

REFEREED ARTICLE

IMMEDIATE PLACEMENT OF OSSEOINTEGRATED DENTAL IMPLANTS INTO EXTRACTION SOCKETS: ADVANTAGES AND CASE REPORTS

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INTRODUCTION

OSSEOINTEGRATED DENTAL IMPLANTS HAVE PROVEN TO BE PREDICTABLY SUCCESSFUL WHEN APPROPRIATE GUIDELINES ARE FOLLOWED.¹ THE TECHNIQUE AS OUTLINED BY BRÄNEMARK INCLUDES A POST-EXTRACTION PERIOD OF UP TO 12 MONTHS IN ORDER TO ALLOW FOR BONE HEALING.² THIS DELAY, COMBINED WITH RIDGE RESORPTION FOLLOWING EXTRACTION, MAY CONTRIBUTE TO SEVERAL PROBLEMS. INSUFFICIENT AVAILABLE BONE FOR IDEAL IMPLANT PLACEMENT AND PROLONGED TREATMENT TIME ARE TWO COMMON DIFFICULTIES. RECENTLY, SEVERAL INVESTIGATORS³⁻¹⁰ HAVE REPORTED IMMEDIATE PLACEMENT OF DENTAL IMPLANTS INTO EXTRACTION SOCKETS ACHIEVING EXCELLENT RESULTS WHILE, AT THE SAME TIME, MINIMIZING OR ELIMINATING THE ABOVE-MENTIONED DIFFICULTIES. THIS PAPER WILL DISCUSS THE TECHNIQUE OF IMMEDIATE PLACEMENT OF OSSEOINTEGRATED DENTAL IMPLANTS INTO EXTRACTION SOCKETS AND ITS POTENTIAL ADVANTAGES. A FUTURE ARTICLE WILL DETAIL SURGICALLY-RELATED DIFFICULTIES WITH THIS TECHNIQUE.

PROBLEMS ASSOCIATED WITH RIDGE RESORPTION

Following tooth extraction, the socket undergoes bone healing and maturation. In the maxilla, this process is usually accompanied by ridge resorption in a palatal and

apical direction. Complete bony healing of the extraction socket may take six months or more. This delay adds substantially to the treatment time and can represent a significant inconvenience for the patient. The post-extraction resorption may eliminate or reduce

the number and/or size of fixtures that could be placed, or compromise the positioning of the fixtures. Moreover, development of an undercut in the vestibular aspect of the ridge will create an esthetic problem, possibly requiring the incorporation of a prosthetic flange or surgical ridge augmentation. In addition, advanced resorption of the ridge will force the surgeon to place the fixtures in a more palatal position relative to the natural teeth they replace. This problem might be alleviated if ridge-lap designs were incorporated into the prosthesis. However, as a result, oral hygiene procedures would be made more difficult. If the ridge resorption pattern resulted in an unfavourable ridge angulation (i.e. in the sagittal plane), the implant might also have to be placed at an unfavourable angle. In the maxilla, this would usually result in emergence of the implant with an accentuated buccal inclination. This in turn would result in the non-axial direction of occlusal forces as well as creating other prosthetic difficulties. For example, the fixation screw would emerge on the labial aspect of the prosthetic teeth, an obvious esthetic impairment and,

in most instances, the restorative dentist can deal with angulation problems by incorporating specially-designed abutments and supra-structures. The potential difficulties associated with unfavourable placement of implants in ridges with advanced resorption are summarized in Table 1.

ADVANTAGES OF IMMEDIATE IMPLANT PLACEMENT INTO EXTRACTION SOCKETS

The elimination of the post-extraction healing period and reduction of the number of surgical sessions are obvious advantages to the patient (and to the dentist). An additional significant advantage is improved preservation of the alveolar width and height. The experience of this author, based on a relatively small number of cases, confirms that most of the height and width of bone can be preserved and this gives the surgical specialist the choice to prevent the difficulties outlined in Table 1. A further advantage is that the extraction socket as a recipient site offers excellent landmarks for reference during the surgery relative to the pertinent anatomical structures. The advantages of immediate placement of osseointegrated dental implants into extraction sockets are summarized in Table 2.

CLINICAL CATEGORIES — PROTOCOLS

Specific prerequisites when the immediate placement technique is planned are: a) patient to be informed about the "newer" nature of this technique; b) the presence of sufficient bone surrounding the extraction socket to allow adequate initial implant stabilization; c) lack of gross periapical and/or periodontal pathosis, and d) atraumatic extraction. Clinical situations can generally be placed in one of two categories.

TABLE I POTENTIAL DIFFICULTIES ENCOUNTERED DURING PLACEMENT OF IMPLANTS IN SEVERELY RESORBED RIDGES

- a) insufficient bone for implant placement
- b) shorter and/or narrower implant(s) must be placed
- c) unfavourable inclination of residual ridge resulting in poor implant alignment leading to:
 - non-axially directed occlusal forces
 - complex prosthetics
 - compromised esthetics



FIG. 1 INITIAL RADIOGRAPHIC VIEW OF A MAXILLARY CENTRAL INCISOR WITH ADVANCED BONE LOSS. NOTE THE PROXIMITY OF THE ANTRUM TO THE APEX OF THE LATERAL INCISOR.



FIG. 2 AFTER PLACEMENT OF A 16 MM SCREW-VENT™ HEALED SITE) AND A 13 MM SCREW-VENT™ (FRESH EXTRACTION SITE) TO ALLOW SEVERAL MM OF COUNTERSINKING BELOW THE BONY CREST.



FIG. 3 OCCLUSAL VIEW OF FIXTURES WITH SURGICAL COVER INSERTS. NOTE THE SUB-CRESTAL POSITION OF THE FIXTURE IN THE EXTRACTION SITE.

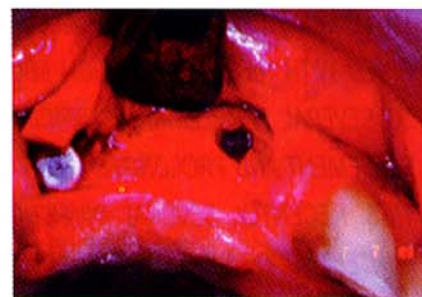


FIG. 4 OCCLUSAL VIEW OF THE RE-ENTRY PROCEDURE SIX MONTHS AFTER INITIAL PLACEMENT. NOTE THE BONE FILL IN THE EXTRACTION SITE AND THE NEW BONE COVERING THE INSERT.

TABLE II ADVANTAGES OF IMMEDIATE PLACEMENT OF OSSEOINTEGRATED DENTAL IMPLANTS INTO EXTRACTION SOCKETS

- a) elimination of the post-extraction healing period
- b) reduction of the number of surgical sessions
- c) preservation of alveolar height and width
- d) potential for more implant support (i.e. a combination of more, wider and/or longer implants)
- e) lower risk of dehiscences and/or fenestrations around implants
- f) better angulation leading to improved esthetics and axial occlusal loading
- g) improved surgical orientation relative to pertinent anatomical structures

CASE II

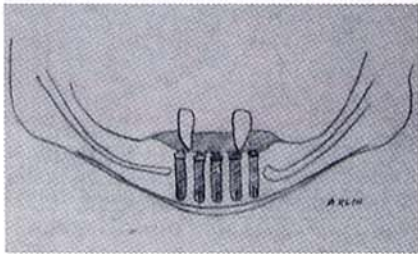


FIG. 5 DIAGRAM OUTLINING ANTICIPATED OSTEOPLASTY (SHADED AREA) AND FIXTURE PLACEMENT. THIS CASE IS CHARACTERIZED BY A NARROW MANDIBULAR RIDGE AND PERIODONTALLY HOPELESS CUSPIDS.

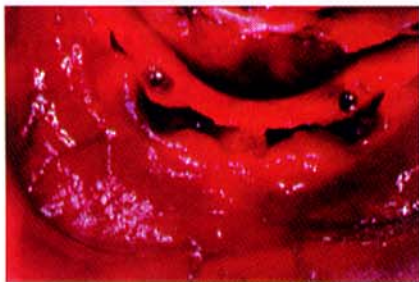


FIG. 6 OCCLUSAL VIEW IMMEDIATELY AFTER EXTRACTION. OSTEOPLASTY WILL ESTABLISH ADEQUATE RIDGE WIDTH AND AT THE SAME TIME ELIMINATE THE EXTRACTION SOCKETS.



FIG. 7 OCCLUSAL VIEW IMMEDIATELY AFTER PLACEMENT OF FIVE (18 MM LENGTH) BRANEMARK FIXTURES. NOTE THAT RIDGE OSTEOPLASTY HAS TO BE CARRIED OUT PRIOR TO FIXTURE PLACEMENT IN ORDER TO ACHIEVE AN OSSEOUS CREST TABLE WIDTH OF AT LEAST 5 MM.



FIG. 8 OCCLUSAL VIEW OF THE FINAL "FIXED-DETACHABLE" PROSTHESIS. NOTE THAT THE BILATERAL CANTILEVERS PROVIDE A FIRST MOLAR OCCLUSION.

CATEGORY ONE: Nearly all of the surface area of the implant is in intimate contact with vital bone.

CATEGORY TWO: There is lack of intimate contact with vital bone on a significant portion of the implant.

Most commonly, the tip of the implant will extend beyond the apex of the extraction socket providing adequate stabilization, while the coronal aspect of the implant may be submerged only slightly apical below the rest of the extraction socket. In this second category, a significant void will exist between the implant and the surrounding walls of the extraction socket. This void is present because the diameter of the root in the coronal third is substantially larger than the diameter of most "root form" or cylindrical endosseous implants.

CATEGORY ONE — IMPLANT IS ALMOST TOTALLY ENCASED IN VITAL BONE

There are three clinical situations in this category. The first situation is where the implant is purposely submerged or countersunk until the coronal aspect of the implant binds in the apical aspect of the extraction socket. In this way, the implant will end up apically to the osseous crest. A minimal void may exist between the coronal aspect of the implant and vital bone. In this type of situation, clinical experience indicates predictable osseointegration and bone may grow over the implant. (See literature review and case reports later in this article.)

In the second situation the surgical specialist carries out osteoplasty or ridge reduction (prior to implant placement) to a level at — or close to — the apices of the sockets. The implants are then placed in the conventional manner. One might hypothesize that the osteoplasty is accomplishing the natural process of post-extraction ridge resorption at an accelerated pace, i.e. minutes vs months. This situation is not really signifi-

cantly different from the clinical situation that arises when a narrow edentulous ridge is encountered. In order to achieve the minimum required ridge width for "root form" or cylindrical osseointegrated implants (5-6mm), narrow ridges that diverge apically must be subjected to similar ridge reduction or osteoplasty. Although ridge height and the crestal cortical bone are reduced, this osteoplasty is often a requirement for the most ideal implant placement (e.g. to avoid dehiscences).

The third situation is where the implant is actually wider than the extracted tooth, such as might occur with a mandibular incisor. During the preparation of the recipient site the socket will disappear by being "drilled out".

CATEGORY TWO — A SIGNIFICANT VOID EXISTS BETWEEN THE IMPLANT AND VITAL BONE

Where a significant peri-implant space is present, our objective is to have complete bony fill of the void after healing. The advantages of this technique as compared to submerging the implant further apically are: 1) a longer implant can be placed; 2) the implant will be at a level that more closely approximates the adjacent CEJ's of any existing natural teeth, and; 3) the implant is more often easily exposed at the second surgical stage. "Guided Tissue Regeneration" (GTR) provides us with a predictable method for bone fill in these situations. Because of its importance for this situation, a condensed summary of GTR will be of interest.

GUIDED TISSUE REGENERATION (GTR)

GTR was originally developed to achieve more predictable periodontal regeneration,¹¹ and the technique has recently been adapted to achieve peri-implant bone regeneration when: a) implants are placed into extrac-

CASE III



FIG. 9 LINGUAL VIEW OF THE SIX REMAINING MANDIBULAR TEETH. ANY ATTEMPT AT SAVING THESE TEETH WOULD REQUIRE MUCOGINGIVAL SURGERY, SURGICAL CROWN LENGTHENING, RESTORATIONS, ENDODONTICS, POSTS, CORES, AND FULL CROWN COVERAGE, ALL WITH THE RISK THAT ONE OR MORE TEETH STILL MIGHT BE LOST. AT BEST, THE PATIENT WOULD ONLY HAVE A FIXED ANTERIOR OCCLUSION.

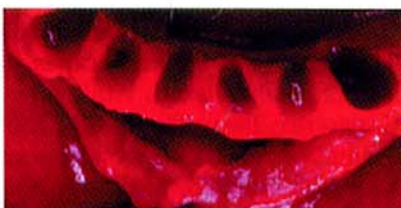


FIG. 10 OCCLUSAL VIEW IMMEDIATELY AFTER NON-TRAUMATIC EXTRACTIONS. IMMEDIATE PLACEMENT OF SIX FIXTURES WAS JUDGED TO BE MORE CONSERVATIVE, MORE PREDICTABLE, AND WOULD LEAD TO A SUPERIOR PROSTHETIC RESULT.

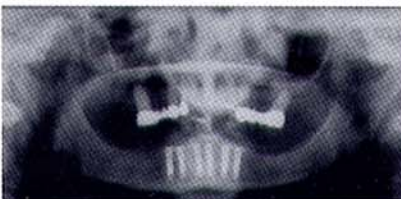


FIG. 12 PANORAMIC VIEW 12 MONTHS AFTER INITIAL FIXTURE PLACEMENT. NOTE EXCELLENT BONE CONTACT TO ALL THE FIXTURES AS WOULD BE ANTICIPATED WITH FIXTURE PLACED SUCCESSFULLY IN A "HEALED" EDENTULOUS RIDGE.



FIG. 11 OCCLUSAL VIEW IMMEDIATELY AFTER POST-FIXTURE PLACEMENT. AFTER OSTEOPLASTY TO ELIMINATE THE SOCKETS, SIX (16 MM LENGTH) SCREW-VENTS™ WERE PLACED.



FIG. 13 OCCLUSAL VIEW OF THE COMPLETED "FIXED DETACHABLE" PROSTHESIS.

CASE IV



FIG. 14 OCCLUSAL VIEW AT INITIAL FIXTURE PLACEMENT. NOTE THE SIGNIFICANT PERI-IMPLANT VOID THAT RESULTS IN SEVERAL IMPLANT THREADS BEING EXPOSED.



FIG. 15 LABIAL VIEW OF THE FIXTURE AFTER PLACEMENT OF FREEZE-DRIED DECALCIFIED BONE (AMERICAN RED CROSS).

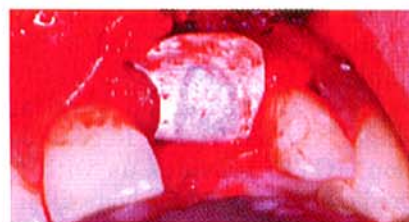


FIG. 17 OCCLUSAL VIEW FOLLOWING INITIAL PLACEMENT OF THE GORE-TEX AUGMENTATION MATERIAL, WHICH, WHILE NOT SUTURED IN PLACE, WILL BE RETAINED BY THE SUTURED OVERLYING SOFT TISSUE FLAPS.



FIG. 18 PERIAPICAL RADIOGRAPH TAKEN 10 MONTHS AFTER IMPLANT PLACEMENT. NOTE COMPLETE BONE FILL AROUND THE THREADED PORTION OF THE IMPLANT. (COMPARE TO FIG. 14.)



FIG. 16 A GORE-TEX AUGMENTATION MATERIAL, OVAL 4, HAS BEEN TRIMMED IN ORDER TO FIT INTO THE SINGLE-TOOTH EDENTULOUS SPACE.



FIG. 19 LABIAL VIEW OF COMPLETED PROSTHESIS DEMONSTRATING EXCELLENT ESTHETICS AND SOFT-TISSUE CONTOURS.

tion sockets;⁷ b) implant bone dehiscences and/or fenestrations occur;¹² and; c) pre-implant localized osseous ridge augmentation is required.⁸

In essence, the technique consists of placement of a "barrier" made up of specially manufactured and configured "Gore-Tex" membrane. There are unique Gore-Tex

configurations designed for the various different clinical applications. Although the precise mechanism of how GTR works is not proven, the rationale is that the Gore-Tex barrier prevents epithelial cells from migrating into the wound area allowing cells of the surrounding endosteal bone to preferentially populate this site.

With immediate placement of an implant into an extraction socket, and where a peri-implant space exists, the specially designed "Gore-Tex Ridge Augmentation Material" (GTAM) can be utilized. Following thorough debridement of the extraction socket, the implant is placed. The GTAM is trimmed such that it covers the implant and

extends beyond the socket margin by 2-3 millimetres. After the placement of the GTAM, the undersurface of the flap is trimmed in order to remove the granulation tissue and epithelium. Complete flap closure may not be achieved due to the pressure of the extraction socket soft tissue "hole". Sometimes, primary closure can still be achieved by adequately released, and then coronally positioned, vestibular flap. Post-operative care is carried out in the usual manner except that the GTAM is removed after a minimum of four weeks. Alternatively, the GTAM can be left in place longer, or even until the second stage implant exposure, as long as there is no significant GTAM-associated tissue inflammation.

It is worth mentioning that some clinicians prefer to fill in the peri-implant space with an osseous graft such as freeze-dried decalcified cancellous or cortical allograft bone. The rationale for the osseous graft is primarily that it serves as a "spacer" between the implant and the GORE-TEX barrier avoiding the collapse of the membrane into the "void". This space should eventually be filled by new host bone. The GTAM is designed to prevent the collapse of the material against the implant. The use of a resorbable osseous graft with bone-"inductive" properties may accelerate bone fill.¹³ In the opinion of the author, a non-resorbable osseous substitute (e.g. hydroxylapatite) is contra-indicated as the biological end result desired is vital bone in contact with the implant.

LITERATURE REVIEW

It is important to emphasize that observations in humans with the immediate placement technique (at the time of writing this article) have been mostly limited to case reports with short term follow-up. Readers are reminded that immediate placement should be considered "new" and perhaps

"experimental". The "significant" and "related" published materials will be outlined below. However, the author is aware of ongoing, but as yet unpublished, work on this particular topic. Readers are therefore urged to keep up-to-date, as several new reports on this subject are likely to appear in print in the near future.

Barzilay et al carried out a pilot³ and follow-up studies^{4,5} in monkeys. These studies compared the clinical and histological results after Bränemark implants were placed into both healed edentulous ridges and into fresh extraction sockets, then subsequently loaded. The results were equally good in both groups. The GTR technique was not utilized, yet both groups showed comparable degrees of osseointegration. Yukna⁶ compared the healing of hydroxylapatite-coated titanium implants placed in fresh sockets and healed sites in 14 human patients. Both categories achieved similarly good results.

Lazzara⁷ utilized the GTR technique after placing Branemark implants into fresh extraction sockets in humans. The case reports demonstrated excellent clinical and radiographic results. Nyman et al⁸ published two human case reports utilizing the GTR technique. In one case an implant was placed into a fresh extraction socket and achieved excellent clinical bone fill. The second case utilized the GTR technique to demonstrate ridge augmentation, which was subsequently followed by implant placement. Becker and Becker⁹, in a series of human case reports, demonstrated excellent clinical and radiographic results with immediate implant placement into extraction sockets. Candill and Meffert¹⁰ compared immediate placement with and without the adjunctive use of Gore-Tex membranes. The results supported the conclusion that the membrane enhanced the bony regeneration in the artificially-created bony defects in dogs.

CASE REPORTS

The four cases shown here underline the concepts presented in this article. Brief and pertinent comments about the cases are presented in the captions.

CONCLUSION

This article has outlined the advantages of immediate placement of cylindrical osseointegrated implants into extraction sockets, and the potential difficulties encountered by the surgeon during the technique and clinical protocols to be followed during specific clinical situations. A brief description of the guided tissue regeneration technique as it pertains to immediate placement of implants is also provided. This technique is relatively new, hence before using it in fully informed patients, the clinician must complete a risk/benefit analysis. The immediate placement technique is a dynamic and exciting area of implant dentistry.

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A LIST OF 13 REFERENCES ARE AVAILABLE FROM THE AUTHOR, CARE OF THE MANAGING EDITOR OF ORAL HEALTH.