

Aranyarachkul P, Caruso J, Gantes, B, Schultz E, Riggs M, et al. Bone density assessments of dental implant sites: 2. Quantitative cone-beam computerized tomography. J Oral Maxillofac Implants 2006;20:416-24. (29 refs.)

Purpose: 1) To evaluate variations in bone density in designated implant recipient sites using HU (Hounsfield units) density recordings made with the new QCBCT (Quantitative cone-beam computerized tomography) method; 2) to compare HU density recordings made using the conventional QCT (Quantitative CT) method with HU density recordings made with the new QCBCT method and 3) to compare Leckholm and Zarb subjective assessments to HU density recordings made with the new QCBCT method.

Materials and Methods:

Cadaver specimens
(63 implant sites among 36 specimens; each specimen providing 1-4 implant sites, and each had at least the minimum alveolar bone height necessary to accommodate 4x10 mm dental implant).

↓
Placement of aluminum indicator rods at designated implant recipient sites
(Direction-indicator rods 2 mm in diameter were placed in designated implant recipient sites to a depth of 2mm, osteotomies were performed, rods extended 2-4 mm coronal to the bony crest.)

↓
4% neutral buffered formalin

↓
Vacuum

↓
Scanning CT
Scanning CBCT

↓
Image archiving
archiving

↓
QCT (HU)
QCBCT (HU)

↓
Subjective scoring
Subjective scoring

↓
Image

Results: Reproducibility of the QCBCT bone density measurements as evaluated from the duplicate readings showed an ICC (Intra-class correlation co-efficient) of 0.99. The repeat ratings by the examiners using the Leckholm and Zarb classification showed ICC of 0.7 for examiner 1 and 1.0 for examiner 2.

QCBCT bone density: The highest readings were found for the coronal 1 mm of the rectangular implant area, followed by the coronal third of the rectangular area. Values for images from the mesial aspect of the designated implant sites were generally higher than corresponding readings for the distal aspects. Large ranges of values were seen for all subdivisions of the rectangular implant areas.

Comparison between QCT and QCBCT: QCBCT bone density values for the coronal, middle, and apical thirds were generally higher than the corresponding QCT recordings. The relationships between the QCT and QCBCT values were close, as demonstrated by the Pearson correlation co-efficient (0.92-0.98).

Correlation between QCBCT bone density and subjective scoring: Although overall relationships were observed, there was a lack of precision in the Lekholm and Zarb measurement ratings.

Conclusion: QCBCT should be considered an alternative diagnostic tool for CT for implant preoperative evaluation, particularly as the associated radiation dosage is reportedly much lower.

Becker W. Immediate implant placement: treatment planning and surgical steps for successful outcomes. Br Dent J 2006; 201:199-205. (71 refs.)

Purpose: The purpose of this article was to review the concept of immediate implant placement and to expand the indications, limitations, anatomic, prosthetic and aesthetic requirements for placement of implants at the time of extraction.

Materials and Methods: Literature review and author's opinion.

Findings: Placement of implants has made it possible to restore patients who are fully or partially edentulous. Original protocols required placement of implants into healed edentulous areas. Becker et al. reported at 93.3% implant survival rate for implants placed at the time of extraction and augmented with barrier membranes after one and five years following loading. The stability of the implant can be verified using resonance frequency analysis. Resistance to vibration of the transducer to the surrounding bone is registered and measured as ISQ (Implant Stability Quotient) values. A recent study evaluated stability of implants placed at the time of extraction with resonance frequency analysis. Stability measurements were taken at the time of implant placement and after healing. Resonance frequency measurements showed a mean primary stability of 62.0 ISQ and a mean secondary stability of 64 ISQ for all implants. The increase was not statistically significant. Studies indicate that implants with an RFA greater than 50 are stable.

Diagnosis and Treatment Planning: The most important step in treatment planning is determining the prognosis for the dentition and tooth in question. In the aesthetic zone bone morphology, scallop of the periodontium, level of crestal and interproximal bone, smile line, morphology of the gingival tissues must be considered before initiating treatment. Proposed interimplant distance as well as existing contact relationships and interproximal bone must be analyzed. Patients with a thin periodontium will have soft tissue recession at the implanted site. In these situations, it is advisable to use orthodontic forced eruption procedures prior to tooth removal. This allows bone and soft tissues to move coronally, assuring adequate mucosal tissue adjacent to the implant. Radiographic evaluation should consider availability of native bone, bone shape, quality, quantity, bone width and height. A minimum of 4-5 mm of bone width at the crest and 10 mm or greater from the alveolar crest to a safe distance above the mandibular canal is recommended. For a satisfactory aesthetic result in the aesthetic zone, the interproximal bone height should be 5 mm or less when measured from the contact point of the adjacent tooth. As the distance from the contact point to the interproximal bone increases, the likelihood of retention of the interproximal papillae post implant placement diminishes. Once the decision has been confirmed that the patient is a candidate for immediate implant placement, a surgical guide should be used to assure proper implant placement. A provisional appliance with an ovate pontic should be available for insertion after implant placement.

Tooth Extraction and Implant Placement Procedure: The patient is anaesthetized and various flap procedures can be used to gain access for tooth extraction. A Molt C2 curette can be used to luxate the root mesially-distally, and not buccal-lingually, which could damage the buccal plate. After tooth removal, a curette is used to explore the location of the buccal plate and confirm that it is intact. The surgical guide is placed over the surgical site and a sharp Precision Drill is used to penetrate the palatal wall of the extraction socket. This drill guides the drills used to create the osteotomy. In the maxillary anterior region it is important to avoid placing the implant directly into the extraction socket, which will invariably cause the implant to perforate the buccal plate and jeopardize survival. The axis of the implant must be even with the incisal edges of the adjacent teeth or slightly palatal to this landmark. A direction indicator should be used to verify the correct angulation. Standard drilling procedures are performed. In the aesthetic zone, the implant head should be a minimum of 3 mm apical to an imaginary line connecting the CEJs of the adjacent teeth and apical to the interproximal and crestal bone. A healing abutment or cover screw is placed. The healing abutment should be even with or slightly apical to the adjacent marginal tissues. Interproximal papilla adjacent to the implant can be adapted with interrupted sutures under minimal tension. The provisional is then inserted and evaluated, making certain the pontic is clear of the healing abutment. The provisional restoration should have an ovate pontic to support the adjacent tissues and help preserve soft tissue anatomy.

adjacent to the implant. The patient is instructed in proper after surgery care and the sutures are removed in 7-10 days. Restoration of the implant can take place once osseointegration has been confirmed (maxillary anterior region 4-6 months).

The Gap: On occasion, the marginal tissues do not adapt to the healing abutment. In experimental studies, if the gap is too wide, connective tissue forms between the coronal implant aspect and surrounding bone. A series of animal and human studies has demonstrated that small gaps between implants and bone will fill with bone with or without grafting materials or barriers. In practice, when the gap is present no effort is made to surgically advance the flap. A small amount of allograft or alloplast is layered between the margin and implant abutment. This material is left exposed. Within a few weeks some of the material will be exfoliated and gingival mucosa will migrate over the exposed materials and healing is uneventful. Bovine bone has been used to augment small gaps. Results from these studies demonstrate that the bovine bone does not affect the survival of implants.

Socket Preservation: Socket preservation implies that placement of varying implantable materials within the sockets alone or with barrier membranes maintains socket anatomy. To date, there is inconclusive evidence this procedure maintains original socket dimensions. There is some evidence that placement of foreign materials into extraction sockets will interfere with normal bone formation. Unaugmented or grafted sockets decreased in width by an average of 1.7 mm, while grafted sites decreased by 1.2 mm. The quantity of bone observed on histologic analysis was slightly greater in preservation sites, although these sites included bone vital and non-vital bone. There is evidence that resorbable barriers without grafting reduces alveolar ridge resorption after tooth extraction.

Conclusions: Multi-center studies have validated the predictability of placing implants at the time of extraction provided these procedures are appropriately treatment planned. To date, evidence for placement of bone substitutes adjacent to small bone defects related to immediately placed implants appears safe. There is insufficient evidence that "socket preservation" procedures predictably maintain socket anatomy without crestal resorption.

Ellegaard B, Baelum V, Kolsen-Petersen J. Non-grafted sinus implants in periodontally compromised patients: a time-to-event analysis. Clin Oral Implants Res. 2006 Apr;17(2):156-64.

Purpose: To report the results of implant therapy involving a sinus lift procedure in conjunction with conventional implant therapy in 68 periodontally compromised patients.

Materials and Methods: 68 periodontally compromised patients with mean age ~57 years, majority were smokers and women. 262 implants were placed and followed over 12 year period. Each patient had ≥ 2 implants placed, one in the maxillary sinus region (min. 3mm alveolar ht.) following Caldwell-Luc sinus augmentation procedure without graft. 2 implant systems were used in both conventional and sinus sites: Astra (2 stage system) and ITI (1 stage system). Most of implants were of solid screw type except that many of ITI conventional implants used were of hollow screw type implants. Patients were instructed to rinse with CHX for 2 weeks. They followed weekly during 1st 3 weeks, every 3 months thereafter. After 5-6 months, submerged Astra implants were provided with healing caps. Periimplantitis were treated accordingly with CHX irrigation, antibiotics, and certain cases GTR. Implants were removed when periimplantitis treatment failed (remained with suppuration.) Follow-up visits included recording of plaque, probing pocket depth and radiographic measurement implant shoulder- alveolar crestal distance. Data collected was analyzed statistically.

Findings:

| % of implants had not explanted at 1, 5, 10 years | | | | |
|---|--------------|-------|--------------|-------|
| Time after Insertion (years) | Astra | | ITI | |
| | conventional | sinus | conventional | sinus |
| 1 | 100 | 98.1 | 98.7 | 98.5 |
| 5 | 97 | 91 | 90 | 88.7 |
| 10 | 97 | 85.4 | 59 | 79.9 |

| Estimated hazard ratio describing factors influential for implant explantation | | | | |
|--|---------|------------|-----------------|--------------|
| factors | smoking | # of teeth | Length (< 10mm) | Brand (ITI) |
| Estimated Hazard ratio | 2.2 | 3.8 | 3.1 | 2.8 |

Conclusion: According to the authors, study results demonstrate that sinus implants may be inserted with the same success as conventional implants in periodontally compromised patients.

Degidi M, Piattelli A, Iezzi G, and Carinci F. Wide-diameter implants: Analysis of clinical outcome of 304 fixtures. *J Periodontol* 2007; 78: 52-8.

Purpose: To evaluate the clinical outcome of wide-diameter implants retrospectively.

Materials and Methods: 205 patients were operated from Oct. 1996 to Dec. 2004. Inclusion criteria were as follows: controlled oral hygiene, the absence of any lesions, and sufficient residual bone volume to receive implants of ≥ 5.0 mm in diameter and 8.0 mm in length.

A total of 304 implants were inserted. 4 Ankylos, 1 Branemark, 99 Frialit, 41 Maestro, and 159 XiVE implants were inserted. Implant diameters ranged from 5.0 to 6.5 mm, and implant lengths ranged from 8.0 to 15 mm.

The difference between the implant abutment junction and the bone crestal level was defined as the insertion abutment junction (IAJ).

Δ IAJ (crestal bone resorption) = IAJ at the last control - IAJ just after the operation.

Results: (1) Distribution of series with regard to implant type and Δ IAJ

| | | | | |
|-------------------------|--------------------------|--------------------------|--------------------------|------------------------|
| Ankylos (4 implants) | Branemark (1 implant) | Frialit (99 implants) | Maestro (41 implants) | XiVE (159 implants) |
| 0.35 | 1.2 | 1.4 | 1.0 | 0.65 |

- There is no difference among implant types.

(2) Distribution of series with regard to tooth site and Δ IAJ

| | | | |
|---------------|--------------|----------------|--------------|
| Incisors (37) | Cuspids (40) | Premolars (81) | Molars (146) |
| 1.1 | 1.1 | 0.9 | 0.7 |

- Distal teeth showed significantly lower Δ IAJ.

(3) Distribution of series with regard to implant diameter and Δ IAJ

| | | |
|----------------------|-----------------------|----------------------|
| 5.0 mm (42 implants) | 5.5 mm (248 implants) | 6.5 mm (14 implants) |
| 1.0 | 0.8 | 1.8 |

- Narrow implants (5.0 and 5.5 mm) showed significantly lower Δ IAJ.

(4) Distribution of series with regard to implant length and Δ IAJ

| | |
|------------------------|-----------------------------|
| < 13 mm (162 implants) | \geq 13 mm (142 implants) |
| 0.7 | 1.0 |

- Shorter implants (< 13 mm length) showed significantly lower Δ IAJ.

(5) Distribution of series with regard to bone quality and Δ IAJ

| | | | |
|------------------|-------------------|-------------------|------------------|
| D1 (15 implants) | D2 (152 implants) | D3 (115 implants) | D4 (22 implants) |
| 1.6 | 0.8 | 0.9 | 0.65 |

- There is no significant association between bone quality and Δ IAJ.

Conclusion: In wide-diameter implants, distal teeth, small implant diameter, and short implant length correlated with a statistically lower crestal bone resorption.

Lal K, White G, Morea D and Wright R. Use of Strereolithographic templates for surgical and prosthodontic implant planning and placement. Part I. The concept. J Prosthodont 2006; 15:51-8. Techniques and Technology

Purpose: to describe a technique that uses computer-generated strereolithographic template to transfer implant position from a 3D computer model, intraopeartively, to stage one surgery.

Materials and Methods: Review of technique and author's opinion

Findings and Conclusion: Technique:

1. Diagnostic study cast are mounted in a semi-adjustable articulator
2. Diagnostic Wax-up is completed and an impression of the wax-up is made using an irreversible colloid impression material and a duplicate cast is made in type IV dental stone.
3. Radiographic template is fabricated using barium sulfate as the a radiopaque marker incase of complete dentures a duplicate of a previously fabricated complete denture could be used as a readiographic template , in this case, radiopaque markers can be placed in the center of the occlusal surfaces of the teeth corresponding to the screw access holes of the planned implant-supported prosthesis.
4. CT scan is performed with the radiographic template in place. During the scanning procedure simultaneous transmission of information is achieved, besides a conventional scanning protocol, some additional instruction to the radiologist should be included on a roentgenographic prescription.
 - Use a bone or high resolution image reconstruction algorithm to get sharp reformatted images to locate internal structures
 - Image should be obtain with a 512x512 matrix and a field view between 140-170 mm
 - Only axial images required
 - Sliced thickness and increment should be 1.0mm
 - Gantry tilt should be 0 degree
 - Image should be saved as a ".sim" file format in a ZIP or CD
5. Using the software , the surgeon and prosthodontist can simulate implant placement on the 3D , to select specific implant length and diameter and then translated this image to the software model when it could be tilt until ideal positioned is observed, at this moment the prosthodontist can planned the prosthesis by accessing the occlusal surfaces when the screw access holes are emerging, at this point minor changes on angulation or mesio-distal positioned, could be made, if the changes could not be made because of anatomical deficiencies for example, then the Prosthodontist can be prepared to used an angulated abutment at the time of restoration.
6. Once the 3D simulation is completed is sent to the processing center via e-mail. This is transfer into geometrical information and this data is transfer to the stereolithographic apparatus (SLA).
7. The SLA consisting of a vat containing liquid photo-polymerized resin is used. A laser is used to polymerize the resin at 1mm increments, until completion of the SLA model of the patient's jaw. The same process is used to prepared the surgical template
8. Two sets of surgical templates are fabricated with different sleeve diameters corresponding to the incremental size of the osteotomy drill that will be used. The sleeves are 5mm in height and 0.2mm wider than the osteotomy drill being used.
9. At the time of surgery, a full thickness flap is reflected and the first template corresponding to the 2mm twist drill is secured, after this the second template is used with the wider osteotomy drills.
10. Conventional implant placement protocol is followed according to the system being used.

The SLA template is a good aid in the treatment plan of partially and full edentulous cases. However, cost and patient compliance are factors to be taken in consideration

Romanos GE, Nentwig GH. Immediate versus delayed functional loading of implants in the posterior mandible: A 2-year prospective clinical study of 12 consecutive cases. Int J Perio Rest Dent 2006; 26(5): 459-469. (35 refs.)

Purpose: To compare the success rate of immediately loaded implants versus implants loaded in a delayed protocol placed in the posterior part of the mandible in a prospective clinical study of 12 consecutive cases.

Materials and Methods: This was a prospective randomized controlled study. Patient were screened and examined clinically and radiographically by using panoramic radiographs. Pregnant patients, alcohol-, drug-, or medication- dependent patients, or postradiotherapy or postchemotherapy patients were excluded from the study. Twelve subjects (composed of 7 males and 5 females; average age approximately 51 years) were selected for the study. All subjects had bilateral edentulous regions in the mandible distal to the canines. In 8 cases, periodontally healthy maxillary teeth or a fixed maxillary prosthesis opposed the bilateral edentulous regions; while in 4 cases, a maxillary RPD opposed the edentulous regions. All subjects had high levels of compliance, were systemically healthy, and presented with sufficient alveolar bone levels (11.0 mm in height and 6.0 mm in width.) Subsequent to the examination, one side of the mandible was randomly selected to serve as the control site (delayed loading) while the other side of the mandible was the test site (immediate loading.) The control site had a 3 month osseointegration period after implant placements, followed by fabrication of provisional restorations (at the 3rd month) with eventual insertion of the definitive restorations at the 6th month period. The test site had provisional restorations that were immediately fabricated subsequent to implant placement with eventual cementation of the definitive restorations at the 6th month period. Subjects returned at different time intervals to be clinically (Silness and Loe PII, Muhlemann and Son SBI, probing measurements, and width of the keratinized mucosa, and Periotest mobility values) and radiographically (panoramic) re-evaluated. Peri-implant crestal bone loss was scored as follows: 0= no bone loss, m= bone loss of less than 2.0mm, 1= bone loss less than ¼ of the implant length, 2= bone loss of less than ½ of the implant length, 3= bone loss of less than ¾ of the implant length.

Findings: All implants osseointegrated. There were no overt signs of inflammation, mobility, or postoperative complications associated with either control or test groups during the experimental period. Bone loss was generally less than 2 mm in both groups.

Conclusions: Statistically significant differences between both groups were not evident after a 25 month period. However, the investigators admit that their results may be limited due to the small sample size.

AC: This is an intriguing study, yet I am unclear on several aspects:

1. *"...panoramic radiographs were obtained to evaluate crestal bone levels around both test and control group implants." (pg. 463; 1st column)*

Panoramic radiographs are excellent adjuncts for screening examinations. Yet, panoramic radiography is notorious for its inaccuracy because of variations in projection geometry (specifically, unequal magnification and distortion in the vertical and horizontal dimensions throughout the radiograph.) Therefore, definitive measurements of alveolar bone levels based off of panoramic radiographs will result in inaccurate measurements and will mislead the clinician. More accurate measurements can be obtained from periapical, cephalometric, and occlusal radiographs. The most accurate assessment can be made from CT scans provided that the patient can afford it, and is willing to undergo an imaging technique that emits excessive radiation.

2. *"Alcohol-, drug-, or medication-dependent patients, postradiotherapy or postchemotherapy patients, and pregnant subjects were excluded from the study." (pg. 460; 3rd column)*

This is the investigators' exclusion criteria. However, they fail to exclude patients with parafunctional habits. Parafunctional habits (i.e. bruxing) can lead to implant failure--excessive horizontal forces (non-axial forces) exerted on an implant. Granted, the investigators have one line concerning this concept in their **Discussion** section (pg. 466, second column) however, no mention is made in regards to excluding patients who have parafunctional habits from the present study. Furthermore, the investigators fail to mention if an occlusal analysis was performed prior to implant placement to detect potential occlusal prematurities. As a result, it is unclear whether or not these patients had an acceptable occlusion that would not be detrimental to the implants.

3. *"All patients were bilaterally edentulous in the mandible distal to the canines or first or second premolars." (pg. 460; 2nd column)*

Just by reading this statement, we know that all subjects have bilateral edentulous regions in their mandible. What is not made apparent, however, is the duration of their edentulous state. In patients who have been partially edentulous for a long period of time, the neuromuscular control of the masticatory system adapts so that the masticatory loads only occur on existing natural teeth (i.e. anterior teeth.) This change in neuromuscular control results in an alteration of a patient's masticatory habit. We do not know if the subjects' masticatory habits changed after implant placement. For example, *after* implant placement and *upon* mastication, do we know if the subjects have changed their oral habits so that direct, maximal axial force is applied to the implants? Or, are the subjects maintaining their old masticatory habits by chewing only on their anterior teeth? In other words, are all subjects applying the same type of axial force on the implants?

4. *"Bone quality, which was evaluated during surgery, determined the technique of implant placement according to the following criteria....." (pg. 461; 1st column)*

I thought that bone quality should always be assessed in the treatment plan phase prior to the actual surgical procedure. Also, the classification of bone quality ("hard", "normal", and "soft") seems to be highly subjective.

5. *"According to the selection criteria of the study, all included patients showed high levels of compliance with treatment and were in good general health." (pg. 460; 3rd column)*

How did the investigators assess the compliance levels? Did they take an O'Leary plaque score of the existing teeth, or did they assess the soft tissue by changes in color, contour, and consistency? Granted, the investigators used Silness and Loe Plaque Index to assess the status of the oral cavity *after* implant placement, but again, it is not made clear what they used to assess the status of the soft tissue *prior* to implant placement.

6. *"All implants were examined clinically and radiographically at different time intervals. Clinical periodontal measurements, including Plaque Index according to Silness and Loe, Sulcus Bleeding Index according to Muhlemann and Son, probing pocket depth, width of the keratinized mucosa, and mobility values...were obtained after removal of the prostheses at different time intervals." (pg. 462; 3rd column)*

Aside from mobility, I am unsure of the validity of using periodontal parameters to assess implant success. The Sulcus Bleeding Index, for instance, is subjective because probing force may be a factor in eliciting bleeding. Also, bleeding upon probing of peri-implant tissues may elicit false-positive responses because it represents traumatic wound healing of the tissue and may not be a valid sign of true inflammatory disease. Probing pocket depths of peri-implant tissues may also result in false-positives since there is no connective tissue fiber attachment (into the implant) to impede the progress of the probe. In regards to measuring the width of the keratinized tissue, the investigators fail to explain the relevance of this as it pertains to their study.

I also question the use of Silness and Loe Plaque Index in assessing osseointegration. Previous articles that we have read in this class do not seem to implicate plaque as a *cause* of implant failure. Instead, implant failure is depicted as such:

Overload→ excessive implant movement→ separation at the bone-to-implant interface→ implant failure→ plaque accumulation→ secondary infection → loss of bony support.

In other words, plaque accumulation can be a *result* of implant failure. Moreover, in 339 implants, Chung et al. (we reviewed this article three weeks ago in this class) demonstrated that even though peri-implant tissues with inadequate keratinized mucosa are associated with higher PII and GI, *there is no significant alveolar bone loss*¹. The increase in plaque, in other words, does not result in implant failure. Thus, reliance on measurements obtained from periodontal indices to assess the present status of the implant and to predict implant success may be of little value and may be highly dubious, if not spurious, at best.

¹ Chung DM, Oh TJ, Shotwell JL, et al. Significance of Keratinized Mucosa in Maintenance of Dental Implants with Different Surfaces. J Periodontol 2006; 77(8): 1410-1420.

Misch CE, Steigenga J, Barboza E, et al. Short dental implants in posterior partial edentulism: A multicenter retrospective 6-Year case series study. J Periodontol 2006;77:1340-7.

Purpose: The purpose was to retrospectively evaluate and report on the survival rate associated with short implants in the posterior regions of the mouth and to correlate this to the prosthetic methods used to decrease forces and the implant design characteristics to decrease stress.

Methods and Materials: 745 implants, 7 or 9mm long, were placed in the posterior region in 273 partially edentulous patients. The vast majority of those implants (562) were 9mm long with a 4mm diameter. Implants were used to support 338 fixed restorations for a period ranging from 1 to 5 years. 102 of those restorations were single tooth implants, while the remaining 236 fixed restorations were supported by multiple implants, which were always splinted together. The restorative protocol for those posterior implants was specific. One implant per tooth was used in an independent posterior restoration. Multiple implants were always splinted together. Either larger diameter implants were used in the molar region for two 3.5 or 4mm implants per molar inserted. Incisal guidance was used on all fixed restorations, with no lateral forces on the posterior restorations in any mandibular excursion. Implant survival data were collected relative to stage I to stage II healing, stage II to prosthesis delivery, and prosthesis delivery to as long as 6 years follow-up.

Findings: From stage I surgery to stage II healing, there were six failures. Of the 505 implants with a two-stage surgical approach in the maxillary and mandibular arches, the survival rate at uncovering was 99.6%. Of the 240 implants with a one-stage surgical approach, there was a 98.3% survival rate. Hence, the overall surgical survival of short implants in the posterior regions of the mouth was 99.2%. All six failures in this report were implants 9 mm long and 4 mm in diameter. During the fabrication of the fixed prostheses, two implants failed which were 4 mm in diameter and 9 mm long, showing a survival rate of 99.7%. The overall implant survival from implant placement to the prosthesis delivery of 338 posterior restorations was 98.9%.

Conclusions: The authors concluded that short implants may be considered a predictable treatment to be used to support fixed restorations in the posterior edentulous regions. They also assumed that their biomechanical stress reduction protocol was beneficial for this treatment.

Myshin HL, Wiens JP. Factors affecting soft tissue around dental implants: A review of the literature. J Prosthet Dent 2005;94:440-4. (60 refs.)

Purpose: To review the pertinent literature on soft tissue healing in both partially and completely edentulous dental implant patients.

Materials and Methods: A Medline search of the English peer-reviewed literature from 1980 to 2004.

Findings and Conclusions:

1. Dental implant interface: The factors that may influence the health or quality of the soft tissue around an implant are 1. the presence of keratinized mucosa, 2. a microgap between the implant and the prosthesis, and 3. the material selected for the transmucosal connector to the implant. "Peri-implant mucositis" is distinct from bacterially mediated peri-implant bone loss (peri-implantitis). The connective tissue and epithelium may actually integrate with the titanium surfaces of dental implant. This observation may be of clinical significance and contribute to the functional and esthetic success of the prosthesis.

2. Histology and animal studies: The implant-soft tissue interface has certain similarities with that of natural teeth, including an oral epithelium, a sulcular epithelium, and a junctional with underlying connective tissue. The differences between the soft tissue barrier at dental implants and that at natural teeth are: 1. collagen fibers of the peri-implant tissue appear to run parallel with the surface of the abutment, and 2. the peri-implant tissue may have an impaired defense system due to lack of vascular supply. Moon et al postulated that the fibroblast-rich layer adjacent to the titanium surface has a role in the maintenance of a proper seal between the oral environment and the peri-implant tissue. In a 3-month animal study by Buser, it was concluded that the different surface textures of the dental implants did not influence the healing pattern of the soft tissues and the author found nonkeratinized sulcular epithelium with a zone of dense circular fibers close to the implant surface. Abrahamsson showed plaque formation around implants caused the establishment of an inflammatory cell infiltrate to a pocket epithelium, regardless of the 3 implant surfaces tested (Astra Tech, Nobel Biocare, and Straumann). When the influence of the type of abutment on the quality of the mucosal barrier around implants was investigated, gold alloy abutments were unable to promote mucosal healing and a zone of connective tissue attachment (Abrahamsson). Todescan et al investigated the influence of the depth of implant in the bone on the peri-implant soft tissue. In this 3-month study, there was a tendency for the epithelium and connective tissue to be longer when the implants were placed deeper (1mm below the alveolar crest). Hermann et al stated that bone would maintain its biologic width. Also, according to the theory of the microgap, it was postulated that bone would resorb to a level approximately 2mm from the microgap.

3. In vivo studies: Quirynen et al concluded that for implants with healthy gingival, the clinical attachment level is a reliable indicator of bone level. Etter et al determined that healing of the epithelial attachment after probing around implants is complete after 5 days and does not appear to have any detrimental effects on the soft tissue seal and longevity of implants. It was suggested that periodontal indices should not be relied on to infer the state of the implants (Chaytor). Also, Apse et al also concluded that periodontal indices are of limited value when applied to success or failure of osseointegrated implants. Observations of soft tissues have had inconsistent results in several human studies. The amount of soft tissue recession did not seem to be different between single-stage implants and 2-staged implants. Significant recession of 0.5mm within the first 3 months, and a mean decrease in tissue levels of 1.6mm after 24 months was found by Oates et al. Tarnow et al suggested that implants should have at least 3mm between them and noted that implants placed closer than 3mm had increased amounts of crestal bone loss. An average of 3.4mm of soft tissue was found over the interimplant crestal bone (Tarnow et al). Small and Tarnow noted most of recession occurred during the first 3 months postoperatively and

suggested that definitive impressions should not be made until after 3 months of healing in esthetic areas. Abrahamson et al found the length of the barrier epithelium, the height of the connective tissue attachment, and the level of the marginal bone did not differ in the 3 groups tested.

Yoo R, Chuang S, Mohamaed E, Weed m et al. Changes in the crestal bone levels for immediately loaded implants. Int J Oral Maxillofac implants 2006;21:253-61

Purpose: To measure changes in the bone level over time and to identify risk factors associated with increased rates of crestal bone loss in immediate loaded implants. A cohort study.

Materials and Methods: A sample of 174 subjects and 347 implants placed and loaded on the same day were selected for this study. The factors associated with the possible changes in crestal bone level were grouped as follows:

1. Demographic: age and gender
2. Health status: tobacco, medical conditions
3. Anatomy: Implant location, dentition status, bone quality, relationship to other dentoalveolar structure.
4. Implant-specific variables: Implant diameter, size and coating
5. Prosthetic variables: Number of units in the span of the prosthesis
6. Surgical variables: Type of reconstructive procedure to enhance the recipient site and the timing of implant placement relative to tooth extraction.

Changes in the crestal bone levels were measured in millimeters by comparing the immediate postoperative radiographs to the most recent radiograph available for review.

Changes in bone levels over time were estimated by direct measurements on nonstandardized, digital periapical radiographs by 2 examiners. Magnification was not known or repeatable factor for intraoral images was not assured. The length of the implant was measured on digital radiographs from the implant abutment interface to the apex of the implant. Next the distance between the observed crestal bone level and the implant abutment interface was measured at the mesial and distal implant surfaces. To adjust the measurements for magnification error, the following equation was used:

Corrected bone level = measured crestal bone level X (actual implant length / measured implant length). A regression analysis (GEE) was applied to identify risk factors for increased crestal bone levels.

Findings and Conclusions: The mean age of subjects was 53.9±15.8 years, tobacco use was reported by 8.7% of subjects, the majority of implants were placed in the maxilla (81.3%) of which 52.7% were placed in the anterior area. 93.1% of the implants were placed on partially edentulous subjects. Most implants were placed in type 3 or type 4 quality bone. 43.8% of the implant sites were at tooth locations that were previously root canal-treated and 22.2% were adjacent to at least one root canal treated tooth. Of the 347 implants, 85% did not have periapical radiolucency adjacent to it. The mean survival time of the implant was 9.4±5.4 months (range 0.1 to 24.6 months), survival rate was 93.1%. Overall 67.8% of implants had evidence of <1.5mm crestal bone loss at 12 months. Mean changes in radiographic bone levels were 0.5±1.5mm and 0.6±1.4mm on the mesial and distal surfaces respectively. GEE analysis showed that gender, dentition status and radiolucency adjacent to the implant site could be considered variables for inclusion. Radiolucency adjacent to the implant site was statistically associated with crestal bone loss OR 1.88; 95% CI, 1.00-3.6) (P<0.5)

According to Albrektsson's criteria success rates of 97.6% overall, 98.8% in the maxilla, and 98.2% in the mandible were recorded, as were cumulative success rates of 94.9% in the maxilla and 91.9% in the mandible. The overall cumulative success rate was 93.8%.

Misch CE, Steigenga J, Barboza E, et al. Short dental implants in posterior partial edentulism: A multicenter retrospective 6-year case series study. J Periodontol 2006;77:1340-1347.

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refs)

Purpose: To report on the retrospective clinical study in evaluating the survival of short dental implants used in the posterior regions of the mouth and to correlate this to the prosthetic method used to decrease forces and the implant design characteristics to decrease stress.

Materials and Methods: This retrospective study of 273 patients (204 females from 19-77yrs, and 69 males from 20-81 yrs) received 745 implants < 10 mm long supporting 338 restorations (102 posterior single tooth-64 mandibular, 38 maxillary, 236 multiple-splinted restorations) in the posterior maxilla or mandible partial edentulous areas over a 6 year period (from Jan. 1998 to Dec. 2004) from 4 private dental clinics. There were 562 implants that were 9 mm long with 4 mm in diameter (79.3%), 89 implants that were 9 mm long with 5 mm diameter (12%), 4 implants 9 mm long with 6mm diameter (0.5%), and 60 implants 9 mm long with 3.5 mm in diameter (8%). In a one-stage surgical approach, 218 mandibular posterior implants and 22 maxillary posterior implants, and 505 implants were placed on a two-stage surgical approach. The density of the bone found in the posterior regions of the jaw were classified using the Misch bone-density classification (D1-D4, with D4 being the softest bone type). A biomechanical approach to decrease stress to the posterior implants including splinting of multiple implants together with no cantilever load, 1 implant per tooth was used in an independent posterior restoration, larger diameter (5 or 6 mm) implants were used in the molar region or two 3.5 or 4 mm diameter implants per molar were inserted, and the implants selected were designed to increase bone-implant contact surface area. A mutually protected or canine guidance occlusion was used on all fixed restorations, with no lateral forces on the posterior restorations in any mandibular excursion movements.

Results: Of the 745 short dental implants in the 5 year period, 6 surgical failures from stage I to stage II surgery healing were reported. All of these 6 failures were implants of 9mm long and 4 mm in diameter. Of the 505 implants in the two-stage surgical approach, 1 failure in the mandible and maxilla (99.6% success) were reported. Of the 240 implants in the one-stage approach, 3 failed in the posterior mandible (out of 218 implants) and 1 failed in the posterior maxilla (out of 22 implants). Two implants failed during the stage II healing to prosthesis delivery. No implants failed after the 338 final implant prosthesis were delivered. Overall a 98.9% survival rate was obtained from stage I surgery to prosthetics follow-up.

Conclusion: From this study, short dental implants can be placed successfully to support fixed restorations in the posterior partial edentulous areas by employing properties of biomechanical stress reduction to the bone-implant interface and eliminating lateral contacts in the mandibular excursions thus reducing forces on the implants.

Oh TJ, Shotwell J, Billy E, et al. Flapless Implant Surgery in the Esthetic Region: Advantages and Precautions. Int J Periodontics Restorative Dent 2007; 27:27-33. (27 refs.)

Purpose: This paper presents two clinical cases of single-tooth implants in the esthetic region in which systematic approaches to flapless implant surgery using immediate or delayed loading protocols are described.

Materials and Methods: Case series presentation. Two surgical cases are presented that were treated in the Graduate Periodontics Clinic at the University of Michigan. Case 1: A 40-year old, healthy Caucasian women presented with a missing #7. The patient had a 20 pack year smoking history. The initial examination revealed that the width of the keratinized tissue on the edentulous area was sufficient, and an adequate ridge width (7 mm), mesiodistal distance (8 mm), and bone height were available for placement of a standard dental implant. Prior to surgery, preliminary impressions and cast fabrication were carried out, a surgical stent was made, and a periapical radiograph was obtained with a radiographic reference on the stent to verify the direction of future implant drilling. Under local anesthesia with 2% Lidocaine, the center of the implant site was marked on the soft tissue, with guidance by the surgical stent, and the soft tissue was punched with a 4 mm tissue punch. Immediately after the tissue punch, the soft tissue thickness was measured to provide the surgeon and prosthodontist with references, including the location of the crestal bone and emergence profile for implant placement and restoration. A sequential, atraumatic implant osteotomy was performed under copious saline irrigation using size-customized surgical guides, followed by placement of a root-form Endosseous dental implant 3.7 x 12 mm. After implant placement, an index impression was taken for the fabrication of the definitive crown which would be placed 4 months postimplantation. A flared 5 mm healing abutment was placed to develop an esthetic soft tissue emergence profile. The patient was given post-op instructions and given Ibuprofen 600 mg every 4-6 hours for 2 days and Amoxicillin 500 mg three times daily for 7 days. Postoperative bleeding and swelling were unremarkable and patient satisfaction was reported to as excellent. After 4 months of healing, the definitive abutment was torqued to the implant with 30 Ncm and the implant was loaded with the definitive crown, which had been fabricated in a laboratory using the implant-level index. A periapical radiograph was taken. There was no changes in soft tissue profiles at the implant site and adjacent teeth from the implant surgery, and the tissue levels remained stable and esthetically pleasing at the 6-month follow-up.

Case 2: A 39-year-old Hispanic man presented with #13 missing. His medical history was unremarkable and he does not smoke. The width of the edentulous ridge were sufficient to receive a 3.7 mm implant. There was 2 mm of gingival recession on both adjacent teeth; however, the amount of keratinized tissue at the implant site was adequate to perform the flapless surgery. The implant surgery progressed as discussed in case 1 and a 3.75 x 10 mm implant was placed. An implant-level index impression was taken for the fabrication of the definitive restoration. At chairside, a

provisional crown was made on a provisional abutment, which was hand-torqued onto the implant. Implant primary stability was tested and confirmed by hand-torquing the provisional abutment. Any heavy contacts with the provisional crown in centric occlusion were eliminated and no contacts were provided during protrusive and lateral excursions. Ibuprofen and Amoxicillin were prescribed to control postoperative pain and prevent infection. The patient returned after 10 days and received the definitive metal-ceramic crown, which had been fabricated in a laboratory. Heavy contacts were avoided on the implant crown in centric occlusion and during excursive movements. Abutment connection and crown cementation were verified with a periapical radiograph. Healing was uneventful with no signs of postsurgical complications. At 1 year, the soft tissue appeared healthy and esthetically pleasing, and no notable bone loss was observed.

Findings: Advantages of the flapless implant surgery, shown in the present cases, included less traumatic surgery and decreased operative time, which resulted in accelerated postsurgical healing, fewer postoperative complications, and increased patient comfort and satisfaction. Especially with the immediate loading protocol, the advantages were more pronounced because of the absence of a waiting period before prosthetic restoration. Another advantage of the flapless implant surgery was in the preservation of soft tissue profiles, including the gingival margins of the adjacent teeth and the interdental papilla. Prerequisites for the flapless surgery include sufficient bone width and height, adequate keratinized soft tissue, and an absence of tissue undercuts.

Conclusions: These cases demonstrate a successful usage for both delayed implant surgery and immediate loading cases. Appropriate case evaluation/selection, meticulous planning with well-constructed surgical guides tailored to the specific implant site, and systematic surgical and prosthodontic protocols are considered to be crucial to the success of flapless implant surgery for single-tooth implants.

Dilek OC, Tezulas E. Treatment of a narrow, single edentulous area with mini dental implants: a clinical report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007;103:e22-e25. (16 refs.)

Purpose: To present a case that a Sendax Mini-Dental Implant (MDI) was placed in a narrow, single tooth edentulous area.

Materials and Methods: A 40-year-old female with a missing tooth of #5 participated in the study. Approximately 15mm of bone was present in vertical direction and the mesiodistal distance between the neighboring teeth was 5mm. A square head of MDI implant with a diameter of 2.4mm and a length of 15mm was chosen. Osteotomy was performed by drilling to a depth equal to one third of the implant length with a single pilot drill without flap. The implant was placed using the self-tapping feature of the implant while using a finger driver, winged thumb wrench, and ratchet. A Periotest was used to measure primary stability. Primary stability was sufficient for immediate loading. On the day of surgery, an impression was taken. 4 days after the surgery, the implant was immediately loaded by applying a single ceramic fixed denture with a supporting metal framework.

Findings: Follow-up for 1 year showed no bone resorption around the implant, and no inflammation was observed at the soft tissue level. The Periotest revealed that the implant had osseointegrated.

Conclusion: Mini-dental implants with small diameter can be successfully used as an alternative to treatment with fixed partial dentures.