A Novel Optimization Aspect of Osseointegrated Dental Implant

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Abstract- This paper highlights a new removal technique performed recently to osseointegrated dental implants utilizing a heating approach. This optimization technology ensures the uprooting of the capsule perfectly. Moreover, it ensures minimum necrosis of the embracing area.

Index Terms- Implant, Osseointegration, Denture Therapy and Optimization.

I. Introduction

Tooth loss, either of a single tooth or of more than one tooth, predominates in a significant percentage of the adult population in all over the world. The statistics behind this medical fact are dangerous. In fact, a report of 1985 and 1986 healthcare data illustrates the proportion of the adult population with one or both dental arches edentulous oscillated from 5% for those in their fourteen years old of life to more than 30% for those in their seventy years old [1]. These days, about 450,000 osseointegrated dental implants are being placed yearly. Not only this, there is an anticipation of 95% success rate (in the case of single tooth replacement with an implant supported crown), with minimal consequences and correlated impediments [2]. Typical comprehensive denture therapy, requires a clinical skill as well as art. Furthermore, this therapy proposes the patient a substitution for the natural dentition which is barely satisfactory at best. Earlier dental implant approaches utilized in clinical dentistry to improve the preservation of the artificial dentition positively amended the function as well as the security of the dental prosthesis. Nonetheless, each was interested in enough impediments and morbidity to prohibit approval by the different formal and confidential dental associations [3].

Furthermore, the osseointegrated implant is defined as a form of implants that identified as "an endosteal implant comprising openings into which osteoblasts and establishing connective tissue be able to roam". According to oral implantology, an osseointegrated implant implies a bone matured right up to the implant surface, not including the interpolated soft tissue layer [4]. Figure 1 below shows the differences between the way that natural tooth attaches to the bone and an implant attaches to the bone. From the figure, it is obvious that there is a difference in the tooth crown. In the natural tooth, there are fibers that serve as a holder for gum to the tooth (i.e. periodontal ligament). On the other hand, the bone attaches directly to the implant in a process called “osseointegration [5].

II. Medical Benefits

In fact, the osseointegration process goes through several important steps. Starting with inserting the implant into the bone. Then, the healing process of the bone. This step should take some time to ensure perfect and healthy healing to the affected tooth. After that, a dental abutment is placed on the dental implant. Finally, the ceramic crown is placed which replaces the real tooth. Osseointegration dental implant goes through the surgical process. This process affords assistance to a dental prosthesis like bridge, crown, and bridge. Moreover, it offers assistance to the facial prosthesis and it gives help to make the facial prosthesis perform like an orthodontic anchor. A removal implant maintains denture and it is identified as the form of the dental prosthesis that is not installed perpetually in a place [5, 6].

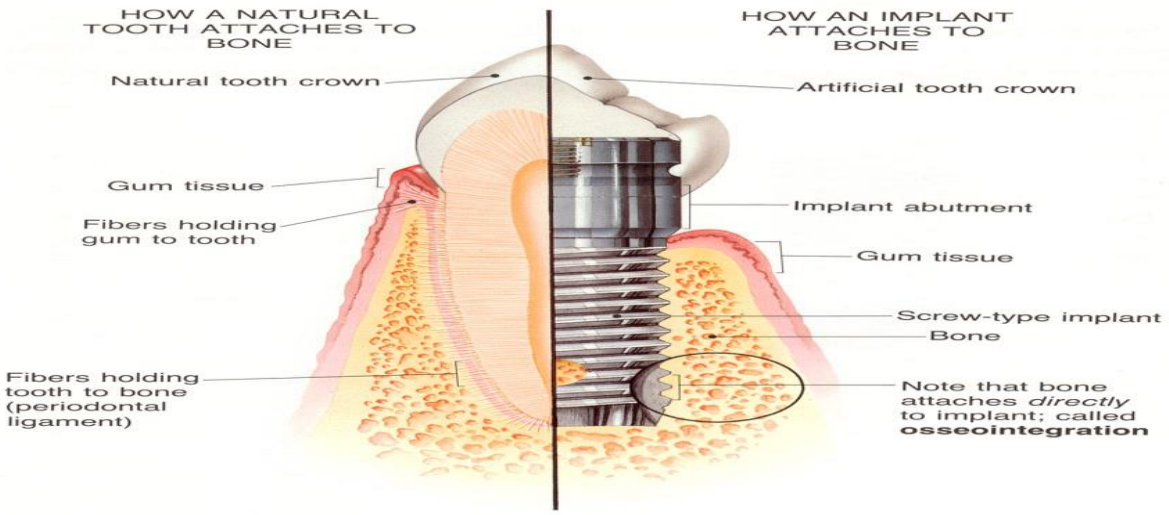

Figure 1: Differences Between Natural Tooth Attachment to Bone and Implant Attachment to Bone

Indeed, the dental prosthesis could be detached from the implant abutments by utilizing the finger pressure of the wearer. To ensure this happened perfectly, the abutment is designed as a little connector such as a button. This particular connector could be attached to comparable adapters in the underneath of the dental prosthesis.

III. Optimization Technique of Removal Dental Implants

With the development of science and the conquest of technology in various medical fields, new challenges have arisen regarding dental implants. Thus, professional engineers in medical devices to benefit from this science in this era. Moreover, computational patterning of sophisticated physiological systems and their collaboration with medical equipment has developed an essential field of biomedical engineering research internationally. The importance of this field is expanding to converge the market requirement for the spurt in the advancement of secure, well-performing and consistent medical equipment. Contemplating the whole clinical catastrophe consequences, their prevalence in the clinical procedure, the inquiry of undesired impacts and their influence is fundamental. In the layout procedure, these aspects ought to be considered. Furthermore, exhibiting and imitation affords sufficient and cost-effective explanation. A comprehensive and precise evaluation of exchanges of model variables is essential to distinguish the best preference from many hypothetically good layout choices of a medical device [7].

Consequently, incorporating various layout specialties, systematizing the simulation procedure and supporting layout evaluation with mathematical models perform a significant role. This optimization methodology maintains the accomplishment of dense biomedical engineering layout challenges with extraordinary improvements by means of time-saving, proficiency and consistency. Optimize a modern removal method of osseointegrated dental implants depends on a heating procedure. This technique guarantees the extraction of the capsule at the same time as certifying insignificant necrosis of the neighboring district. Besides, two important embedded software are implemented. The first one is called modeFRONTIER and the second one is called ANSYS software integration between this two software is performed. This integration aided utilizing a two-step simulation procedure [8]. The first step implicated the adjustment of a numerical algorithm via scheduling different numerical variables such as heat transfer coefficient as well as material properties. This calibration process is performed to precisely simulate the heating procedure. The second step was the calibration of the removal procedure by realizing the best standards for the followings:

1- direction
2- duration
3- temperature
4- power of the heating instrument.

The integration between modeFRONTIER and ANSYS software enables the ability to establish a numerical algorithm to replicate the removal procedure in the most practical approach. Using this approach, engineers possibly will optimize the same process in a prudent and efficient method, averting the recurrence of numerous tests on patients or test subjects.

This optimization approach has some key advantages over the dental industry and opens more areas for scientific research in this challenge. The advantages can be summarized as follows:

1- Expand the understanding of the problem, taking all parameters and potential consequences into account.
2- Improve the consistency of simulation utilizing model optimization
3- Support minimizing the figure of luxurious models and pre-clinical experiments
4- Improve the safety of experiments
5- Minimize design times by supporting computerization of sophisticated simulation procedures
6- Integrate various design specialties for universal design

Figure 2 below shows the findings of the integration software and the new dental implant.

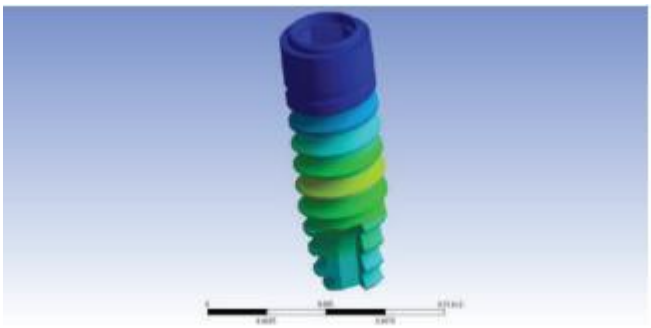

Figure 2: New Dental Implant

IV. Discussion

With the ultimate accomplishment percentage of every tooth replacement opportunity and a track record straddling decade, implants are the most excellent long-term explanation to absent teeth. Appropriately caring for implants could save the remainder of anyone's life. This the reason that makes them such a good solution. In fact, during the natural process of osseointegration, the titanium metal is used to make the implant. This titanium made implant turns out to be blended with the living bone cells of the jaw. This extraordinary combination structures a robust as well as a stable anchor for the new teeth.

Dental implants are practically impossible to differentiate from the patient's actual teeth, in both aesthetics and function. Additionally, they offer a multitude of advantages that other tooth-replacement systems just cannot match. The visible component, which is the crown, is a ritual that is prepared to enrich the patient's smile, although the actual beauty of dental implants extends much deeper.

V. Conclusion

Dental implants become integrated into the bone itself. Dental implants stop the bone loss that inevitably follows tooth loss. The new optimization technique, preserving bone structure, helps to preserve the patient's appearance and helps to keep the patient confident.

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