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CAD/CAM

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CE article

Utilizing the Tempcap abutment with CAD/CAM

special

Intra-oral scanning with 3M True Definition Scanner, realisation with CARES

case report

Contribution of CAD/CAM technology to implant-supported screw-retained restorations

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Current state of CAD/CAM in dentistry


Prof. Selim Pamuk

_Digital technologies are everywhere in our daily life. We no longer go to post offices to send letters to our friends; we e-mail them instead. We no longer have walls of CDs or DVDs, but a tiny hard drive containing thousands of albums and movies. Newspapers, books and magazines are available in digital format and we store them in our tablets to take them wherever we go. In this context, dentistry is no exception and the last decade has seen the rise of the digital age in dentistry. As a result, the range of digital equipment available to dentists has increased significantly. New technologies in dentistry offer patients modern treatments for their dental problems.

An increasing number of dentists and laboratory technicians are adopting a digital workflow, and the uptake of digital technologies has been more rapid for dental laboratories than dental practices. For many of them, the high cost of equipment, apparently long learning curves, and selecting the most suitable and up-to-date equipment are still reasons for hesitation. Like all revolutions, the digital revolution has started slowly while the technology has grown and matured.

During the last several years, we have seen an increasing number of new intra-oral scanners in the dental market. With these, dentists are able to achieve faster, more accurate digital impression taking, which is more comfortable for patients. Systems rely on a single image and video camera to record the digital file that is the foundation for an accurate outcome. There is no doubt that in the near future intra-oral scanners will be cheaper, smaller and integrated into dental units.

Intra-oral scanners are a wedge technology for in-office CAD/CAM solutions. With the adoption of this technology, dentists will be able to produce same-day single-unit restorations using in-office milling systems. As the majority of restorations fabricated for dental offices are single-unit restorations and three-unit bridges, in-office milling machines will become increasingly indispensable equipment in dental offices. Therefore, the market for chairside milling will grow at a faster pace than today. New companies are gaining a large share of the market, which is currently led by CEREC and E4D.

Chairside milling systems will be the impetus for new millable material. A large spectrum of materials that can be processed via digital options are available. Companies are investing significant amounts in developing new millable materials. Eventually, analogue methods and materials will be replaced by fully digital workflows.

Dental laboratories have been quick to make the transition from analogue to digital. They will be a valuable resource for dentists, offering immediate restoration to dental practices in close proximity. Nothing can take the place of a dental technician and a dentist working together to manufacture high quality restorations; there is still no replacement for skilled professional handwork on the horizon.

In this decade, dental CAD/CAM has reached a very high level of development. According to forecasts, more than 50 per cent of dental services will be performed using CAD/CAM technology by 2050. This figure demonstrates the importance of keeping pace with this fast moving technology. As the leading companies in dentistry are investing in this area, we would be wise to investigate it for our future.

I can say without question that the age of CAD/CAM dentistry is here. It is time to be part of it.

Prof. Selim Pamuk
Founder of the Society of Digital Dentistry in Turkey
President of the Turkish Academy of Esthetic Dentistry


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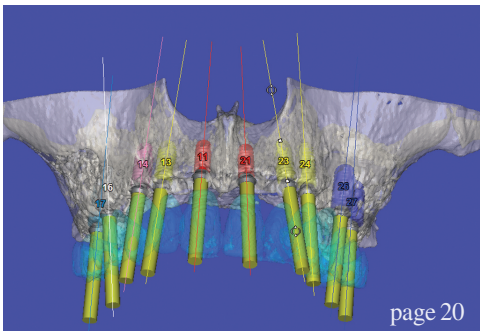
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Utilizing the Tempcap abutment with CAD/CAM

Combination of Tempcap, in-office CAD/CAM and e.max allows for final restoration

Author_Dr Les Kalman, USA

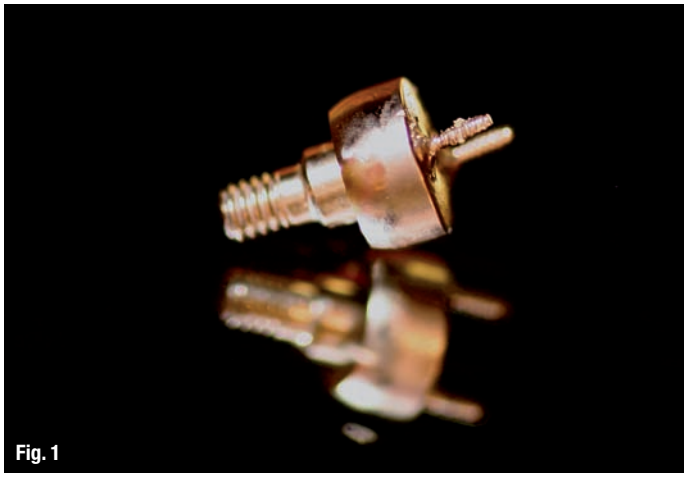
Fig. 1

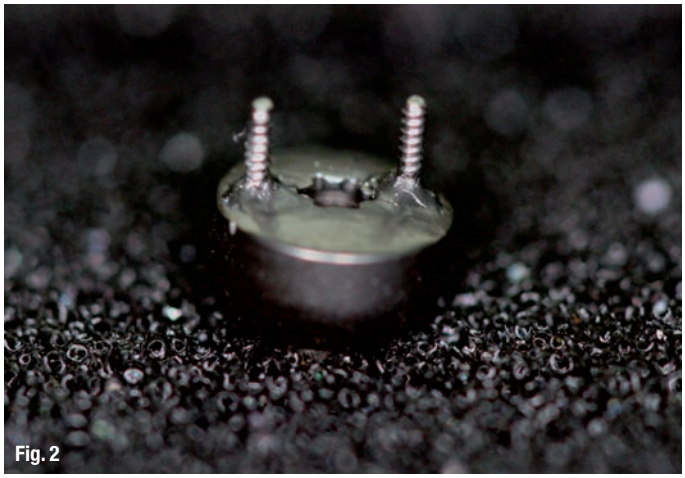
Fig. 2

Fig. 1_Tempcap abutment.
Fig. 2_Retentive pins.

_ce credit CAD/CAM

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_Abstract

The E4D in-office CAD/CAM unit *(Editorial note: Planmeca E4D Technologies)* has been employed in an investigative laboratory study to design and mill an unconventional IPS e.max restoration that would be coupled with the Tempcap as a final implant-supported crown. The combination of the Tempcap, in-office CAD/CAM procedures and IPS e.max allows the clinician to create an immediate final restorative product with ideal characteristics.

The procedure is a simple, efficient and effective solution for the restoration of implants.

_Introduction

The temporization of a dental implant following surgery, particularly in the anterior region, is a necessary procedure. The temporization allows for surgical healing, preservation of the gingival architecture and, most important, replacement of a tooth in the edentulous space for patient acceptance. Several techniques for the temporization exist, but the process has proved to be time-consuming and frustrating. The Tempcap abutment and the process for temporization were created to provide a simple yet effective approach.[1] With the advent of CAD/CAM technology and e.max, the potential of the Tempcap to act as a final abutment seemed likely and suitable for investigation.

_Background

Following the surgical placement of a dental implant, several requirements must be met to maximize healing and osseointegration of the implant body to bone:

_Minimal forces, if any, should be exerted on the implant body, permitting proper healing and preventing a non-osseous union.[2]
_The gingival architecture must be managed meticulously to prevent contamination, minimizing the risk of peri-implantitis and possible failure.[3]

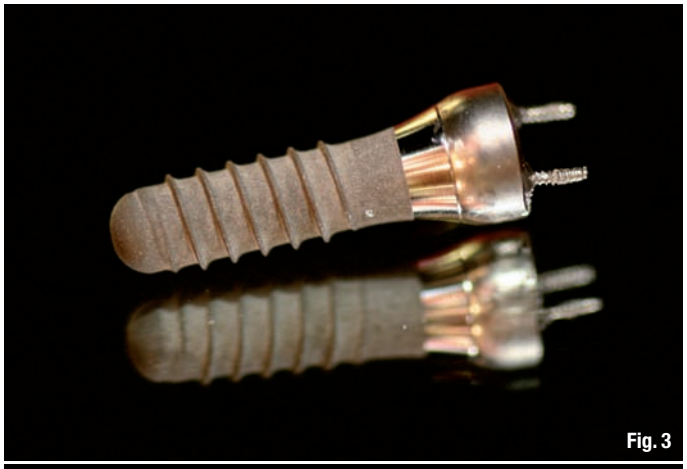
Fig. 3


Fig. 4


Fig. 5


Fig. 6

_There must be sufficient time for the process of osseointegration.[4]
_Temporization and immediate restorations should not violate these factors.[5]

The Tempcap is a healing cap and restorative platform combined (Fig. 1). It has an all-metal construction, and it contains two to three retentive pin projections (Fig. 2). Tempcap is available in different widths and heights to accommodate different implant sizes (Fig. 3) and is compatible with existing instrumentation (Fig. 4).

The function of the Tempcap is:

_to allow for optimal gingival healing;
_prevent contamination of the surgical field;
_minimize forces and micro-vibrations on the implant;
_facilitate the simple yet successful restoration of the implant (Fig. 5).

CAD/CAM stands for computer-aided design and computer-aided manufacturing. CAD enables the individual to digitally capture an image of a pre-

Fig. 3_Tempcap with Straumann implant.
Fig. 4_Use of existing instruments.
Fig. 5_Temporization form and function.
Fig. 6_Tempcap on soft-tissue model with Ankylos implant (DENTSPLY Implants).
Fig. 7_Digitization with E4D camera (Editorial note: Planmeca E4D Technologies).
Fig. 8_Digitized images of arch.


Fig. 7

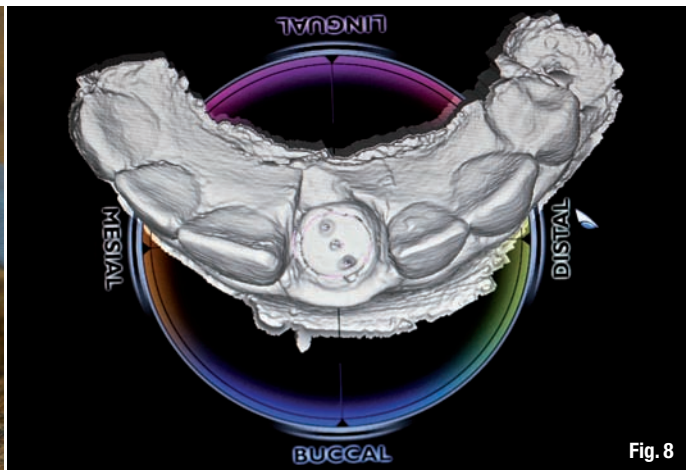

Fig. 8

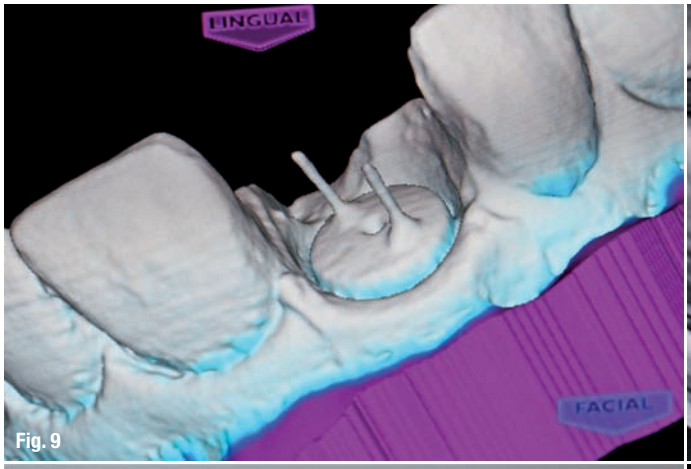

Fig. 9

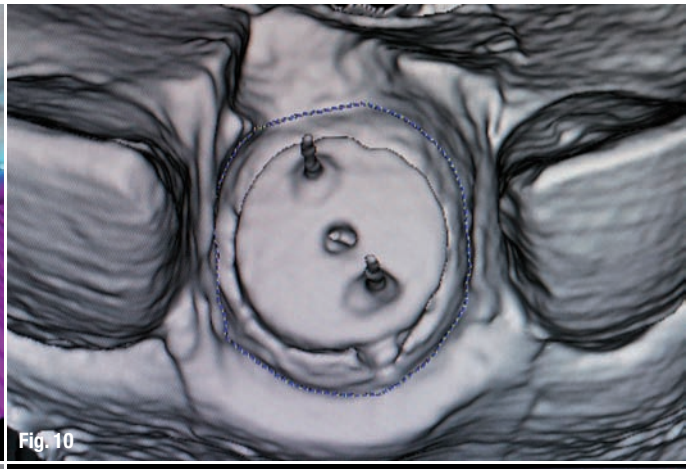
Fig. 10

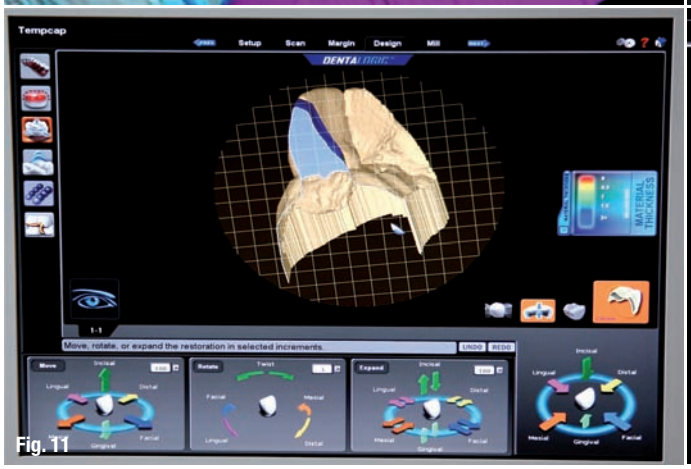

Fig. 11

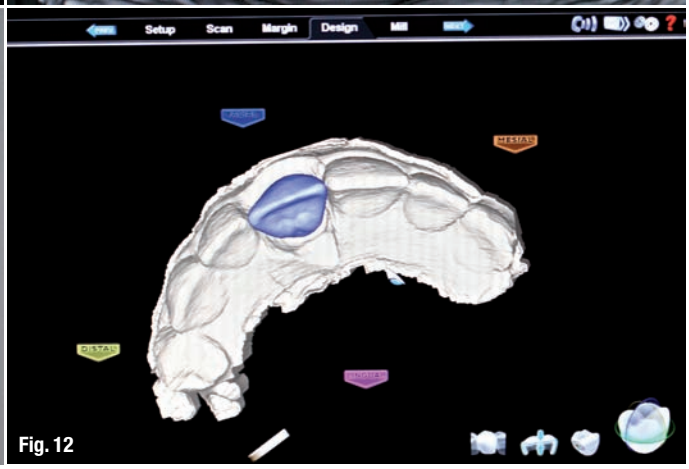

Fig. 12

Fig. 9_Tempcap digitized.
Fig. 10_Digitized delineation of Tempcap.
Fig. 11_Development of emergence profile.
Fig. 12_Occlusal view of restoration.

pared tooth or structure and then design an indirect (out of the mouth) restoration by using software.[6]

After the ideal restoration has been produced, the design is then fabricated out of a material by a milling machine. In-office E4D units *(Editorial note: Planmeca E4D Technologies)* are currently available to allow for immediate chairside fabrication without the use of a commercial laboratory.

IPS e.max (Ivoclar Vivadent) is a relatively new metal-free dental material used in indirect restorations. It is an aesthetic material composed of lithium disilicate and has ideal physical and aesthetic properties, allowing it to be the first choice for CAD/CAM restorations. IPS e.max has strength second only to gold and has the ability of detailed CAM production.[7]

_Methodology

The Tempcap was selected and placed on an Ankylos (DENTSPLY Implants) implant body (master cast with soft tissue) (Fig. 6). Digitization was

Fig. 13_Lingual view of restoration.
Fig. 14_Facial view of restoration.

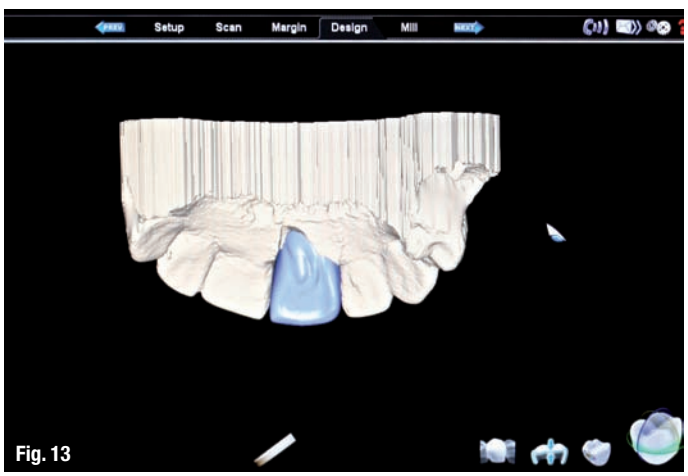

Fig. 13

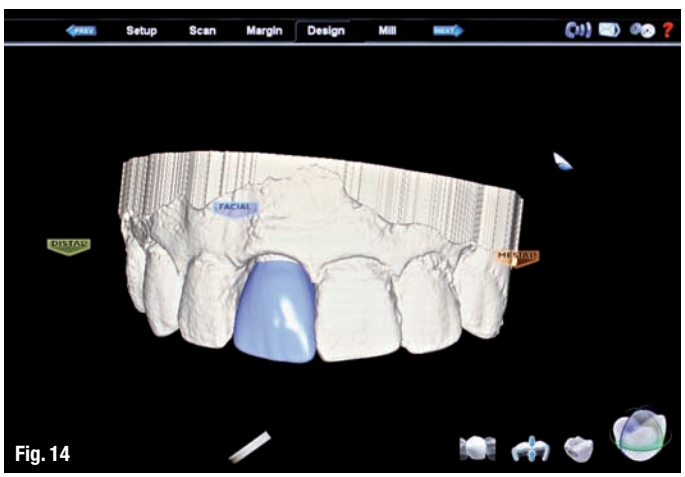

Fig. 14

Fig. 15

Fig. 16


Fig. 17

Fig. 18

achieved by using an E4D camera *(Editorial note: Planmeca E4D Technologies)* (Fig. 7), in which several images were captured to compile an accurate image (Figs. 8 & 9). CAD design was used with E4D software *(Editorial note: Planmeca E4D Technologies)* to determine and delineate margins (Fig. 10).

Tooth design was initiated incorporating several parameters:

_ideal aesthetics and emergence profile (Fig.11);
_adequate proximal contacts;
_appropriate occlusal scheme;
_material thickness requirements;
_internal surface morphology to adapt to Tempcap;
_design that can be milled via CAM technology.

Numerous design iterations were required to achieve the desired design requirements (Figs. 12–14). IPS e.max was selected for milling (Fig. 15) and was executed by an E4D CAM unit *(Editorial note: Planmeca E4D Technologies)* (Fig. 16). Milling limitations, such as bur contact and pros-

Fig. 15_IPS e.max CAD/CAD block (Ivoclar Vivadent).
Fig. 16_E4D CAM unit *(Editorial note: Planmeca E4D Technologies).*
Fig. 17_Milled IPS e.max restoration.
Fig. 18_Ivoclar furnace.

Fig. 19_Staining and glazing.
Fig. 20_Facial aspect of final restoration.

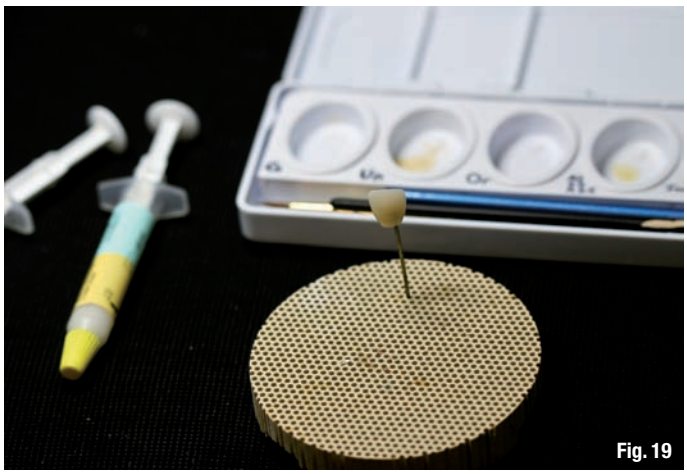
Fig. 19


Fig. 20