers to articulate themselves on the internet? J Interactive Marketing 2004;18(1):38-52.
7. Li C. Bernoff J (2008). Groundswell: Winning in a world transformed by social technologies. Boston, MA: Harvard Business Press.
8. Yelp. An Introduction to Yelp Metrics as of March 31, 2016. Available at http://www.yelp.com/factsheet. Accessed July 31, 2016.
9. Luca M, Zervas G. Fake It Till You Make It: Reputation, Competition, and Yelp Review Fraud. Harvard Business School NOM Unit Working Paper; 2013:1-35.
10. Donovan R, Jalleh G. Positively versus negativity framed product attributes: the influence of involvement. Psychology and Marketing 1999;16(7):613-630.
11. Levin I, Gaeth G. How consumers are affected by the framing of attribute information before and after consuming the product. J Consumer Res 1988;15(3):374-378.
12. Fiske S. Social cognition and social perception. Ann Rev of Psychology 1993;44(1):155-194.
13. Dennis M, Ahn W. Primacy in casual strength judgments: The effect of initial evidence for generative versus inhibitory relationships. Memory & Cognition 2001;29(1):152-164.
14. Pennington D (2000). Social Cognition. London: Routledge.
15. Anderson E. Customer satisfaction and word of mouth. J Service Res 1998;1(1):5-17.
16. Ye Q, Law R, Gu B, Chen W. The influence of user-generated content on traveler behavior: An empirical investigation on the effects of e-word-of-mouth to hotel online bookings. Computers in Human Behavior 2011;27(2):634-639.
17. Vermeulen I, Seegers D. Tried and tested: The impact of online hotel reviews on consumer considerations. Tourism Management 2009;30(1):123-127.
18. Papathanassis A, Knolle F. Exploring the adoption and processing of online holiday reviews: A grounded theory approach. Tourism Management 2011;32(2):215-224.
19. Lee J, Park D, Han I. The effect of negative online consumer reviews on product attitude: An information processing view. Electronic Commerce Res and Applications 2008;7(3):341-352.
20. Smith A, Bolton R, Wagner J. A model of customer satisfaction with service encounters involving failure and recovery. J Marketing Res 1999;5:356-372.
21. Fergusson R, Paulin M, Pigeassou C, Gauduchon R. Assessing service management effectiveness in a health resort: Implications of technical and functional quality. Managing Service Quality 1999;9(1):58-65.
22. Butcher K, Sparks B, O'Callaghan F. Beyond core service. Psych and Marketing 2003;20(3):187-208.
23. Crosby L, Stephens N. Effects of relationship marketing on satisfaction, retention, and prices in the life insurance industry. J Marketing Res 1987;5:404-411.

# Smile Design with Immediate Implant Placement

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## Abstract

**Background:** This article describes about the immediate implant placement and guidelines that increase the thickness of soft tissue around the implants.

**Methods:** The esthetic dentist should have a thorough knowledge and appreciation of the artistic principles that can be applied to the dentofacial complex and should combine artistic creativity with scientific discretion to effect an appreciable change in the dentition. The smile we create should be esthetically appealing and functionally sound and requires a comprehensive approach to patient care. Appropriate application of principles of smile designing for any restorative work can drastically improve the esthetics of the patients. Nowadays, patients do not accept even the shortest period of edentulism.[2]

**Results and conclusions:** The evolution of one-stage protocol of immediate implant placement into fresh extraction socket with an immediate provisional restoration have served the purpose as it is less traumatic, more time efficient and yields highly predictable esthetic results. This article will describe an interdisciplinary approach to immediate implant placement and smile designing.

**KEY WORDS:** Dentofacial complex, smile designing, immediate implant placement, immediate provisional restoration

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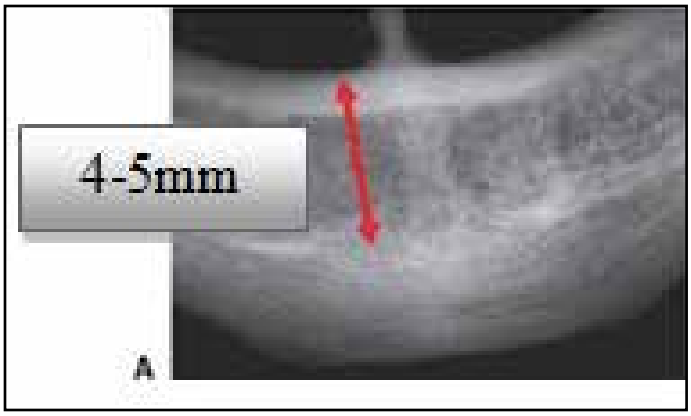


**Figure 1A:** Radiograph depicting bone width of 4-5mm.

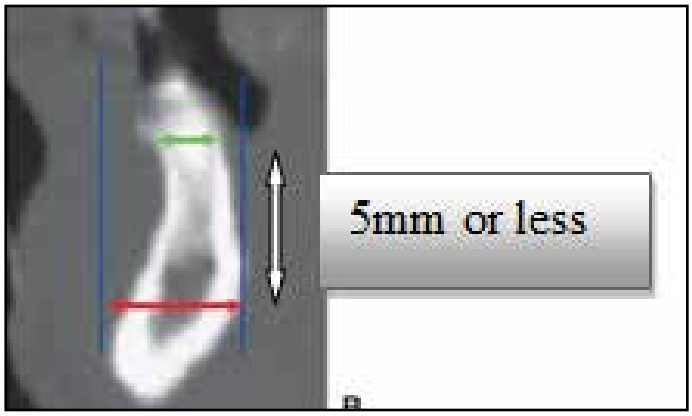


**Figure 1B:** Radiograph depicting bone height of 5mm or less.

## INTRODUCTION

Smile, a person's ability to express a range of emotions with the structure and movement of the teeth and lips, can often determine how well a person can function in society. Harmonizing an esthetic smile requires a perfect integration of facial composition and dental composition and the dental composition relates more specifically to teeth and their relationship to gingival tissues.[1-7] These days the people are very much concerned regarding their esthetic looks as nearly everyone is on a social networking site. So one cannot even imagine being without teeth for even the shortest period of time. The evolution of one-stage protocol of immediate anterior implant placement into fresh extraction sockets and sometimes with an immediate provisional restoration placed at the same appointment without compromising implant survival rates have served the purpose for such patients. This protocol requires appropriate diagnosis and treatment planning before initiation of the treatment. Understanding of the objective and subjective criteria related to hard and soft tissues provide an esthetic outcome. The ultimate aim for the implant restoration is to harmonize with the frame of smile, face and more importantly the individual. So, prior to placement of implants, we need to look upon the diagnostic factors that affect the predictability of peri-implant esthetics.[8] Variables affecting the predictability of the esthetic outcome of implant restoration are: 1) Patient selection and smile line; 2) Tooth position; 3) Root position of the adjacent teeth; 4) Biotype of the periodontium and tooth shape; 5) The bony anatomy of the implant site; 6) The position of the implant. Correct positioning of the implant requires precision in implant placement in which the most critical surgical strategy is atraumatic tooth removal without flap elevation, and there should be intact buccal plate.[3] As tooth extraction leads to dimensional change of height and width of the alveolar ridge, so immediately placing the implant in to fresh alveolar sockets after extraction reduces the amount of ridge width resorption. For this we need to radiographically examine the bone in which the bone width should be 4-5mm (Figure 1A) and interproximal bone height should be 5mm or less (Figure 1B). In case of mandible the bone length from the alveolar crest to a safe distance above the mandibular canal should be

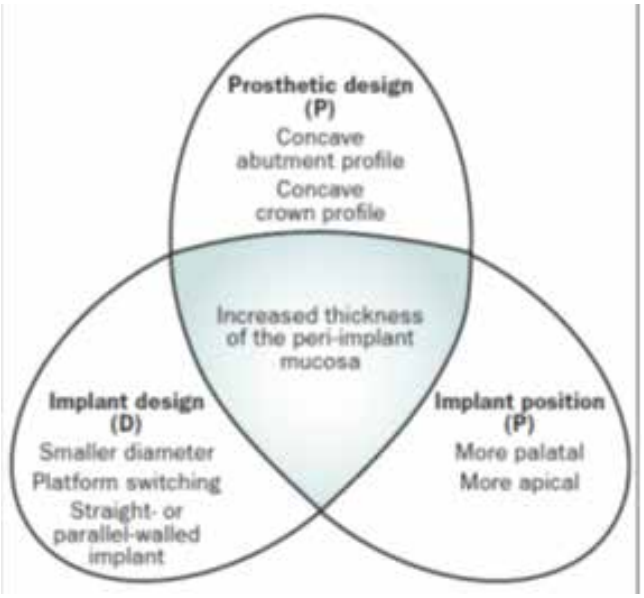


**Figure 2:** PDP Management Triad.

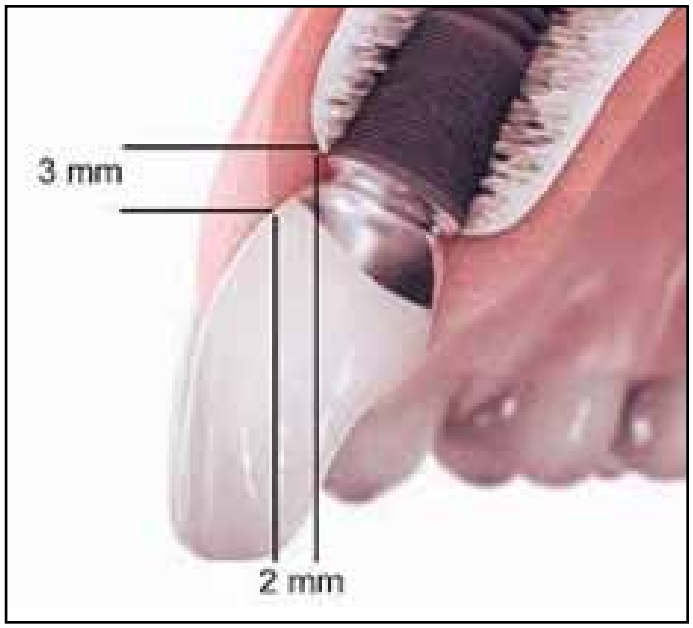


**Figure 3:** Implant placed 3mm apical to the gingival zenith and implant/abutment interface 2mm to the zenith.

10 mm.[9] After the radiographic examination the implant is placed engaging the palatal wall of the socket. While placing implants, the implant head should be 3mm apical to the imaginary line connecting the cementoenamel junction of the adjacent tooth.[9,10] For an esthetic restoration that is indistinguishable from natural teeth establishing peri-implant soft tissue compatibility with the surrounding gingiva and mucosa is essential. For this, establishing a thick tissue biotype around implants is important because it contributes to the esthetic result of an implant-supported restoration.[10] A thick biotype is more resistant to recession, is better at concealing titanium, and is more accommodating to different implant positions. There is a guideline that demonstrates possible ways to increase soft tissue thickness around implants, i.e., the "PDP management triad" (Figure 2): implant position (P), implant design (D), and prosthetic design (P).[10]

## (I) IMPLANT PLACEMENT

The gingival zenith is used as a guide for dental implant placement.[11] It represents the most apical part of the clinical crown. It also represents both the faciolingual and the mesiodistal location of the crown in relationship to the edentulous ridge. As such, it has a remarkable influence on the morphology of the planned restoration. The gingival zenith affects other objective criteria, including the balance of gingival levels (too inferior or superior), the tooth axis (too distal or mesial), the tooth dimension (too inferior or superior), and the tooth form (triangular becomes ovoid if too inferior). Without the control of the gingival zenith, the clinician's ability to define dental implant esthetics is vastly diminished. At least four factors[11] affect the gingival zenith: 1) Relative location of the tissues to the planned gingival zenith; 2) Depth of the dental implant placement; 3) Response of the buccal bone and mucosa to the implant


**Figure 4:** Abutment with concave features.

**Figure 5:** Implant with parallel-walled platform.


**Figure 6:** Platform switching.

procedure and components; 4) Prosthodontic management of the gingival zenith architecture.

## Location of the Tissues to the Planned Gingival Zenith

Ideally, the planned gingival zenith is symmetric with the contralateral tooth and harmonious with the gingival levels of adjacent teeth. The exact position of the gingival zenith can be determined through diagnostic wax-up which permits the exact determination of the extent of resorption and permits planning to the key esthetic parameters.

## Controlling the Depth of Implant Placement

The ideal depth of the implant placement is suggested to be 3 mm apical to the planned gingival zenith.[12] The implant/abutment interface should also reside 2 mm palatal to the zenith to ensure adequate thickness of bone and mucosa to support tissue form. This "3:2 rule" (Figure 3) further suggests to the clinician when bone grafting or soft tissue augmentation should be performed.[13] Controlling the depth of placement is achieved by defining the gingival zenith. Managing the gingival zenith at the time of implant placement sets

the stage for ideal anterior single-tooth esthetics.

### Controlling Peri-implant Mucosal Architecture

Most prognostic indicator of eventual esthetic success through symmetry is gained by evaluation of the connective tissue attachment at the adjacent teeth. Careful assessment using a periodontal probe and diagnostic periapical radiograph are needed. Loss of attachment of greater than 1 mm is clinically discernible and difficult to regenerate. This step is essential because interproximal peri-implant mucosal contours (papillae) are greatly dependent on adjacent tooth contours.

Following the diagnostic waxing, it is possible to understand the relationship between the proposed gingival zenith location and the existing mucosa. The relationship of the gingival zenith to the underlying bone can only be determined by bone sounding with a diagnostic template in place or, preferably, by use of volumetric imaging (e.g., Cone Beam Computed Tomography) with a radiopaque image of the gingival zenith in place. This assessment is critical.

### Prosthodontic Management of Peri-implant Mucosal Architecture

With an implant positioned properly in the alveolus, the control of peri-implant tissues is enhanced morphologically by enforcing the remodeling of tissues using properly contoured abutments and provisional crowns. Polished abutments of titanium or zirconia should be sculpted to support the soft tissue form, and thus, the cervical contour of the crown. Typically, the abutment will possess concave features (Figure 4), with the possible exception being a convexity of the buccal surface. This is particularly important in developing the contours of any provisional restoration for a dental implant. Morphologic refinement is established using the provisional crown and, again, the submucosal contours should be refined to be more root-like (concave interproximally) to support ideal tissue form. The provisional crown should be highly polished, well adapted to the abutment margin and free of extruded cement.

## (II) IMPLANT DESIGN

The thickness of the facial bone plate provides bony support for the soft tissue. If it is less than 1.8 mm, there will be bone resorption at the crestal margins after the implant is placed. Therefore, smaller-diameter implants can be used in the maxillary anterior area to maintain the facial bone thickness, thereby minimizing peri-implant mucosal recession. Additional soft tissue augmentation can be derived through the use of an implant with a straight or parallel-walled platform (Figure 5) instead of a conical or tapered platform. The advantage of a straight platform over a conical platform is that there is less outward pressure on the peri-implant mucosa; this reduces potential gingival recession and/or remodeling after implant placement. Soft tissue augmentation can also be gained through the use of implants with platform-switch concept.

Platform switching, (Figure 6) involves connecting a narrower-diameter abutment to a wider implant platform. This subsequently leads to a horizontal shifting of the implant abutment microgap toward the center of the implants, thus preventing crestal bone resorption and allowing soft tissue ingrowth.[12] This will thicken the tissue and facilitate papillae formation.

## (III) PROSTHETIC DESIGN

As the implant platform is placed at the level of the crestal bone, connecting a concave abutment and/or crown to the implant will create additional space in which the peri-implant mucosa can proliferate and occupy. Remodeling of soft tissue at the abutment connection level will enhance the emergence profile of the restoration, henceforth giving rise to a better esthetic outcome. The proposed management triad (PDP) uses basic concepts behind implant position (P), implant design (D), and prosthetic design (P) to mount a three-prong attack on implant esthetics by increasing soft tissue thickness. Modification of the implant position, such as a more palatal and apical placement will facilitate a more esthetic emergence profile. On the other hand, alterations to the implant and to the prosthetic design will promote soft tissue remodeling and fullness, thus creating a more esthetic restoration. After the implant placement, it needs to be evaluated in the following three planes of space[8]:

i) **Apico-coronal placement:** It is the most critical aspect. Errors in apico-coronal implant placement can have serious aesthetic and biomechanical implications.

An implant placed too coronally will not allow adequate transition from the head of the implant to the point where the restoration exits from the free gingival margin. The restoration will look short in comparison to the contra lateral tooth. If an implant is placed too apically with excessive countersinking procedures an unnecessary amount of bone loss will occur. Because this bone loss takes place circumferentially it will affect not only the proximal bone structure but also the height of the facial bone wall and can lead to undesirable soft tissue contours.

i) **Mesio-distal placement:** Mesio-distally an implant should be placed 1.5-2 mm from an adjacent tooth.[8,10,14] Improper mesiodistal positioning of implants can also have a substantial effect on the generation of interproximal papillary support as well as on the osseous crest of the adjacent tooth. Placement too close to the adjacent tooth can cause resorption of the interproximal alveolar crest to the level of that on the implant. With this resorption comes a reduction in papillary height. Restorative problems exist as well. Poor embrasure form and emergence profile will result in a restoration with a long contact zone and compromised clinical outcomes.

i) **Facio-lingual placement:** The amount of bone available should be at least 1 mm greater than the implant diameter on each side. Hence a 4 mm diameter implant would require 6 mm of bone.4,6 The single implant placed in the maxillary anterior region should be situated palatal to an imaginary line that outlines the curve of the arch formed by the facial surfaces of the adjacent teeth. Implants placed too palatal complicate development of hygienic contours. Implants are often mistakenly placed too facial. This error results in excessive resorption of the supporting osseous structure resulting in a restoration that will appear long in comparison to the contra-lateral tooth.

## CONCLUSION

The smile which we create with the help of an implant restoration should be esthetically pleasing and functionally sound and it requires perfect integration between the restoration, implant position and the peri-implant mucosal tissue, so that we end up providing with an esthetic smile as "The person is never fully dressed without a smile."

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**References**

1. Thumati P. Evaluation of function and esthetics for creating a beautiful smile in dental practice using digital smile designing. Journal of Interdisciplinary Dentistry. 2014 Sep-Dec;4(3):144-147.
2. Levin BP. Immediate temporization of immediate implants in the esthetic zone: Evaluating survival and bone maintenance. COMPENDIUM. 2011 May;32(4):52-62.
3. Chu SJ, Salama MA, Salama H, Garber DA, Saito H, Sarnachiaro GO, Tarnow DP. The Dual-Zone Therapeutic Concept of Managing Immediate Implant Placement and Provisional Restoration in Anterior Extraction Sockets. COMPENDIUM. 2012 Jul-Aug;33(7):524-534.
4. De Rouck T, Collys K, Cosyn J. Single-tooth replacement in the anterior maxilla by means of immediate implantation and provisionalization: A Review. The International Journal of Oral & Maxillofacial Implants. 2008;23(5):897-904.
5. Kan JYK, Rungcharassaeng K. Immediate placement and provisionalization of maxillary anterior single implants: a surgical and prosthodontic rationale. Pract Periodont Aesthet Dent 2000;12(9):817-824.
6. Silva DBNF, Neves LC, Querino E, Rosa JCM, Barreto MA. Behavior of peri-implant tissues in immediate implant with provisionalization: A literature review. Dental Press Implantol. 2013 July-Sept;7(3):41-51.
7. Bhuvaneswaran M. Principles of smile design. Journal of Conservative Dentistry. 2010 Oct-Dec;13(4):225-232.
8. Jivraj S, Chee W. Treatment planning of implants in the aesthetic zone. British dental journal. 2006 Jul;201(2):77-89.
9. Becker W, Goldstein M. Immediate implant placement: Treatment planning and surgical steps for successful outcome. Periodontology. 2000. 2008;47:79–89.
10. Fu JH, Lee A, Wang HL. Influence of tissue biotype on implant esthetics. The International Journal of Oral & Maxillofacial Implants. 2011;26(3):499-508.
11. Dhaded S, Khan MA. Anterior implant esthetics. GUIDENT | Your Guide on the path of Dentistry. 2014 Jan:10-18.
12. Levin BP, Wilk BL. Immediate provisionalization of immediate implants in the esthetic zone: A prospective case series evaluating implant survival, esthetics, and bone maintenance. COMPENDIUM. 2013 May; 34(5):352-361.
13. Rojas-Vizcaya F. Biological aspects as a rule for single implant placement. The 3A-2B Rule: A clinical report. Journal of Prosthodontics. 2013;22: 575–580.
14. Leblebicioglu B, Rawal S, Mariotti A. A review of the functional and esthetic requirements for dental implants. JADA. 2007 Mar;138:321-329.

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# Bone Quality Assessment in Routine Dental Implant Treatment among Dental Implant Practitioners in the Kingdom of Saudi Arabia

**Dr. Fawaz Alqahtani[1] • Dr. Abdullah Alnasser[2]**
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## Abstract

**Objectives:** To evaluate dentists who perform dental implants in the Kingdom of Saudi Arabia about the dentists' awareness of methods and knowledge of bone quality assessment.

**Methods:** A questionnaire was created that included shut inquiries about attitude and knowledge and also to assess for symptomatic routines of bone quality evaluation. The questionnaire was web-based and sent to the most of the dental practitioners who practice dental implants in dental schools, hospitals, and private clinics in Saudi Arabia. The questionnaire was designed for four groups: general practitioner, postgraduate resident, specialist, and consultant. The response rate in the general practitioner group was 24.6%, in the postgraduate resident group 31%, in the specialist group 22.2%, and in the consultant group 22.2%.

**Results:** Most respondents considered bone quality to be a banderole parameter for implant treatment outcome. The most mainstream technique for surveying bone quality is panoramic radiography for general practitioners and specialists, while the postgraduate residents and consultants use computed tomography (CT). Both general practitioners and specialists use the classification proposed by Misch, while postgraduate residents and consultants use Leckholm & Zarb classification.

**Conclusions:** All groups of implant practitioners in Saudi Arabia considered bone quality to be a critical parameter for a positive implant treatment result. However, there was no agreement on what bone quality means or on the most proficient method to evaluate bone quality.

**KEY WORDS:** Dental implants, questionnaire, dental education, bone quality

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**Table 1: Respondant Characteristics: General Practitioner, Postgraduate Resident, Specialist and Consultant in Saudi Arabia, 2016 (n=126)**

| Variables | Categories | General Practioner (n=31) (%) | Postgraduate Resident (n=39) (%) | Specialist (n=28) (%) | Consultant (n=28) (%) | P-value$ |
|---|---|---|---|---|---|---|
| Gender | Male<br>Female | 25 (26.9)<br>6 (18.2) | 22 (23.7)<br>17 (51.5) | 20 (21.5)<br>8 (24.2) | 26 (28.0)<br>2 (6.1) | < .007 |
| Time working in dental implants | | Mean (SD)=31 (1.19) Median=1(1) | Mean (SD)=39 (1.33) Median=1(2) | Mean (SD)=28 (2.54) Median=2(3) | Mean (SD)=28 (2.61) Median=2(3) | 0.000 |

* Chi-squared test
$ Data expressed as Mean (and standard deviation) and Median

## INTRODUCTION

For decades, the option available for treating an edentulous area was to use a removable denture, either complete or partial. Then, the fixed partial denture became a better option in replacing missing teeth. Both the drawbacks of these modalities of treatments and higher patient expectation have shifted the scientist toward a more revolutionary treatment option. Dental implant in recent years has become the most predictable treatment for missing teeth in terms of function and esthetic. The success rate of a dental implant is highly dependent on case selection, accurate diagnosis, well-established treatment planning, osseointegration, and maintenance.[1] There are two main parameters that help in diagnosis of dental alveolar bone in terms of quantity and quality, both of which play a major role in implant success. The clinician needs to be aware about the importance of each variable for long-term stability of an osseointegrated implant. Bone quantity is frequently named by the width and height of the alveolar bone.[2] Bone quality includes factors other than bone density, such as skeletal size, bony architecture, three-dimensional orientation of the trabeculae, and matrix properties.[3] Clinical reports suggest that survival rates of dental implants is higher for the mandible than those for the maxilla, especially for the posterior maxilla.[4,5] Clinicians generally consider that the basic cause of the difference in the survival rates between maxilla and mandible is bone quality.[6] Several studies in the literature corroborate that a type IV bone has a higher failure rate of implant placement. Likewise, studies have shown good results with implants placed in Type I, II, and III bone, the latter being the optimal type of bone for adequate implant stability. Bone density and implant stability are important factors for implant osseointegration, which has been widely demonstrated by several authors.[7] The treatment plan of some procedures in implant treatment can be

**Table 2: Attitude Toward Bone Quality (BQ) Eva**
**General Practitioner, Postgraduate Resident, Speci**

| Questions | Categories | General Practioner (n=31) (%) | Postgraduate Resident (n=39) (%) | Specialist (n=28) (%) | Consultant (n=28) (%) | P-value* |
|---|---|---|---|---|---|---|
| How important is bone quality connection to implant treatment? | Very relevant | 26 (26.5) | 37 (37.8) | 16 (16.3) | 19 (19.4) | < .007 |
| | Relevant | 3 (11.5) | 2 (7.7) | 12 (46.2) | 9 (34.6) | |
| | Not relevant | 2 (100.0) | 0 (0) | 0 (0) | 0 (0) | |
| Do you use bone quality as criteria when you suggest implant treatment? | Yes, always | 20 (26.3) | 32 (42.1) | 15 (19.7) | 9 (11.8) | < .000 |
| | Yes, sometimes | 11 (24.4) | 7 (15.6) | 13 (28.9) | 14 (31.1) | |
| | No | 0 (0) | 0 (0) | 0 (0) | 5 (100.0) | |
| Do you evaluate bone quality before implant treatment? | Yes, always | 26 (31.0) | 29 (34.5) | 18 (21.4) | 11 (13.1) | < .000 |
| | Yes, sometime | 5 (16.7) | 10 (33.3) | 10 (33.3) | 5 (16.7) | |
| | No | 0 (0) | 0 (0) | 0 (0) | 12 (100.0) | |

influenced by the alveolar bone quantity, such as choice of implant type, length and diameter, angle of placement, and also bone augmentation.[8] In poor bone density, primary implant stability is lower than on implants placed in denser bone.[9] The most famous classification system for jaw bone anatomy (quantity and quality) for dental implant treatment, was suggested by Lekholm and Zarb.[2] The quantity of jawbone is divided into five groups, based on residual jaw shape following tooth extraction. Bone quality is classified into four groups according to preparation and structure of compact and trabecular bone tissue (Types 1- 4):

- Quality 1 (Type 1)—comprises homogeneous and compact bone
- Quality 2 (Type 2)—a thick layer of compact bone surrounding a core of dense trabecular bone
- Quality 3 (Type 3)—a thin layer of cortical bone surrounding dense trabecular bone of favorable strength
- Quality 4 (Type 4)—a thin layer of cortical bone surrounding a core of low-density trabecular bone[10]

luation in Implant Treatment of Dental Implant
ialist and Consultant in Saudi Arabia, 2016 (n=126)

| Questions | Categories | General Practioner (n=31) (%) | Postgraduate Resident (n=39) (%) | Specialist (n=28) (%) | Consultant (n=28) (%) | P-value* |
|---|---|---|---|---|---|---|
| After evaluating bone quality how do you use this information? | Pre-surgical implant planning & evaluation | 25 (26.3) | 34 (35.8) | 21 (22.1) | 15 (15.8) | < .001 |
| | Only at surgical stage | 3 (10.7) | 5 (17.9) | 7 (25.0) | 13 (46.4) | |
| | Post-surgical stages | 3 (100.0) | 0 (0) | 0 (0) | 0 (0) | |
| Relation between bone quality & success rate? | The better the BQ the higher the success rate | 28 (25.0) | 33 (29.5) | 23 (20.5) | 28 (25.0) | < .134 |
| | I don't have statistics | 3 (21.4) | 6 (42.9) | 5 (35.7) | 0 (0) | |

* Chi-squared test

To assess the bone mineral densities (BMD), there are the standard examination protocol of either dual-energy X-ray absorptiometry[11] or quantitative computed tomography (QCT).[12] QCT is the only method that allows investigation of the cortical and trabecular bone component separately.[13] The QCT method looks for hydroxyapatite concentration and it has a close relationship with it. The BMD measured in Hounsfield units (HU) using QCT.[13] Few published studies assess how specialists interpret the term bone quality and how they evaluate bone quality in dental implant treatment. Specifically, the study by Lindh et al., which investigated the criteria used for bone quality assessment, revealed that most Brazilian and Swedish implant specialists who performed dental implant treatment considered bone quality to be an applicable parameter and they analyze it and utilize it in their practice. The study hypothesis concerns whether Saudi clinicians who do implant treatment have enough awareness and knowledge regarding assessment of bone quality due to increasing scientific activity in dental implant recently in Saudi

**Table 3: Evaluation Methods Used Before and During Implant Treatment General Practitioner, Postgraduate Resident, Specialist and Consultant in Saudi Arabia, 2016 (n=126)**

| Methods Used* | General Practioner (n=31) (%) | Postgraduate Resident (n=39) (%) | Specialist (n=28) (%) | Consultant (n=28) (%) | P-value$ |
|---|---|---|---|---|---|
| Periapical Radiography | 22 (71.0) | 17 (43.6) | 23 (82.1) | 12 (42.9) | 0.002 |
| Panoramic Radiography | 31 (100.0) | 26 (66.7) | 25 (89.3) | 9 (32.1) | 0.000 |
| CT Scan Radiography | 22 (71.0) | 30 (76.9) | 23 (82.1) | 20 (71.4) | 0.729 |
| Surgeon's Hand-felt Perception of Drilling Resistance | 9 (29.0) | 10 (25.6) | 21 (75.0) | 19 (67.9) | 0.000 |
| Peak Insertion Torque | 3 (9.7) | 9 (23.1) | 12 (42.9) | 5 (17.9) | 0.021 |
| Periotest | 2 (6.5) | 8 (20.5) | 3 (10.7) | 0 (0) | 0.044 |
| Resonance Frequency Analysis 'RFA' | 3 (9.7) | 0 (0) | 0 (0) | 0 (0) | 0.024 |
| Dual Energy X-Ray Absorptiometry | 3 (9.7) | 0 (0) | 0 (0) | 0 (0) | 0.024 |

* More than one answer allowed

$ Chi-squared test

**Table 4: Classification of Bone Quality used by Dental Implant General Practitioner, Postgraduate Resident, Specialist and Consultant in Saudi Arabia, 2016 (n=126)**

| Classification Used | General Practioner (n=31) (%) | Postgraduate Resident (n=39) (%) | Specialist (n=28) (%) | Consultant (n=28) (%) | Total | P-value$ |
|---|---|---|---|---|---|---|
| No Classification | 12 (38.7) | 10 (25.6) | 4 (14.3) | 6 (22.2) | 32 | 0.175 |
| Leckholm & Zarb | 6 (19.4) | 19 (48.7) | 14 (50.0) | 13 (48.1) | 52 | 0.042 |
| Misch | 16 (51.6) | 14 (35.9) | 15 (53.6) | 2 (7.4) | 47 | 0.001 |
| Lindh et al. | 3 (9.7) | 0 (0) | 0 (0) | 6 (22.2) | 9 | 0.003 |

* More than one answer allowed
$ Chi-squared test

Arabia. Our aim is to measure the awareness of Saudi clinician about bone quality assessment.

## MATERIAL AND METHODS

### Subjects and Sampling

Practitioners who perform dental implants in Saudi Arabia (n=423) were invited randomly to participate in this study. Only 126 participants respond to this study. The sample is composed of dental general practitioners, postgraduate residents, specialists, and consultants who work in Saudi Arabia.

### Questionnaire Development

An organized questionnaire was created especially for this study. The questionnaire was initially outlined in English and has been translated to Arabic for non-English speakers. It contained questions regarding the respondents' attributes and also included questions concerning their knowledge, attitudes, and understanding of indicative techniques for bone quality assessment in dental implant treatment. Numerous decision inquiries were utilized to distinguish techniques and estimation units ordinarily utilized by the respondents. The decision about strategies and measurement units depended on the consequences of a cross-sectional study on clinical techniques used for assessing alveolar bone in dental implant treatment. Questions were amended by specialists to enhance clarity/reliability and pre-tested before being released.

### Data Collection

The survey was sent by email to all Saudi dental school and Saudi Board training centers, governmental hospitals, and implant private centers. Participants filled out the questionnaire

**Table 5: Concepts of Bone Quality of Dental Impant General Practitioner, Postgraduate Resident, Specialist and Consultant in Saudi Arabia, 2016 (n=126)**

| Category* | General Practioner (n=31) | Postgraduate Resident (n=39) | Specialist (n=28) | Consultant (n=28) | P-value$ |
|---|---|---|---|---|---|
| Quantity of Cortical and Marrow | 16 | 25 | 12 | 8 | 0.033 |
| Density | 19 | 32 | 28 | 19 | 0.002 |
| Volume/Bone Height | 11 | 14 | 0 | 5 | 0.002 |
| Morphology | 18 | 20 | 5 | 4 | 0.000 |
| Primary Stability | 8 | 3 | 14 | 11 | 0.001 |
| Bone Thickness/Width | 8 | 12 | 0 | 3 | 0.006 |
| Bone Mineralization | 5 | 9 | 12 | 14 | 0.013 |
| Hardness/Rigidity | 7 | 10 | 13 | 3 | 0.022 |
| Vascularization | 4 | 14 | 12 | 9 | 0.070 |
| Resistance | 6 | 3 | 7 | 0 | 0.018 |
| Bone Repair | 0 | 2 | 1 | 1 | 0.538 |
| Absence of Pathology | 21 | 19 | 19 | 10 | 0.033 |

* More than one answer allowed

$ Chi-squared test

online without identification. An explanation was sent with the survey that clarified that only those dental professionals who perform dental implant treatment in their clinical practice in Saudi Arabia ought to answer the questionnaire.

### Statistical Analysis

Data were collected and summarized using descriptive frequency analysis. The chi-squared test was used to compare general practitioner, postgraduate resident, specialist, and consultant responses. Statistical significance was set at $P<0.05$. The statistical package for the social sciences (SPSS 17.0; SPSS INC., Chicago, IL, USA) was used in data analysis.

## RESULTS

The questionnaire response rates were: general practitioner group 24.6%, postgraduate resident group 31%, specialist group 22.2%, and consultant group 22.2%. Table 1 describes demographic characteristic of the participants. Most of the respondents (73.8 %) were male.

The attitude toward bone quality assessment during implant treatment is presented in Table 2. Contrasts in reactions between the four groups were significant except for "relation between bone quality and success rate." Most respondents in all groups considered bone quality to be a pertinent parameter (response: "relevant" or "very relevant")(general practitioner 93.5%, postgraduate resident 100%, specialist 100%, and consultant 100%). However, 6.5% of the general practitioner group considered bone quality not relevant. There was a significant difference ($p < 0.000$ ) between all groups' responses concerning the frequency of utilizing bone quality assessment as a criteria for dental implant placement, with more postgraduate residents emphatically responding to this item. Most of the respondents, 90.5%, evaluate bone quality prior to the implant treatment, while 42.8% of the consultant group doesn't consider the bone quality assessment prior to the implant placement. The majority of the respondents used data from bone quality assessment in planning and evaluating treatment result, with 88.9% of the respondents believing that the higher implant success rate corresponded with better bone quality.

Eight frequent methods to assess bone quality were used in this study. The most prevalent techniques for evaluating bone quality in the general practitioner group were panoramic radiography, followed by CT scan and periapical radiography (Table 3). Postgraduate resident respondents most commonly used the CT scan radiography followed by panoramic and periapical radiography. The specialist respondents commonly use the panoramic radiography, followed by CT scan and periapical radiography. Consultant respondents most frequently used CT scan radiography, followed by surgeon's hand-felt perception of drilling resistant and periapical radiography.

Most respondents not only assess the bone quality but also know how to classify it, and most of the respondents used the classification proposed by Lekholm & Zarb,[2] with the second most frequently used classification being Misch[14] (Table 4). In regard to multiple-answer questions about the concept of bone quality, most respondents indicated that the density only is representative of bone quality (Table 5).

## DISCUSSION

This research found that all the implant (general practitioner, postgraduate resident, specialist, and consultant) practitioners accepted bone quality to be an imperative component in many phases of dental implant treatment. Our hypothesis was confirmed that the dental implant practitioners in Saudi Arabia have enough awareness and knowledge regarding assessment of bone quality. Through the survey, we discovered a

divergent response regarding what bone quality means and how to assess it. A web-based English questionnaire was developed to assess the awareness of bone quality assessment methods by dental implant practitioners in Saudi Arabia. The response rate of the questionnaire was low (30%) of the total number (n=423). We assumed the low response rate was because some of the practitioners were addressed through their official emails provided by their universities, which might be not valid. Professional training is different for all four groups. Also, years of experience plays a major role and explains the conflict of answers in some questions. Most of the respondents in all groups were using the same methods in assessing bone quality before and during implant placement. Those methods are periapical radiography, panoramic radiography, CT scan radiography, and surgeon's hand-felt perception of drilling resistant. These methods of assessment used due to the availability of these measurements if compared with the other methods of assessment.

There is no consensus on the meaning of bone quality in the scientific literature,[12] nor on the proficiency of the distinctive strategies utilized as a part of implant planning and treatment.[16] The assortment of bone quality definitions and classification and the numerous techniques for its assessment reported by the respondents in this study were, therefore, anticipated.

The classification proposed by Leckholm & Zarb[2] is the most commonly used system (41.3%) as reported in this study, which is in line with findings of the above study by Lindh et al.[15] A large portion of the respondents in all groups demonstrated positive attitudes and reported common agreement in relation to assessment of bone quality. The present study is clinically applicable in light of the fact that it is the primary study that examines the state of mind toward bone quality in four diverse human services groups. Areas in Saudi Arabia at alternate levels of economic development and the human services status of citizens varies, as do the health care systems. This study has a direct impact in daily dental implant practices as it is an exploratory overview that researches the parameters of the clinical routine of dental implant treatment and the levels at which it is upheld by evidence-based guidelines. The outcomes demonstrate the need for further national and universal studies to research whether jawbone quality is a vital parameter in implant treatment planning and, provided that this is true, to find a validated standard index for daily implant clinical practice.

## CONCLUSION

From the results of this study, it is possible to conclude that a large proportion of dental implant practitioners in Saudi Arabia who perform dental implant treatment consider bone quality an essential parameter for implant treatment planning and there was no agreement on what bone quality means or on the most ideal method to assess bone quality.

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**References**

1. Esposito M, Hirsch J-M, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants,(II). Etiopathogenesis. Eur J Oral Sci. 1998;106(3):721–64.

2. Lekholm U. Patient selection and preparation. Tissue-Integr Prostheses Osseointegration Clin Dent. 1985;199–209.

3. Lindh C, Obrant K, Petersson A. Maxillary bone mineral density and its relationship to the bone mineral density of the lumbar spine and hip. Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology. 2004;98(1):102–9.

4. Tinsley D, Watson CJ, Ogden AR. A survey of UK centres on implant failures. J Oral Rehabil. 1999;26(1):14–8.

5. Jemt T, Lekholm U. Implant treatment in edentulous maxillae: a 5-year follow-up report on patients with different degrees of jaw resorption. Int J Oral Maxillofac Implants. 1994;10(3):303–11.

6. Turkyilmaz I, McGlumphy EA. Influence of bone density on implant stability parameters and implant success: a retrospective clinical study. BMC Oral Health. 2008;8(1):32.

7. Molly L. Bone density and primary stability in implant therapy. Clin Oral Implants Res. 2006;17(S2):124–35.

8. Wakimoto M, Matsumura T, Ueno T, Mizukawa N, Yanagi Y, Iida S. Bone quality and quantity of the anterior maxillary trabecular bone in dental implant sites. Clin Oral Implants Res. 2012;23(11):1314–9.

9. Martinez H, Davarpanah M, Missika P, Celletti R, Lazzara R. Optimal implant stabilization in low density bone. Clin Oral Implants Res. 2001;12(5):423–32.

10. Reddy TK, Kaliraja T, Ramesh B, Gurumurthy G. Computer Aided Diagnosis of Dental CT images for Bone Quality Assessment. Int J Biosci Biochem Bioinforma. 2011;1(3):226.

11. Pluskiewicz W, Tarnawska B, Drozdzowska B. Mandibular bone mineral density measured using dual-energy X-ray absorptiometry: relationship to hip bone mineral density and quantitative ultrasound at calcaneus and hand phalanges. Br J Radiol. 2000;73(867):288–92.

12. Ribeiro?Rotta RF, Lindh C, Pereira AC, Rohlin M. Ambiguity in bone tissue characteristics as presented in studies on dental implant planning and placement: a systematic review. Clin Oral Implants Res. 2011;22(8):789–801.

13. Nilsson M, Johnell O, Jonsson K, Redlund-Johnell I. Quantitative Computed Tomography in Measurement of Vertebral Trabecular Bone Mass A Modified Method. Acta Radiol. 1988;29(6):719–25.

14. Misch CE. Density of bone: effect on treatment plans, surgical approach, healing, and progressive boen loading. Int J Oral Implantol Implantol. 1989;6(2):23–31.

15. Lindh C, Oliveira GHC, Leles CR, Carmo Matias Freire M, Ribeiro?Rotta RF. Bone quality assessment in routine dental implant treatment among Brazilian and Swedish specialists. Clin Oral Implants Res. 2014;25(9):1004–9.

16. Ribeiro-Rotta RF, Lindh C, Rohlin M. Efficacy of clinical methods to assess jawbone tissue prior to and during endosseous dental implant placement: a systematic literature review. Int J Oral Maxillofac Implants. 2007;22(2).

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