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Case Report

Rehabilitations of a single element with one-piece implants with electrowelded needles: A different approach

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ABSTRACT

To ensure single dental implant stability, there are some approaches. The stabilization of a single-piece implant by welding it to a titanium needle allows immediate loading and promotes the final osseointegration. The aim of this case report study was an evaluation of long-term clinical outcomes of immediate loading in cases with bone atrophy in the canine region by welding single implant to a titanium needle. In two cases with maxillary atrophic anterior bone, single-piece titanium implants were used. As support structure, a Scialom-type stabilization titanium needle was used (diameter 1.2 mm and suitable length to obtain a bicortical positioning). These two elements were joined together using a Mondani intraoral welder. The implants immediately loaded by temporary restorations. The cases were followed for 24 years, and clinical outcomes were assessed. The use of this method, in the cases with maxillary atrophic anterior bone, allows immediate loading with a fixed acrylic prosthesis at the end of the surgical session. Clinical outcome was successful for 24 years. This approach is a successful method that allows immediate loading in atrophic bone.

Key Words: Dental implant loading, immediate, single tooth dental implant

INTRODUCTION

The immediate enhancement of primary stability of the one-piece implant by welding it during the surgery with a thin additional cylindrical titanium implant is an Italian technique introduced at the end of the seventies. The purpose of this method is to increase primary stability in normal condition that is supported by the geometric shape of the implants used (wide-pitch spires) aiming for a bicortical placement. The use of Italian school one-piece implants, of Tramonte's and Garbaccio's screw types, yields predictable clinical successes, especially in the rehabilitation of single missing teeth.[1-3]

From the point of view of resistance to static and dynamic occlusal stresses, the use of one-piece implants designed specifically for immediate loading, especially in the presence of poorly mineralized bone, is really useful when connected to other support structures to form a single body, thus increasing the support surface. All this leads to the achievement of an immediate and permanent primary stability, suitable to speed up the process of osseointegration.[4-7]

The natural example of the above arrangement is borrowed from nature. In fact, just dwell on the anatomy of the molars designed to withstand most static stresses of chewing and swallowing. The morphology of the roots

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of these teeth is suitable to allow load dispersion over a greater area compared to their occlusal surface.[8-10]

By exploiting the geometric shape of the molar roots, it is possible, in the case of implants, to get "the deep balancing" of the fixture through the insertion of a titanium needle (such as a Scialom needle) divergent from the main axis of the implant. The needle must reach and impact the deep cortical bone and be welded to the base of the one-piece screw using the intraoral welder, so as to form a single prosthetic stump to support a prosthesis[11,12]

In addition, it increases the strength of the primary stability and it is able to improve the resistance to static and dynamic stresses; the "deep balance" also produces an antirotational effect, opposing the loosening that can be caused by the pressure exerted by the tongue during swallowing.[13]

With this technique, it is possible to eliminate those dangerous micromotions above 150 microns, particularly harmful and capable of inhibiting the osseointegration of the implants.[14] The "deep balancing" has proved particularly effective for the immediate loading of postextractive implants in the frontal areas, with a reduced bone depth and/or when it is poorly mineralized.[15]

In posttraumatic situations with loss of a single element of the upper front teeth group, this method is really useful. In such situations, reduced bone availability that can occur due to loss of cortical parts and consequent esthetic requirements recommend the immediate prosthetic replacement of the avulsed tooth. Even in the presence of anatomical situations with particularly reduced bone thicknesses or when one cannot or does not want to perform regenerative and/or augmentation surgery, the use of the method indicated above is of particular reliability and effectiveness. It is almost always possible to insert small implants that are particularly effective because they are enclosed between two cortical walls close to each other and resting on the deep cortical layers.[16]

The cortical bone is ideal for these one-piece implants with very small diameters (between 2 and 3 mm) that provide large support surface if stabilized with needles.

One-piece screws benefit from deep balancing when used as a doubled-up implant system, especially as a single tooth replacement of a canine. This is in consideration of the fact that, as in natural teeth, this dental element has to bear the entire load in laterality to ensure protected occlusion.[17]

Of course, in these cases, it is recommended to balance the occlusion both during construction and the immediate provisional positioning phase, as well as in the positioning of the final crown.[18]

CASE REPORT

One-piece titanium implants are used of the Garbaccio's bicortical screw and Tramonte's screw types (CE0434, BREV. IT 0000253996 Vi-STOM s. a. s.), with spire diameters between 3.2 and 4.5 mm and a 2.5 mm core, built in compliance with CE regulations.[19-21]

The implant length is variable, subordinated to the achievement of deep cortical positioning.

For "deep balancing," a support structure has been used made of a titanium Scialom (AG01160 CE0476 Acerboni S. N. C.) type needle of diameter 1.2 mm and variable length that always depends on the achievement of bicortical positioning.

The needle implants used, made of titanium grade 4 certified for medical use according to the ASTM F67 standard, are cylindrical, and provided with a tip at an acute angle that allows an easy and atraumatic penetration into the bone tissue.[22]

The needle is inserted in a divergent direction with respect to the main implant, respecting the integrity of adjacent teeth and pushed deeply until it reaches and impacts the deep cortex. Once it reaches such depth, it has to be welded, using a Mondani intraoral welder (93/42/CEE 110-230 Vac ±10%–50/60 HZ), to the implant head emerging from the mucosa to form a single prosthetic head.[20-22] The "biocompatibility" of the welding that occurs in the mouth and on the protruding joined portions of the titanium implants fixtures in living tissues is ensured by the fact that the current transmission occurs at high speed that has a microwork time of 2 miliseconds.[23]

This microtime, combined with a calculated pressure of the electrodes on the structure to be welded, helps to avoid any spread of the huge heating gradient beyond the welding point into the adjacent tissue. Titanium, in addition to being a poor conductor, also has a very low thermal conductivity, very close to that of enamel. While industrial welders melt titanium only in the presence of an argon atmosphere and in the absence of oxygen, the small Mondani welder welds titanium implants even in the presence of air, water, blood, and saliva. It is important to point out that this operation is absolutely not harmful for the patient

in all those cases when we are working with local anesthesia. In the cases of using general anesthesia, the intraoral wielding should be avoided since, for the presence of oxygen, could be dangerous for the possibility of the spreading of microcombustions.

The intraoral welder allows to connect and fasten with each other implants (one-piece and two-piece), both to immobilize them temporarily during the osteogenesis period or to keep them connected permanently. The expression "intraoral welding" is intentionally used, although technically, this process is not a real welding but a more stable process of molecular syncrystallization or a union of the crystalline structures of the two component pieces.[24,25]

After opening a flap, the preparation of the screw-shaped implant site is performed using Pasqualini's self-centering burs (Sweden and Martina MEP-252SC-5), with progressively increasing diameters starting with 1.1 up to 2.5 mm, mounted on micromotor with cooling liquid (saline solution).

Specifically, the deep cortical bone layer is reached with the probe bur of 1.1 mm diameter. After an X-ray control, the measurement obtained is reported on the self-centering bur, to complete the preparation of the implant site.

The self-centering burs are equipped with sharp triangular points and triangular beveled backs [Figure 1]. This important feature allows the achievement of very precise osteotomy tunnels, with a light traumatic effect on the bone.

Needle implant insertion uses the same initial preparation of the site, with the 1.1 mm milling probe to reach the deep cortical layer. In the osteotomy thus obtained, the needle of 1.2 mm is inserted and is pushed along the way so prepared with a press-fit technique, using a surgical mallet.

The indicated method involves the use of block anesthesia and antibiotic coverage. Depending on the patient, it is preferable to use a precautionary treatment with amoxicillin + clavulanic acid, 2 g/day for 5 days, and anti-inflammatory drugs such as sodium naproxen, 550 mg tablets as needed.

Immediate loading is realized with acrylic resin crowns while the permanent prosthesis is made of metal ceramic and has been replaced 2 months after the provisional crown. Thus, being in the presence of a fork, no periodontal defect will be present, since with the welding, you are able to create a single block of titanium and the margin of the crown will seal on the abutment with a knife-edge closure.

The case reports presented were realized in accordance with the ethical standards set forth in the Helsinki Declaration and with the patients' consent.

Clinical case #1

The case refers to a young female patient (18 years) of Caucasian race, suffering from iatrogenic loss of the upper right canine and bearer of a removable prosthesis with no dynamic but only esthetic function.

The photographic sequences [Figure 2] show how single stage immediately loaded implants on the canines require scrupulous adherence to the occlusion dynamic.

As a precaution, the immediate temporary restoration must be excluded from static and dynamic contacts during the osteogenesis period because they could be particularly traumatic and prevent osseointegration.

Figure 1: The initial situation and the different phases of the surgery with the radiographical control

Figure 2: The placement of the permanent crown with the radiological control and a follow-up 28 years later

Instead, the final crown will follow the standards of physiological disclusion.

The patient's condition was followed up regularly from 1987 to 2015 [Figure 2].

The following up criteria evaluated: gum health, bone levels, peri-implant structures, mobility, and general esthetic. The patience was an assistant in the clinic and she was evaluated every year practically day by day; however, radiological controls were carried out every 5 years during the first 20 years and then every 3 years. According to the general consensus in implant dentistry, we accept that 1, 5 mm of bone loss is normal and physiological as stated by Brånemark 1981.[26]

Gum health was evaluated according to the presence or absence of bleeding.

The bone levels were put in relationship with the previous radiographies.

Peri-implant structures, such as deep bone health and the positive architecture of the bone crest, were evaluated in the same way as bone levels.

General esthetic was a personal consideration both from the doctor and the patient.

Clinical case # 2

This case refers to a 32-year-old Caucasian woman, whose right upper incisor, indicated by the arrow [Figure 3], was severely compromised by occlusal trauma not clinically controlled over time, and was lost spontaneously in 1989.

The edentulism correction, characterized by a marked bone atrophy, was performed using the method already described and finalized with a permanent prosthetic crown made of noble metal and ceramic. The case was followed clinically for 24 years evaluating the same parameter as case 1 but doing radiological control every 4 years (1989–2013) [Figure 4].

Figure 3: The initial situation and the spontaneous loss of the central incisor

DISCUSSION

Immediate loading is particularly suitable in cases of single missing tooth and when the esthetic conditions require a prompt therapeutic intervention. However, when we proceed with this treatment planning, it is necessary to take into account certain characteristics of the front teeth (central incisors, lateral incisors, and canines) as these have an inclination different from that of premolars and molars. In fact, their occlusal stresses are not coaxial with the major axis of the roots but generate transverse forces while those of the premolars and molars produce forces that are dispersed along the major axes of their roots. This is the reason why the front teeth should not have physiological static occlusion contacts but only need to lightly brush against each

Figure 4: The surgical phases and the radiological control the same crown in 1989 and in 2013 24 years later

other. Otherwise, they would be severely damaged during the terminal phase of swallowing, generating noncoaxial forces transversal to the major axes of the roots. Experience and many case reports showed that, when a good primary stability was achieved, immediate load wasn't an issue at all, as soon as no functional charged was applied on the provisional tooth. The first study talking about immediate load was carried out by Tramonte in 1963; nowadays, a follow-up at 50 years was published as proof of the safety about this implant method. From 1963, many immediate load implants have been placed, and many are the authors that have demonstrated the validity of this system.

For this reason also, the prosthetic crowns positioned on front implants, as well as the corresponding natural teeth, must not have static contacts: they should only brush against each other and guide dynamic movements after the completion of osteogenesis.[27] The importance of correct occlusion is reflected in the duration of implant rehabilitation. However, unfortunately, implant failure is often attributed to microbial causes, systemic diseases, inadequate hygiene, and/or smoking.[28-34]

CONCLUSION

With the evidence of the clinical results reported, we achieved a really long-lasting restoration, giving a fast restoration of both esthetic and function; thus, it is mandatory to following up the prosthetic part as ceramics are not able to "get older" as natural teeth do. The important condition is that, during surgery, these implants are complemented by a titanium needle that allows the achievement of "deep balancing." This condition ensures a number of functional advantages that allow immediate loading, while respecting the static and dynamic rules of occlusal balance.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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