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Study of individual healing abutment with standard impression and fully digital CAD-CAM healing abutment

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Abstract

Aim: This study compares the time for making prosthetic structures with individual abutments with standard impressions and fully CAD-CAM abutments. The null hypothesis is that there is no difference between the two groups studied.

Materials and methods: Thirty implants from the Neo system (AlfaBio, Tel Aviv, Israel) placed on patients aged 30 to 50 years without concomitant diseases were examined. Two protocols were used for the abutment and prosthetic construction: fully digital CAD/CAM and standard.

Results: The total time for fully CAD-CAM abutments and crown is statistically significantly less than the time to produce individual abutments with standard impression and prosthetic construction.

Conclusion: The ability to design and manufacture customized abutments with precise anatomical shapes individually according to the clinical situation can reduce stress during chewing and help improve successful long-term aesthetic and functional outcomes.

Keywords: digital healing abutment; individual healing abutment; CAD-CAM construction

Introduction

The use of osseointegrated dental implants for prosthetic purposes was first proposed in 1969. Understanding and awareness of the nature of soft and hard tissue biology allow practitioners to perform rehabilitation with dental implants in a more predictable way[1,2,3].
Nowadays, advances in imaging and 3D imaging combined with implant planning software have created an interdisciplinary environment through which better patient care and a more predictable outcome are achieved[4].
The digital approach involves a paradigm shift in how traditional implantology is understood.
The digital workflow is available in everyday dental practice. It has advantages in implantology, such as the possibility of precise planning, which leads to faster and more consistent positioning of the dental implant, greater predictability of results, and ease of implementation at all clinical stages[5,6]. These advances have led to advantages such as the predictability of treatment, simplifying clinical steps, and quick and easy communication between different specialists (radiologists, implantologists, surgeons, prosthetists, and periodontists). In addition, treatment options, including digital workflow, are developing with new materials and technologies-3D for printing and milling structures[1,7].
The literature describes the mechanical advantages of using digital technologies from a biomechanical point of view: final restorations are produced according to the exact gingival architectonics of the patient, achieving an optimal emergence profile and a better aesthetic result for patients; it is also easier to correct the angulation of implants; Fewer patient visits are needed with a shorter visit time, greater comfort for the patient[8,9,10].
Completion of implantological treatment is associated with a load on the implant. Therefore, the abutment's choice and load are essential after the implant's augmentation. Standard abutments are available, which as a type, are straight and angulated. The angle of angulation is 15 and 25 degrees. But in clinical cases where no surgical guide has been administered, the choice of abutment is severely hampered, especially in larger constructions. A suitable alternative in these cases is individual abutments made using CAD-CAM technology[11,12].

Aim

This study compares the time for making prosthetic structures with individual abutments with standard impressions and fully CAD-CAM abutments. The null hypothesis is that there is no difference between the two groups studied.

Material And Methods

Thirty implants from the Neo system (AlfaBio, Tel Aviv, Israel) placed on patients aged 30 to 50 years without concomitant diseases were examined. The oral-hygienic status was assessed, and correctives were introduced if necessary. The size and width of the implants are selected according to the anatomical parameters of the available bone in the area of interest after the CBCT examination. Implants were examined, restoring single missing teeth. The surgical protocol does not include the use of a surgical guide. The implant is placed at the bone level and covered with a mucoperiosteal flap. After four months after the X-ray, the implant is revealed, and a trans gingival screw is inserted for four weeks. The second visit measures secondary stability by implant stability measuring apparatus (OSSTELL, Beacon, Sweden). Patients are divided into two groups of fifteen at random.

Group 1 has individual superstructures. On the first visit, a scan body is selected. The size of the scan body (AlfaBio, Tel Aviv, Israel) is based on the implant size. The fixation of the scan-body relative to the implant is controlled by X-ray. A digital footprint is being removed. The laboratory is made with a computer-assisted abutment design, and the temporary crown is constructed. The abutment model is thus fed to a milling machine that makes it from PRE-MILLED BLANK (AlfaBio, Tel Aviv, Israel) for Preface® abutment holder for the type of implant, and the temporary crown is made on a printing machine from the respective material.

The individual abutment and the temporary crown are fixed on a second visit.

At the third visit, after two weeks, the condition of the soft tissues around the implant abutment is assessed – bleeding and inflammatory changes. In the absence of such, producing a final crown of zirconium ceramics without a new imprint is ordered.

On the fourth visit, the final crown is placed.

Group 2 used standard abutments from the Alfa Bio system. In addition, straight and angulated abutments with different heights of the gingival part were used. The choice of the type of standard abutment is made according to the height of the gingiva measured from the implant platform to the surface of the gingiva coronary, according to the position of the implant and the distances to the adjacent teeth.

On the first visit of this stage, after the gingival tissues are well shaped, an impression is taken by the method with an open spoon snapshot. The choice of the abutment in terms of gingiva height, diameter, and angulation is made according to the specific clinical case. Then, a temporary construction is made.

On a second visit, the abutment is fixed, and the temporary construction is placed. Contact with adjacent teeth and occlusion with antagonists are traced.

On the third visit after two weeks, the condition of the soft tissues around the implant abutment is assessed – bleeding and inflammatory changes. An imprint is taken for the final construction. The fixed structure is made of zirconium ceramics.

On the fourth visit, the final construction is installed and cemented.

Each clinical visit records the time to perform the manipulations for each patient studied. The number of visits is the same for all patients. The results are processed statistically.

A Student's independent-samples t-test statistically evaluated both groups' results.

Results

Table 1 and figure 1 show the results obtained after measuring the time in minutes needed to produce abutments by a standard and fully digital method.

Table 1. Processed statistically the results of measuring the time for making abutments by two different methods in minutes.

	Visit one IMPRESSION	Visit two ABUTMENT and TEMPORARY CROWN	Visit three CONTROL or IMPRESSION	Visit four FINAL CROWN	TOTAL TIME
GROUP 1- Cad-Cam abutment	31.733± 2.645	32.6±2.274	14.6±2.332	24.866 ±5.446	103.8± 6.493
GROUP 2- conventional	43.733 ± 3.511	32.2± 5.431	34.633± 2.604	25.866± 4.379	135.933 ±8.835
t, P	t(14) = -10.214, p<0.00001	t(14) = 0.254 p=0.801	t(14) =-20.906 p<0.00001	t(14) = 0.560 p=0.579	t(14) = -10.965 p<0.00001

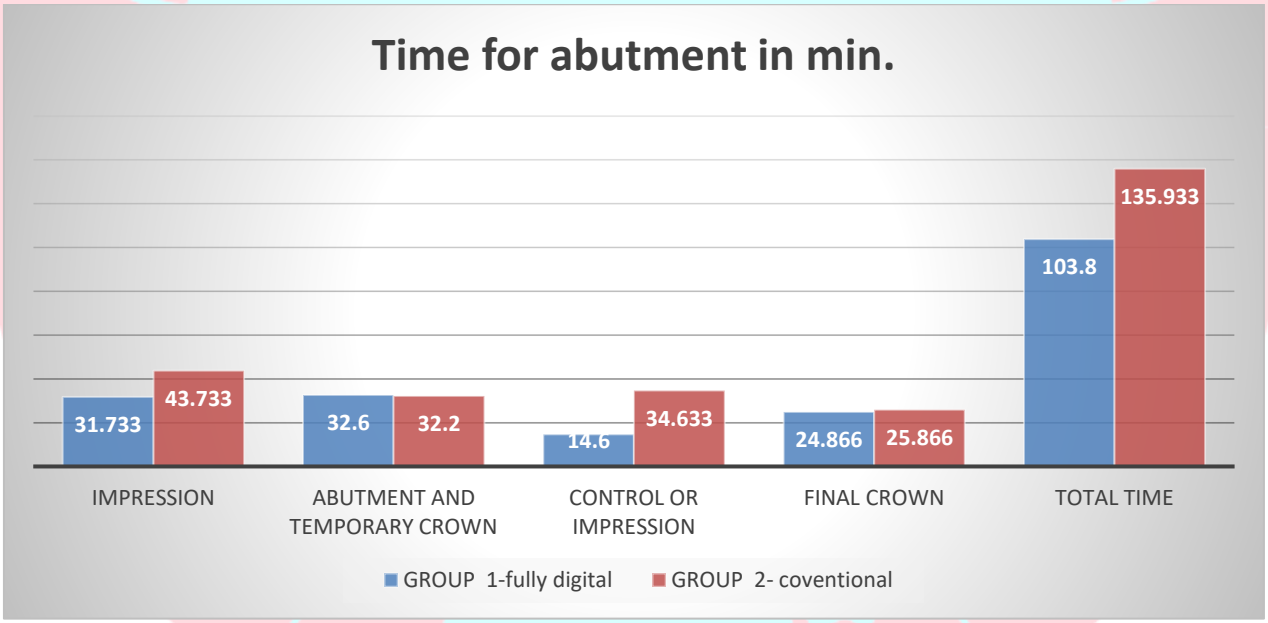

Figure 1. The time of the slice visits for the elaboration of the abutment and temporary crown.

The results show that the total time for making an abutment by a fully digital method is statistically significantly better than that using a standard method. A toast to creating a fully digital abutment, a temporary crown, and then a permanent crown, the time is less ($p<0.00001$). The number of visits for both study groups was the same. The main differences in time are from visit one and third. The digital impression times are significantly shorter than the standard ($p<0.00001$) on the first visit. A significant reversal of the time was also shown by the procedures in the third visit ($p<0.00001$). In the case of fully digital manufacturing, a control examination is carried out, and the final crown is ordered. With the standard protocol, a new imprint is taken.

The total time for fully CAD-CAM abutments and crown is statistically significantly less than the time to produce individual abutments with standard impression and prosthetic construction($p<0.00001$).

Discussion

Dental prosthetic implantology is an important part of clinical practice. One of the keys to successful treatment outcomes is the appropriate selection of implant components and precise clinical and laboratory work. In everyday practice, doctors can choose factory or personalized abutments. Upgrades play an important supportive component in fixing the abutment to the implant body in the ultimate success of dental implant treatment[14].

Manufactured in standard sizes, superstructures are available in straight and angular styles to allow some adaptation to individual cases. Using traditional supports, it can be difficult to provide optimal contours of eruption with less tissue maintenance of adjacent teeth, making it difficult for the dentist to exert precise control over the final placement of the recovery margin with good aesthetic results. That's why personalized abutments have become the new standard for dental implant treatment[14,15]. Customized abutments provide more precise pressure transmission, resulting in precise treatment with fewer visits and adjustments, shorter clinical time, improved aesthetics and prosthetic correction of implant angulation, and passive fit. Individual abutments provide an excellent emergence profile that determines the maintenance of a healthy gingival edge and allows the crown boundaries to be placed below the gingival margin[15].

All these factors in milled abutment contribute to the overall success of implant restoration and patient satisfaction with dental implant treatment as a function and aesthetics[16].

Custom upgrades are price-competitive with factory upgrades due to the digital workflow advantages of improved adaptation, faster processes, and greater design control. Customized superstructures allow dental professionals to provide more precise customized titanium support with high control over aesthetics and transmission of the masticatory pressure of the prosthetic structure[17].

Conclusion

The ability to design and manufacture customized abutments with precise anatomical shapes individually according to the clinical situation can reduce stress during chewing and help improve successful long-term aesthetic and functional outcomes.

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