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HEALING AROUND TRANSITIONAL IMPLANTS: HISTOLOGICAL STUDY IN DOGS

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SUMMARY*

Modular transitional implants (MTI) are made from pure titanium and are used to support non-removable temporary restorations during the osseo-integration period. This study was undertaken to examine the histology and jaw response to functionally loaded MTI implants in mandibles of dogs. Anterior and posterior implants were splinted, using a fixed cemented acrylic bridge to allow immediate loading. The middle implant was left unloaded and used as a control.

In the span of 10-12 weeks after implantation, tissue blocks containing the implants were removed and sectioned. Histologic examination and measurements showed good bone-to-implant contact including the threaded surface. Trabecular bone was in close contact with the implant providing good support for the restoration. The polarized views show bone remodeling in areas of bone-to-metal interface.

Success/failure ratio did not differ between loaded/unloaded implants. Analysis related to causes of success/failure were mainly influenced by the intra-jaw bone quality and by the uncontrolled functional activities in dogs.

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* A completed analysis and details of the study will be submitted for peer review and publication

IMMEDIATE LOADING OF TRANSITIONAL IMPLANTS DURING IMPLANT-SUPPORTED PROSTHETIC RESTORATION

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The clinical and research basis for the use of implants that replace natural teeth roots has gone a long way. At present we can relate to the restoration on implants at the projected level, and to the reliability attributed to the restoration of natural teeth.

Since during the first decade of the era of modern implants basic clinical and research trials concentrated mainly on the method with which to insert the implants, as described by Branemark (1, 2), and since this method advocates the insertion of implants into the bony tissue and its lining through the mucosa for an osseointegration period (1-4), the development of the implant branch [illegible] various aspects – functional, esthetics, etc. – continued [illegible] virtually without opposition.

The advantages of the submerged implantation in the mucosa are obvious: the submerged implant is protected by the mucosa from mechanical traumas and contamination, a frequent phenomena in the oral cavity, and is similar to a transitional one, since it is assigned beforehand a restricted and fixed time in which to perform several tasks under optimal conditions. Thus, inventors and advocates established several rules:

- During the first days (7-14 days) after the implant, no use is to be made of the denture or any device that might exert forces on the implant.

- During the osseointegration period (3-6 months) avoid exerting forces, including functional forces, on the implant.

During this period, perform a stringent follow up by means of clinical and X-ray observation, and check that the implant is covered, protected and separated from the oral cavity.

Undoubtedly the above criteria are reasonable, even though part of them do not have a scientific basis, while others were not checked against control groups to challenge such assertion. Going further: compliance with the classical submerged method, comprising mainly: a) penetration of implants and full coverage through the soft tissue; b) a waiting period in which the implant is placed passively on the bony tissue and completely separated from the oral cavity and c) the exposure of the implant at the end of the osseointegration period and its loading, produced optimal results and in particular a high, long term [in years] success rate (1, 3-4).

However, while the surgeon was presented with the goodness of the implant, the dentist in charge of restoration had an equally important mission: to return the patient to normal functionality as soon as possible. In many situations, in which the patient is completely edentulous or lacks abutments preventing temporary proper restoration, the waiting period becomes a distressing one causing suffering to the patient and a considerable bother to the dentist. This applies in particular to patients for whom a mouth in working order is a pre-condition to continue their [the dentists'] professional activity. Patients often avoid treatment, or reject it, fearing the discomfort suffered during the waiting period.

Thus, no wonder that several clinical researchers decided to put to test the need for the waiting period and/or examine the possibility of shortening it. This consideration of the clinical experience branched out in several directions:

a. Insertion of implants at the time of tooth extraction (immediate implant), trying to shorten the transitional period from lost abutment to restoration of implants (5-9).

b. Insertion of implants according to the non-submerged method, in order to dispense the patient from the need for an additional operation and allow him to recover from implant exposure at the end of the waiting period (10).

c. Skipping the temporary removable denture stage by maximum extraction of lost teeth, and their exchange by implants and when the time comes, leaving a number of teeth in strategic positions to allow for temporary stationary restoration (11). After the integration period, the exposed implants are loaded and serve as support for temporary bridges for a sufficiently long period to allow extraction of the remaining teeth, insertion of additional implants and a supplementary waiting period. This method allows for a more comfortable healing period, but extends by far the treatment period, and doubles the number of surgical activities.

d. Immediate loading – this method ignores the basic instructions as to avoidance of mechanical trauma to the implants during the osseointegration. Implants are loaded immediately, or shortly after insertion into the jaw, by means of a temporary or final bridge, assuming that the osseointegration process will not suffer due to early loading and will take place with application of functional forces on the osseointegration spot (12-13).

In spite of the encouraging results obtained by the research in this field (2-16), the medical community is waiting for additional long-term research resultss before classifying the appropriate researches on immediate loading without fearing that the success rate will fall.

Lately there were reports on the use of transitional implants which largely allow to overcome the problems stated above, by means of insertion of implants capable of supporting temporary bridges for a time and in parallel, during the recovery period of "fixed" implants (17, 18). The use of transitional implants allows shortening the temporary bridge before or during the fixed implant insertion, and the recovery of fixed implants according to the conservative method (1-4), during the healing period with a bridge simulating the final bridge, which is temporary adhered to the transitional implants.

This article aims to survey the use of transitional implants and to dwell upon the advantages and limitations of their use.

Implants and Methods

Since we are dealing with a new method, the transitional implant reported in the professional literature is the Modular Transitional Implant*[1] (MTI). Implants are made of pure titanium, shaped like a screw with a sharp end, uniform diameter (1,8 mm) and variable length (14, 17, 21 mm.) (19). The length of the implant neck above the ridge is 7 mm, a measurement included in the size of the general implant. Implants are inserted into the edentulous area after drilling through the cortical plate of the ridge.

Insert into the bone the whole threaded part, and leave the neck of the implant above the ridge. The implant may be inserted through the cortical drill rotating and self-tapping into the soft bone, or else deepening the initial drilling throughout the length of the implant and tapping the implant later. Drilling is performed with cooling-water spraying. In accordance with the manufacturer's instructions, drilling and tapping may be performed through the mucosa and without raising the stent, this recommendation was not tried out in human beings by the authors of this article for reasons that will be explained hereunder. Since transitional implants are to be prevented from getting in contact with the fixed ones, and it is desirable to preserve a minimum 2-mm. distance between them, plan with absolute accuracy the distribution on the ridge which is to be implanted, establishing and marking the location of the fixed implants. When this distance is increased (photo 1a – b), the lingual/palatal location of the transitional implants is more advantageous. This planning is especially important whenever it is decided to first insert the transitional implants, and immediately afterwards, the fixed implants.

Pre-Surgical Evaluation

Planning of the location of the implants and their direction comprises both fixed and transitional implants. Thus, a pre-surgical evaluation will include. study of prints, recording the relation between jaws, and evaluation of the fixed implants in respect of the remaining teeth and the teeth about to be extracted. We recommend to use a surgical template made of transparent acrylic resin in which the preferred implant points are marked, while at the same time preparing in the laboratory a temporary

[1] Dentatus, New York, N.Y.

acrylic resin denture which shall serve the dentist in charge of restoration on the day of the implant (or close to it). Some prefer to prepare a vacuum shell and make the denture directly in the patient's mouth. The surgical template test can be performed introducing the template into the mouth of the patient, inserting gutta-percha pins into the appropriate drills in the template, and taking a panoramic X-ray or computerized tomography appropriately labeled.

Insertion of Transitional Implants

After giving local anesthetic and lifting the stents, mark on the bony ridge the location of the fixed implants. In most cases, fixed implants are inserted first down to the final stage – closing the implant with a cover screw. If the implants are not of the one-stage type, insert the implant into its final position in order to get a true impression of the area division on the ridge and the area above it, between the fixed and transitional implants. Having established the location of transitional implants, perform transcortical drilling. As stated above, drilling can be performed throughout the depth of the implant. For this purpose, the drill is calibrated 7, 10, 14 mm. from its end. When the bone is relatively soft, the implant can be inserted by tapping it through the cortical drill. The direction of the transitional implant is taken from the jaw structure and the location of the implants. Its main importance lies in that it prevents the breakthrough of the jaw surface on the one hand, and the formation of a protection layer between transitional and fixed implants on the other. In spite of the fact that the insertion of transitional implants in parallel is easy, do not endeavor to achieve parallelism, since later one can bend the implant heads (photographs 2, 3,4). The implant head is grooved to allow the insertion of a titanium stent connecting the implants to each other, and then serves as metal skeleton to bridge the temporary resin. At the final stage of the implant insertion, check that all the slots are laid out in the direction of the arc, and allow for stent introduction. As already mentioned, lack of parallelism between the transitional implants is of secondary importance, because at the end of their insertion implant heads can be bent --the part above the ridge – and made parallel to each other as required. In spite of the above, prevent sharp or repeated and abuting bends so as not to weaken the implant neck and increase the risk of

breaking it later, and also lest the exertion of strong lateral forces on the implant, and thus a reduction of the initial stability.

Whenever it is impossible to locate all fixed and transitional implants, consider renouncing the idea of a fixed implant, and insert a transitional one instead. Later the transitional implant will be exchanged for a fixed one, at the stage when the transitional implants are removed and a bridge is made to support fixed implants. As in the combined implant method, leaving teeth designed for extraction and their later exchange for implants (11) will prolong treatment by 3-6 additional months.

At the end of implant insertion (photographs 3, 4) return the mucosa stents to their places, and stabilize them by means of arbitrarily chosen seams (photograph 5). If the restoration is performed by a dentist dealing in restoration, the patient will go on that same day to continue the temporary restoration treatment. Alternatively, the restoration stage can also be performed by the same dentist who performs the fixed and transitional implant, and temporary restoration in a single sequence.

Installation of Temporary Restoration

The restoration stage starts preparing the temporary replication before performing the surgical stage. In the case of edentulous jaws, it is necessary to transmit to the articulator the ratio between jaws using wax copings, and to perform a teeth set-up test in the patient's mouth. If necessary, it is recommended to correct at this stage any incorrect vertical closing dimensions, and a central reference. The temporary replication can also serve to evaluate the inter-jaw ratio for the fixed restoration stage. It is recommended to prepare a temporary replication in the laboratory made of boiled acrylic resin even though it is also possible to use a vacuum shell, and prepare the temporary bridge in the clinic. The use of a vacuum shell is liable to damage the tissues in the envelope due to the high heat emission during polymerization of the large mass of acrylic resin

A temporary replication made of vacuum shell is inferior from the esthetic point of view, its adaptation to the mouth is difficult and requires much more time than a laboratory replication.

When adapting the temporary replication, the dentist in charge of restoration can re-adjust the implant heads fixed in the jaw, and improve their parallelism. This activity is performed by means of a delicate bend which is feasible given the great plasticity of the implant necks. Avoid repeated bends, for they are liable to cause metal fatigue, and as a result, cracks and fractures.

After completing the surgical stage and before padding the temporary replication set on the MTI screws the following parts in the given order.

a. Protective sleeves to prevent the acrylic from being trapped in the MTI screw necks.

b. A titanium rail to reinforce and stabilize the replication. This rail is adapted to the shape of the ridge, and is introduced into the corresponding slots of the MTI screws.

c. A modular cover fitted over the screw head and the titanium rail (photograph 6).

After assembling all the parts on the screws, check that there are no bottom parts liable to prevent replication extraction after completing acrylic polymerization. At this stage the temporary replication can be padded and finally adapted (photograph 7).

Finally, process the replication so as to allow proper preservation of oral hygiene, and perform final closure adaptation. Should the replication be insufficiently retentive, use temporary cement to improve its adhesion.

Going over to the final restoration: removal of transitional implants

Waiting Period for Final Restoration

The waiting period is fixed considering the time required to allow the patient to recover from the operation, and to generate adhesion of the implant to the bone. This period continues for three to six months, according to the quality of the bone; the latter one varies from jaw to jaw, and from the allocation of the implant and the jaw.