[Dent Implantol Update.](http://www.ncbi.nlm.nih.gov/pubmed/22338850%22%20%5Co%20%22Dental%20implantology%20update.) 2012 Feb;23(2):9-16.

**Comparison of flapless and conventional flap and the effect on crestal bone resorption during a 12-week healing period.**

**Abstract**

There is evidence suggesting that flapless, or minimally invasive, procedures can preserve bone vascularization because they will not disturb the periosteum of the alveolar bone. The aim of this randomized, controlled clinical trial study is to compare the effect of flapless (FL) and full-thickness flap (FT) techniques on crestal bone resorption during healing periods. METHODS: Twenty-two implants were placed by FL and FT flap in nine patients in split mouth design; each patient received two implants, except for two patients who received four implants. A periapical radiograph was taken at implant placement, as well as 6- and 12-week intervals. Crestal bone level was compared between FL and FT during these intervals and compared between intervals for each group. RESULTS: Median (IQR) crestal bone level at implant placement for the FL was 2.70 (0.60) and for the FT was 2.60 (1.20). At six weeks, median (IQR) for the FL was 3.55 (0.70) and for the FT was 3.40 (0.75). At 12 weeks, median (IQR) for the FL was 3.60 (0.30) and for the FT was 3.75 (0.85). Statistically insignificant differences were obtained between the two techniques at implant placement, as well as 6- and 12-week intervals, and were p = 0.894, p = 0.477, p = 0.755, respectively. There was a significant difference between the bone level at implant placement and at the 6-week interval for both the FL (p = 0.006) and FT (p = 0.045), whereas there was no significant difference between the bone level at 6- and 12-week intervals for the FL (p = 0.722) and for the FT (p = 0.229). Conclusions Based upon this study of nine patients with 22 implants, there was no significant difference in crestal bone resorption between FT and FL techniques during a three-month healing period. The preservation of periosteum in the FL group resulted in early progressive bone resorption.

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| [Implantologie](http://www.lefildentaire.com/articles/clinique/implantologie)  |
| Écrit par Dr Stéphan Fraisier     |
| L’implantologie moderne est entrée dans une nouvelle ère. Cette discipline se doit d’obtenir un résultat esthétique et fonctionnel, mais surtout il reste indispensable d’assurer la pérennité du résultat obtenu. Dans le secteur antérieur, il est bien admis que l’on peut désormais s’approcher du naturel. Cependant la littérature et les cours qui sont dispensés sur le sujet divergent parfois. Le clinicien doit être à même de juger, souvent en cours d’intervention, de l’opportunité de ses choix. L’implantologie est avant tout une discipline, d’abord clinique s’appuyant sur des faits scientifiques avérés et validés. Les résultats obtenus lui permettent d’acquérir de l’expérience. Celle-ci est indissociable de la littérature scientifique spécialisée mise à sa disposition. L’implantation immédiate gagne en popularité ces dernières années grâce aux avancées technologiques et à la maîtrise des praticiens. Les nombreux articles publiés sur ce sujet ont fait l’objet d’une méta-analyse. Les conclusions des experts, sur ce sujet, ne sont peut-être pas aussi dithyrambiques que l’on voudrait le croire.**Objectifs**Extraire et implanter dans la même séance, reste un acte séduisant, tant pour le praticien que pour le patient. Cela paraît facile (attention à la paroi palatine) et si « naturel ». On rapporte souvent que cela « rapproche le patient du traitement implantaire », c’est-à-dire de sa dent. Mettons nous à la place du patient : ce qui l’intéresse, c’est moins l’implant que la dent qui va dessus. Ce qui le préoccupe, c’est le résultat final, celui qu’il va voir et celui qu’il va retenir. Schulte, dès 1978, énumérait déjà les avantages de ce protocole :* un traitement global réduit,
* une préservation des parois résiduelles de l’alvéole au niveau vertical et horizontal,
* une position optimisée de la fixture,
* une diminution des besoins en greffe,
* et, une utilisation maximale du potentiel des cellules résiduelles du ligament de la dent extraite.

Il s’agissait d’un précurseur et tous ses arguments ont été depuis développés et étudiés.**Ne pas oublier l’orientation des fibres du tissu conjonctif**De nombreuses études montrent une récession (vestibulaire) des tissus mous quasi certaine au niveau du col de l’implant. L’espace biologique autour de la dent naturelle présente des fibres conjonctives perpendiculaires et circonférentielles insérées dans le cément, assurant la protection de l’os sous jacent. La fixture artificielle ne présente pas de cément, donc pas de possibilité d’attache des fibres conjonctives. Elles se développent donc de façon parallèle autour du col de l’implant et ne constituent pas une véritable attache protectrice. Contre les forces de mastication, les pressions verticales et latérales et les agressions bactériennes, la résistance est ainsi amoindrie. L’avènement des surfaces rugueuses a peut-être permis de combler une partie du manque d’attache.**Les cellules responsables de la cicatrisation**Elles proviennent principalement de la paroi interne de l’alvéole déshabitée. Le « gap » (ou espace) résiduel est un espace à franchir pour aller jusqu’à une surface artificielle, inerte, entourée d’une vascularisation inexistante. Elles peuvent y être aidées par le comblement du hiatus (Fig. 11c et d). La revue de littérature de Tim De Rouck (2008) recommande d’être prudent car le remodelage à long terme des tissus nécessite d’être mieux élucidé. La gencive vestibulaire reste fortement tributaire de la résorption osseuse post-extractionnelle (Fig. 11e).**Les pics osseux**Il est très important de les observer sur la radiographie rétro-alvéolaire avant le début du traitement. La présence de la papille est liée :* au niveau osseux du coté de la dent naturelle, pas à celui du côté de l’implant,
* à la distance entre le pic osseux et le point de contact (3 à 5 mm permettent d’espérer un « cripping attachement » qui va combler l’espace pour obtenir une papille complète. Il faut environ 9 mois.
* à la distance horizontale entre l’implant et la dent adjacente (3 à 4 mm pour un comblement du triangle) ; il est donc important de ne pas se laisser « aspirer » par l’alvéole de la dent extraite.

De plus, si la surface de la dent adjacente n’est pas contaminée et que le ligament persiste, on peut espérer une régénération à partir des cellules de ce même ligament.**La paroi vestibulaire**Elle est fine (Fig. 1a, 1b et p 83-94 de l’Atlas d’Anatomie Implantaire de J.F Gaudy). Elle est très fragile, et peut ne pas résister à l’extraction, aussi précautionneuse soit-elle (Fig. 2). Elle se résorbe rapidement. Sur des clichés scanner, Gaudy montre bien la disparition quasi complète de la fine corticale vestibulaire (p 99). Pourquoi se résorberait- elle moins avec la présence d’un implant ?http://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./focus-clinic--edentation-gestion-tissus-et-implant.-1_2.jpghttp://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./focus-clinic--edentation-gestion-tissus-et-implant.-1_3.jpghttp://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./focus-clinic--edentation-gestion-tissus-et-implant.-1_4.jpgL’extraction-implantation immédiate peut être « flapless surgery » (c’est-à-dire sans lambeau). Le périoste est maintenu, la vascularisation qu’il assure aussi.**Et surtout, le manchon vasculaire :**L’anatomie comparative des tissus mous parodontaux et péri-implantaires offre des similitudes mais aussi de grandes disparités. Outre l’attache conjonctive, le plexus vasculaire et son potentiel d’anastomose dérivé sont très différents (Fig. 3).http://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./focus-clinic--edentation-gestion-tissus-et-implant.-1_5.jpgL’implant ne bénéficie pas des anastomoses vasculaires dérivées des vaisseaux du desmodonte.Les procédés de défense et de réparation seront, par conséquent, moins importants que pour la dent naturelle, les possibilités de correction (greffe conjonctive) moins efficaces. Il faudra en tenir compte lors du choix de la thérapeutique. Burkhardt et al le signalent en conclusion de leur étude récente. Elle concerne 10 cas de recouvrement de déhiscence vestibulaire par un lambeau tracté coronairement associé à une greffe conjonctive enfouie (résultats à 1, 3 et 6 mois). Les résultats sont clairement inférieurs à ceux obtenus pour des dents naturelles. Ils sont également imprévisibles.**La tendance actuelle**Les études sont nombreuses et positives sur ce procédé séduisant et intellectuellement « logique ». Une présentation récente de l’E.A.O en octobre 2007 objective une perte minimale de la paroi osseuse vestibulaire d’extraction- implantation immédiate sans lambeau. Cette expérimentation est réalisée sur 8 chiens, 16 implants et un contrôle histologique à 3 mois. Comment peut-on juger de la valeur de cette étude et apprécier son « niveau de preuve » avec un si faible échantillon et si peu de recul ? Une équipe autrichienne, dans ce même congrès, assure que « l’implantation immédiate préserve les tissus mous et contribue à l’aspect naturel de la restauration prothétique ». Les présentations et publications de ce type sont très nombreuses. Leurs conclusions vont dans le sens « du sentiment général ». Cette année encore, le congrès de l’E.A.O a présenté des conclusions similaires. Toutefois, les conférenciers sont plus prudents et dans leurs conclusions, ils recommandent volontiers des études sur du plus long terme.**Cependant**L’Academy of Osseointegration, lors de sa dernière conférence de consensus a réuni un panel d’experts scientifiques répondant à des questions pré-définies et s’appuyant sur des méta-analyses. Leurs conclusions ont été publiées dans le JOMI de juin 2007 : « de futures études sur le sujet sont nécessaires ».Cette académie ne se prononce pas pour une implantologie immédiate ou différée. Elle demande aux cliniciens de bien étudier le bio-type des tissus environnants. Elle indique que « sans précaution, cela peut conduire à des parties de métal apparent ».Elle précise ce qui est établi : « la résorption de la crête alvéolaire ne peut-être prévenue par l’implantation immédiate et il est plus prudent d’attendre la cicatrisation des tissus mous ».Elle conseille : « les greffes de tissus mous et/ou durs avant ou pendant l’implantation immédiate peuvent contribuer à compenser cette résorption de la crête et améliorer les futurs résultats esthétiques ».Elle conclue : « les cliniciens doivent bien considérer et analyser les possibles bénéfices ou inconvénients d’une implantation immédiate dans la stabilité des résultats fonctionnels et esthétiques ».Est-ce pour cela que les conclusions de l’étude récente d’Evans et Chen (2008) vont dans ce sens ? « Des études prospectives à long terme sur la stabilité des tissus et des résultats esthétiques sont nécessaires ». Le sujet n’est pourtant pas nouveau !La réussite et la prédictibilité d’un traitement implantaire commencent par l’analyse locale et systématique des risques déjà rapportés.**Illustration : à propos de 2 cas cliniques**Une femme de 35 ans avec une alvéole de 21 cicatrisée (Fig. 4 à 9) sera traitée avec une greffe autogène d’origine ramique. A 4 mois, un implant Progress (TEKKA) est inséré dans le site, associé à un lambeau conjonctif pédiculé au cours de la même séance. La greffe conjonctive devrait être un acte complémentaire fréquent dans les situations antérieures. C’est une manipulation de tissu facile, rapide et sans risque. Les avantages sont connus de tous.La dent provisoire et sa céramique en zircone seront réalisées après 6 mois de mise en nourrice de la fixture, sur un faux moignon droit usiné en titane.http://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./ex1.jpgPour le 2ème cas, une jeune femme de 25 ans présente une atteinte carieuse très importante de l’incisive centrale supérieure droite (Fig. 10a et b). L’option thérapeutique retenue sera l’extraction, l’implantation et la mise en charge immédiate. L’aspect des tissus est favorable (Fig. 10a), la paroi vestibulaire reste néanmoins très fine (Fig. 1).http://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./ex2.jpgUne légère concavité peut-être remarquée dès le 3ème mois post-opératoire (Fig. 11e). Elle est liée à une différence de diamètre inévitable entre la dent naturelle et l’implant. Cette évolution de la paroi vestibulaire ne peut pas être compensée complètement par la réduction du « gap » à l’aide des copeaux d’os autogène.A un an, le cas se comporte bien, malgré une inflammation gingivale (Fig. 11h et i) et la perte du pic osseux de ce même côté (Fig. 11f). On peut remarquer la présence de plaque dentaire, notamment en interdentaire.http://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./ex3.jpgCette zone reste la plus délicate à entretenir. Elle est la plus importante dans le maintien de la papille responsable de l’aspect festonné naturel du sourire. Cette patiente est jeune et en bonne santé, mais qu’adviendra-t-il de ce tissu gingival, peu soutenu ?La vulnérabilité de l’herméticité trans-gingivale des tissus mous péri-implantaires est étroitement liée au rôle critique de l’hygiène bucco-dentaire, pour assurer le succès à long terme de la restauration prothétique. Nous ne maîtrisons ni le maintien de l’hygiène des patients dans le temps (malgré les rappels de motivation au brossage), ni la santé de l’hôte. Dans le doute, ne devons nous pas nous prémunir de ce genre d’aléas ? Et ce, d’autant plus que la correction par des techniques de chirurgie plastique parodontale est plus délicate. Ces greffes ne pourront pas bénéficier du même apport en vaisseaux et cellules réparatrices que pour les dents naturelles.**Discussion**Quelle attitude devons-nous adopter ?Comme nous l’avons vu, l’environnement péri-implantaire au niveau des tissus mous procure une herméticité trans-gingivale relative contre les irritants bactériens. La stabilité structurelle est plus fragile. L’implant est moins résistant que la dent naturelle aux agressions mécaniques et bactériennes. Quand l’esthétique doit être prise en compte, ces différences structurelles peuvent compter. Les complications tissulaires liées à ces agressions risquent, à terme, d’entamer la satisfaction du patient vis-à-vis de la restauration implanto-prothétique. Nous n’avons pas le droit à la rétraction gingivale.Le clinicien doit se servir de ses connaissances, analyser l’environnement gingival et osseux, notamment la paroi vestibulaire et le niveau osseux des dents adjacentes. En cas de perte, il doit s’assurer de l’éventuelle présence du périodonte, important pourvoyeur de cellules régénératrices.Le clinicien ne doit se fier qu’à son analyse critique des informations diffusées dans les publications médicales : le « niveau de preuve » n’est pas toujours au rendez-vous et il influence le lecteur dans sa pratique médicale.La qualité et la pertinence des publications sont variables (les résultats négatifs sont rarement rendus publics).A nous d’adopter la lecture critique, c’est-à-dire, de juger de la valeur d’une publication et d’en apprécier le niveau de preuve.Le témoignage du Dr Yves Samama dans la revue Titane (mars 2008) abonde dans ce sens : « souvent, seules les études positives donnent lieu à publication… le problème de l’objectivité de certaines publications au sein de la recherche biomédicale doivent faire l’objet de notre réflexion ». L’éditorial de la revue « Implant » du mois d’août 2008 évoque le même sentiment.Le praticien sera le seul responsable de ses actes et de la pérennité des résultats obtenus.La pose et la dépose des piliers provisoires, l’empreinte de l’implant, la dent provisoire peuvent engendrer une perturbation de la fonction d’herméticité de la zone conjonctive et de son épithélium de recouvrement. Au delà de 5 « aller-retour », les fibres de Scharpey circulaires se délitent et l’épithélium de jonction plonge dans cet espace libéré.http://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./focus-clinic--edentation-gestion-tissus-et-implant.-4_10.jpgLa simulation et l’assistance de la pose avec ordinateur ne pourront changer ni anticiper le pouvoir de cicatrisation des tissus, et encore moins optimiser la position du col de l’implant qui entre pour beaucoup dans les condi- tions d’équilibre et de maintien du niveau gingival. On peut également se tourner vers des techniques de préservation du volume osseux par la pose de membrane.Lors de l’extraction, on peut lever un lambeau de pleine épaisseur et augmenter le volume de la crête en utilisant l’implant comme fixateur crestal d’une membrane, permettant le maintien des copeaux osseux prélevés au safescraper (Fig. 12 a et b).Pour certains cas, une greffe d’os autogène est placée en vestibulaire de l’implant placé immédiatement dans l’alvéole. Selon l’étude récente d’Abrahamsson et Berglundh (juillet 2008, précédée par des publications de 1998, 2003), l’utilisation d’un faux moignon en titane usiné ou en zircone garantit la meilleure cicatrisation des tissus mous.http://www.lefildentaire.com/images/stories/articles2/focus-clinic--edentation-gestion-tissus-et-implant./focus-clinic--edentation-gestion-tissus-et-implant.-4_11.jpgEnfin, la dent provisoire peut guider la cicatrisation mais elle ne doit pas être compressive. Un blanchiment de plus de 5 minutes, signe une ischémie irréversible des quelques millimètres de la gencive la plus importante, celle bordant le col d’implant.**Conclusion**Comment peut-on obtenir les 2 mm d’os nécessaire, en vestibulaire de l’implant à partir de la Fig. 1b ? Il semblerait que la voie la plus fiable, celle capable de fournir de l’os en quantité soit la plus difficile (cicatrisation et préparation du site par R.O.G, greffe osseuse et/ou de tissus mous).L’extraction orthodontique (environ 2 à 3 mois) reste une option pour amener les pics osseux responsables de la présence des papilles en direction coronaire. Les concepts du platform-switching et du cône-morse sont des pistes intéressantes.Selon Dennis Tarnow, le futur passera par notre capacité à récupérer les cellules contenues dans l’alvéole pour en obtenir, en culture, un cément qui sera ensuite placé autour du col de l’implant.Pour Jan Lindhe, les bêta-TCP placées dans le hiatus pourraient modifier la résorption osseuse (« nous travaillons sur ce sujet à l’heure actuelle »).Il faut observer le biotype des tissus environnants et ne pas hésiter à les renforcer si nécessaire.L’implantologie n’impose pas de se passer de sa propre expérience, ni d’oublier certains acquis universellement admis par la profession.**Bibliographie**1. Sculte W, Klelneikenscheldt H, Linder K, Schareyka R. The Tubigen immediate implant in clinical studies. Deutsche Zahnärzt Zeitschrift, 1978; 5; 348-359.2. Polyzois I, Renvert S, Bosshardt DD, Lang NP, Claffey N. 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| **Buccal bone loss after immediate implantation can be reduced by the flapless approach** |
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| **Abstract:**  Aim The aim of this study was to evaluate the buccal bone remodeling after immediate implantation with flap or flapless approach. Material and Methods The mandibular bilateral premolars of 3 dogs were extracted and immediately three implants were placed in both hemi-arches of each dog. Randomly, one hemi-arch was treated with the flapless approach, while in the contra lateral hemi-arch tooth extractions and implant placement were done after mucoperiosteal flap elevation. Non-submerged healing of 12 weeks was provided for both groups. Histomorphometric analysis was done to compare buccal and lingual bone height loss, bone density and bone-to-implant contact in the groups. Fluorescence analysis was performed to investigate the dynamic of bone remodeling in the different groups. Results There was a significant association between the surgical flap and the extent of bone resorption around immediate implants. The loss of buccal bone height was significantly lower in the flapless group when compared to the flap group (0.98 mm x 2.14 mm, respectively, p<0.05). The coronal and apical buccal bone densities of the flap group were significantly higher when compared to the lingual components, showing anatomical differences between the bone plates. Fluorescence analysis showed no major differences in bone healing between the flap and flapless groups, supporting that the higher loss of buccal bone height is linked to the anatomic characteristics of this plate and to the negative influence of the detachment of the periosteum in immediate implant therapy. Conclusion The flapless approach for immediate post-extraction implants reduces the buccal bone height loss.  |
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**THE COMPARISON BETWEEN FLAPLESS AND FULL-THICKNESS FLAP TECHNIQUES**

**THE EFFECT OF DIFFERENT FLAP TECHNIQUES ON CRESTAL BONE RESORPTION AND IMPLANT STABILITY**

**flap text of the book**

Minimal invasive flap(flapless)technique appeared from the concept of periosteum preservation during implant placement was documented by many surgeons which this technique achieved their demands.When this technique was compared with conventional flap of their effect on bone resorption and remodeling around the implant, there was a controversy in the results due to different experimental conditions.The aim of this study was to compare the effect of flapless and full-thickness flap on crestal bone resorption and implant stability.Eleven implants were placed by flapless and also eleven implants were placed by full-thickness flap in split mouth design.Radiograph was taken and resonance frequency analysis (RFA) was done at implant placement at 6-week and 12-week intervals. Data was entered into SPSS software and analyzed using Wilcoxon Signed Ranks test.Results revealed no significant difference in crestal bone resorption and implant stability between both flaps at 6-week and 12-week intervals. In conclusion,results showed that crestal bone resorption and implant stability were not affected by periosteum disruption or preservation.

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Clinical

**Flapless Dental Implant Placement**

**Dennis Flanagan, DDS**

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| **Abstract** |

Flapless dental implant placement is possible in selected patients but limited to those sites with adequate or augmentable attached gingiva and available bone volume and density. Inadequate attached gingiva, available bone, and bone density may be augmented by pre-, intra-, or postoperative procedures. Bone ridge contour can be approximated by using a described fast set polyvinyl siloxane site evaluation technique. Assuming adequate length and height, a bone width of 5 mm is usually acceptable for standard diameter implants (3.5–4.2 mm). However, implant placement in sites with parabolic shaped ridges may need to be placed deeper to avoid vertical bone loss and implant thread exposure. Inadequate bone volume, less than 5 mm of bone width, may be developed by ridge expansion (split ridge) techniques. With ridge expansion, complications may arise such as malposition and labyrinthine concussion. Malposition may be corrected intraoperatively or grafted for a later implant placement. Labyrinthine concussion is usually of short duration but may be treated with head maneuvers. Sites with 2 mm or less width of available bone may not be treated flaplessly and may be more appropriately treated with extracortical augmentation grafting.

Keywords: [dental implant](http://www.joionline.org/action/doSearch?action=runSearch&type=advanced&result=true&prevSearch=keywordsfield%3A%28%22dental%20implant%22%29), [flapless surgery](http://www.joionline.org/action/doSearch?action=runSearch&type=advanced&result=true&prevSearch=keywordsfield%3A%28%22flapless%20surgery%22%29), [bone expansion](http://www.joionline.org/action/doSearch?action=runSearch&type=advanced&result=true&prevSearch=keywordsfield%3A%28%22bone%20expansion%22%29), [site evaluation](http://www.joionline.org/action/doSearch?action=runSearch&type=advanced&result=true&prevSearch=keywordsfield%3A%28%22site%20evaluation%22%29), [bone deformation](http://www.joionline.org/action/doSearch?action=runSearch&type=advanced&result=true&prevSearch=keywordsfield%3A%28%22bone%20deformation%22%29)

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| **Introduction** |

When dental implants are placed by raising a surgical mucoperiosteal flap, there is an associated slight bone loss at the site. Scarring and other complications are of concern. In the esthetic zone these may lead to an unsatisfactory outcome.1,2 Placing implants by using a flapless or envelope incision may eliminate some of these concerns. However, the true quality and quantity of bone underlying the mucogingival covering cannot be directly observed.3 Plane film radiographs can depict some information about the bone site but there is no 3-dimensional information as to actual bone contour or quality. Computerized tomogram radiographic (CT) scans depict bone contour and density (Hounsfield units) but these may be expensive and impractical for single or small sites.4

Flapless implant placement involves recognition by the surgeon of the pitfalls and caveats of the technique. The topography of the underlying available bone is key information in the decision for a flapless procedure. An appropriate site requires 5 mm of facial-lingual width and 7 mm of mesiodistal length. These dimensions allow a standard-sized diameter (3.5–4.2 mm) root form screw type or press fit implant to be placed with adequate bone housing and implant-dental spacing. The vertical platform position should be 2 to 4 mm apical to the adjacent proximal cemento-enamel junction.5

Very small diameter (1.8 mm, mini) implants may be placed flaplessly but a denser quality of bone may be necessary for implant stability as well as an adequate zone of attached gingiva for protection of the implant epithelial coronal attachment.

Sites that are narrow in length can be obviously seen and corrected by orthodontic movement or extraction of imposing teeth. However, a narrow bone ridge width may be obscured. A thick epithelium and submucosa may hide a narrow atrophic ridge, a poorly healed extraction site, or even a nonexisting bone ridge. The implant surgeon must be circumspect. The flapless approach may be less traumatic and time consuming, have fewer complications and faster soft tissue healing, and be restoratively appropriate when compared to an open flap approach.

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| **Patient Selection** |

Some authors believe that there are no absolute contraindications for dental implant treatment.6,7 Most dental implant patients are classified in the American Society of Anesthesiologists (ASA) class I, II, and some in III. These patients are healthy or have medically controlled mild diseases. Smokers and patients with interleukin (IL)-1 cytokine (IL-1 genotype polymorphism) expression may be at higher risk of implant failure to osseointegrate.8 However, there is recent evidence that IL-2 (T-330G) and IL-6 (G-174C) genes are not associated with early implant failure so that these single polymorphisms are not a genetic risk factor.9 Patients with a history of vertigo may need surgical caution for an osteotome procedure.10 Patient expectations should be discussed. The patient needs to understand and accept the procedures, proposed outcome, and the possibility of complications. The patient should be appropriate for implant surgical and prosthetic procedures.

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| **Site Selection** |

Important proximate anatomical structures may need to be avoided or surgically repositioned when considering an appropriate site. An antrum lining may need elevation and bone grafting when there is bone less than 10 mm between the antrum and ridge crest. The implant may be placed flaplessly, concomitantly, with adequate stability. These sites may be pre- or intraoperatively augmented via flapless crestal osteotome or flapped lateral approach bone grafting technique.

The length and width of the site should be adequate to accommodate an appropriately sized implant. The bone height should be adequate to contain the implant or be readily augmented and have a margin of safety from anatomical structures such as a neurovascular bundle. In addition to adequate height and length the flapless approach requires a site that has certain other attributes. The attached gingiva should be at least 4 mm from the proposed free gingival margin to the mucogingival junction. However, a site lacking adequate attached gingiva may be augmented intra- or postoperatively. The bone should be of adequate density to support initial implant immobility. Assuming adequate length and height, three classifications of bone sites are suggested: Class 1 bone, with bone crest width greater than 5 mm, can accept an implant with little or no alteration or development; Class 2 bone, with bone crest width 2 to 5 mm, would need site development in the form of a flapless ridge expansion (split ridge) or extracortical augmentation and thus not flapless; Class 3 bone, with bone crest width less than 2 mm, would probably not be appropriate for a flapless procedure without site development by extracortical ridge augmentation, such as particulate or block grafting. Sites with lengths less than 7 mm may force the surgeon to make an envelope incision that includes the adjacent gingival papilla. This may induce scarring that may compromise the esthetic papillary result. Any hopeless or poor prognosis teeth (bone loss greater than 50%) may be extracted before implant placement to prevent midtreatment plan changes in implant distribution or prosthetic design.

Adjacent periodontal gingival architecture may influence implant positioning. Thick or thin gingival architecture may need to be considered in implant positioning. Sites with thin architecture may be more sensitive to implant positioning in that there may be no leeway for error or range of positioning.

Opposing occlusion should be examined and an occlusal scheme determined that is appropriate for the final restoration. It is understood that teeth intrude under occlusal forces more than osseointegrated implants. This discrepancy needs to be considered so that the supporting implant or implants do not bear the full occlusal load. Occlusal force has been recorded greater than 1000 N.11 It may be that if an implant does indeed bear an occlusal force as much as 1000 N, it may luxate and may produce microhemorrhage, fibrosis, and implant failure.12 Parafunctional conditions may need to be taken into account or avoided in development of the occlusal scheme. Interocclusal spacing should be adequate and may influence the choice of a screw versus a cement-retained prosthesis. Access for oral hygiene should be included in the prosthetic design.

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| **Site Evaluation Technique** |

A technique by Flanagan13 to reveal the underlying bone contour is briefly described as follows. First a fast set polyvinyl siloxane (Blu-Mousse, Parkell, Farmingdale, NY) is used to make a dual arch impression of the site (Figure 1). The impression mass is removed and the site length is measured (Figure 2). The impression mass is then bisected faciolingually with a laboratory Bard-Parker knife to give two arch forms of the proposed site (Figure 3). The gingival interocclusal space is measured and will be added to the gingival thickness to give the bone opposing dentition distance (which should be at least 5 mm to allow a cemented type restoration) (Figure 4). The arch form is then traced on paper (in the patient's record), which is in fact, the gingival contour of the site (Figure 5). Then, bone sounding is done to find the overlying gingival thickness (Figure 6). These measurements are noted and recorded as points on the tracing (Figure 7). So, each recorded measurement is noted as a point under the arch tracing. The points are then connected to give another form which is an approximation of the underlying bone contour (Figure 7). The faciolingual bone dimension can now be measured on the tracing to give the surgeon information as to appropriate implant sizing diameter. A too-large diameter implant or too thin of a ridge may produce a dehiscence (Figure 8). The 5-mm level is the depth to which the implant should be placed to avoid subsequent exposure of the implant threads due to resorption of thin bone (Figure 9). A 1.4-mm osseous gap may be produced from resorption of thin bone.14

Implant companies have transparencies that depict their array of available implants. The transparency can be placed over the tracing to ascertain which implant size is most appropriate for the bone site. Dehiscences, fenestrations, and a range of positions can be predicted and planned for in the treatment (Figure 8). Osteotomies can be avoided that produce thin facial and/or lingual cortices that may resorb and expose the implant threads.

Sites that accept multiple implant placements may have computerized tomography (SimPlant, Columbia Scientific, Columbia, Md) to reveal bone dimensions and quality (Hounsfield units) that can facilitate and expedite the operative procedure. A diagnostic wax-up of the proposed final restoration may be important for a successful outcome.

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| **Surgical Guide** |

Even in small sites, especially in the esthetic zone or in access-difficult sites, a surgical guide can be important for proper implant placement for an esthetic and functional restoration. In the esthetic zone an implant that is as little as 0.5 mm askew may result in a compromised outcome. A simple vacuum-formed guide may insure appropriate implant positioning.

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| **Site Bone Widths 5 mm or Greater** |

These sites with 5 mm of faciolingual bone width or greater usually require little or no site development (Table 1). A small envelope incision or tissue punch can be made to expose the bone for the osteotomy. The appropriate drills are used to create an osteotomy that accepts the appropriate implant. Primary closure is not required for osseointegration to occur. However, initial implant immobility is required. An insertion torque of 35 to 45 Ncm is desirable.

Even with adequate bone at the crest there may be a facial undercut of bone that can produce an implant fenestration, which may be augmented intraoperatively. The undercut may be demonstrated by the aforementioned bone sounding tracing technique. Additionally, during the osteotomy, by placing the thumb and forefinger on the facial and lingual cortices the surgeon may be able to sense the spinning drill that may indicate a cortical fenestration or dehiscence. Adequate attached gingiva may be required for a successful long-term restorative outcome. At least 4 mm of preoperative attached gingiva is needed to support the percutaneous implant, to help prevent a coronal peri-implantitis that may lead to an implant failure. Gingival augmentation can be accomplished by free gingival, pedicle, or acellular dermal grafting. Inadequate bone density may be addressed by compressing bone of the osteotomy with osteotomes for better implant stability. Press fit implants may enjoy an advantage in osteotome-compressed less dense bone sites. Alternatively, these sites may be grafted to increase bone quantity for later site condensation and implant placement.

When placing implants into ridges that appear to be 5 mm near the crest, it may be important to place the implant deeper than the perceived bone crest. This caveat should be heeded in parabolic shaped ridges. The site evaluation technique as previously described can reveal such a ridge contour (Figure 9). An implant placed in a parabolic site will be encased in very thin bone at the collar. This thin bone is very susceptible to resorption which may expose the implant threads. Bone resorption may cause a circumferential 1.4-mm gap at the implant collar and subsequent vertical bone loss thus exposing the implant threads.

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| **Sites 2 to 5 mm of Bone Width** |

Ridge expansion or split ridge techniques can be employed to increase the available bone in sites less than 5 mm in width.15,16 Sites 4 to 5 mm in width can be treated as deemed appropriate by the surgeon. The ridge is surgically split, separated, and then apically drilled to accept an implant. The split produces two cortices that provide facial and lingual bone walls that are conducive for bone repair and osteogenesis in the created gap. These walls contain viable osteocytes with a blood supply. Ridge expansion should only be attempted by experienced implant surgeons.

The crest of the ridge is found by first making the envelope incision and then undermining the facial and lingual edges with the tip of the scalpel (#15) to sense the crest in the “mind's eye” of the surgeon (Figure 10). Once the bone crest has been ascertained, the crest is scored with the scalpel. The scalpel is then carefully and gently malleted into the crest, taking care to keep the blade between the cortices. The blade is taken to the hilt. The blade is removed by moving it mesiodistally only. Moving the blade faciolingually will likely cause it to fracture. If fracture does occur, the remaining blade fragment can be removed with a mosquito hemostat or Steiglitz forceps, failing that, cortical bone may be removed with a very small bur (#330 SS White) to access a purchase. Next, a small channel former (Sun Coast, St Petersburg, Fla) or DF osteotome (D. Flanagan, Willimantic, Conn) is placed in the slot created by the scalpel blade and gently and carefully malleted into the bone to enlarge the slot and deform the facial cortical bone toward the facial (Figure 11).17 This deformation should be made in the crest portion of the bone. It does not need to progress into the deeper areas of the bone. Only the coronal of the narrow ridge needs to be split and deflected to the facial. The site is now ready for the conventional implant drilling sequence and implant installation (Figures 12–14). Thin facial and lingual cortices may result in thinner ridges. The selected implant may need to be set deeper than usual to compensate for any resorption of thin bone that may occur (Figure 9). Less dense bone may require grafting and subsequent implant placement.

This technique is better suited for bone densities of the type D-II, -III, and -IV (Misch). Type D-I (Misch) bone density may preclude a flapless ridge expansion. The trauma induced during a ridge expansion of this very dense bone, especially in difficult access and posterior locations may result in bone damage or excessive patient trauma. Site development may be necessary here. Patients may require sedation for this procedure.18

Ridge expansion takes advantage of the sacrificial bonds peculiar to the collagen polymer that comprises the organic portion of bone. The collagen polymer has atomic bonds that are located within and between the main collagen chain that break under force but allow the main backbone of the polymer to remain intact.19,20 This quality gives bone toughness under deformation. This ability to withstand some deformation without complete fracture (greenstick fracture) allows the ridge expansion technique. In the flapless technique, the periosteum is intact and thus contains the bone and provides a blood supply for healing. Interestingly, the periosteal blood supply to the mandible is more important in the anterior while the osseous supply from the inferior alveolar artery is more important distal to the mental foramen. Additionally, the palatal and lingual cortices are generally thicker and more resistant to deformation than the facial cortices thus providing bracing for the facial cortical deformation (Richard Metszler, PhD, written communication, September 24, 2005).

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| **Sites of 2 mm or Less Bone Width** |

Theoretically, a 2-mm-wide bone width can be expanded to accept an implant. However, this thin bone may be subject to postoperative resorption at the crest that can compromise the restoration and the implant. Ridge expansion of a 2-mm-wide ridge can be difficult at best because it is usually comprised of only cortical bone. Theoretically, a narrow site may be split and expanded but practically these sites are difficult to treat with the presently available instrumentation. These narrow sites can be dense cortical bone that do not section easily. These thin bone sites may be best extracortically augmented with a flap procedure.

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| **Flapless Ridge Expansion for Multiple Implant Placements** |

The same principles apply to single placement as to multiple placements (Figure 15). However, issues of morbidity and esthetics may arise.14,21 An interimplant space of 3 mm should be considered for bone blood supply and to minimize crest resorption. The larger operative site may expose the hard and soft tissue to more trauma and bacterial invasion. Controlling and managing the hard and soft tissue may be more difficult. Implant positioning may be difficult to control and the surgeon must be diligent. Additionally, bone graft material may be needed to fill gaps larger than 1.5 mm between implants.

The problem of lip support may need to be addressed with long span sites. Traumatic bone loss or resorption over time may eliminate osseous volume that maintains the lips in the facial contour. This may need to be replaced in the prosthetic design.

Very small diameter (1.8-mm) implants may be placed flaplessly. These implants may be used in more dense bone and in tandem for prosthetic support (Figures 16 and 17).

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| **Complications** |

Infection is unusual and may be controlled by use of antibiotics and local debridement or implant removal.

Malposition of the implant may not be compatible with a successful prosthetic outcome. Steps should be taken to insure appropriate implant placement for a functional and esthetic result. Intraoperative repositioning of the scalpel, osteotome, or implant may be easier during surgery than later dealing with the result. Alternatively, if the malposition is too great, grafting, healing, and a later re-entry may be appropriate.

Benign positional vertigo may occur in patients subjected to osteotome ridge expansion.10 The force of the surgical mallet may induce a dislodgement of labyrinthine otoliths producing a feeling of vertigo in the patient during head-turning movements. This condition is usually self limiting or may be treated by head maneuvers to reposition the otoliths.

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| **Conclusions** |

Patient and site selection are primary concerns for flapless implant surgery. There is a technique available using a fast set polyvinyl siloxane material for revealing the approximate contour of the underlying bone of a proposed implant site. Assuming appropriate length and height of a proposed implant site, the suggested criteria for flapless implant placement are an appropriate patient, adequate or expandable bone width (ridge expansion, split ridge), adequate or augmentable attached gingiva, and adequate or condensable bone density for implant immobility (osteotome compression).

These criteria may be necessary for a successful flapless approach. A flapless approach can be less traumatic and time consuming, have fewer complications and faster soft tissue healing, and be esthetically and restoratively appropriate. The armamentarium for flapless implant placement can include osteotomes in sites where the bone width is less than 5 mm or in sites where there is less bone density. Careful directing of the scalpels and osteotomes should be observed to prevent malposition of the implant. Surgical guides are very useful for implant positioning. There are proposed three classes of sites based on assumed adequate length and height: Class 1, ridge width of 5 mm or more; Class 2, ridge width of 2 to 5 mm; and Class 3, ridge width of 2 mm or less. Optimal sites have at least 5 mm of bone width and adequate length and height, bone density, and attached gingiva. Implants may need to be placed slightly deeper in sites with parabolic shaped ridges to avoid crestal bone loss and subsequent implant thread exposure. Sites that are 2 to 5 mm wide that have less dense bone and/or inadequate attached gingiva that may be correctable or augmented can be considered for flapless implant placement. Bone widths of 2 mm or less may not be appropriate for a flapless approach and require open flap augmentation or site development. Single and multiple sites can be treated flaplessly. Infection is unusual but may be controlled with antibiotic coverage, debridement, or implant removal. Labyrinthine concussion can be a postoperative complication of osteotome use.

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