Fully digital implant-prosthetic reconstruction in dental office

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Abstract

Intraoral impression, occlusion field registration, 3D print model and CAD/CAM implant prosthetic rehabilitation started to be an important technique in dental practice. Implant-supported CAD/CAM crowns achieved the best possible long-term results from an aesthetic point of view with the least possible distress for the patient. The goal of our study is to demonstrate connection of intraoral scanning with 3D print and with CAD/CAM crowns preparation.

Background and Aim

Precise documentation of the oral cavity and proportions in the face area is crucial not only in dentistry, e.g. prosthetics, orthodontics or orthognathic surgery planning, but also in implantology. Current imaging methods together with dental impressions enable a satisfactory imaging of tissues, which is required for a given purpose. Mainly dental impressions and plaster casts are used for reproduction of the situation in the oral cavity. Usage of an intraoral scanner is one of the new possibilities how to document and preserve 3D data about patients. Intraoral scanning is a non-invasive method, well tolerated by patients and more time effective compared to traditional dental impressions with dental impression trays and appropriate impression material. A record from the intraoral scanner consists of single pictures and video-sequences.

3Shape TRIOS®

Intraoral scanner	Trueness (Accuracy)
3Shape TRIOS®	6.9 ± 0.9 µm
Carestream CS 3500	9.8 ± 0.8 µm
iTero®	9.8 ± 2.5 µm
3M™ True Definition	10.3 ± 0.9 µm
Planmeca PlanScan®	30.9 ± 10.8 µm
Sirona CEREC Omnicam	45.2 ± 17.1 µm

Hack and Patzelt, 2015 Issues of the ADA Professional Product Review, Volume 10 Issue 4, September 25, 2015, American Dental Association, University of Freiburg, Baltimore College of Dental Surgery
Ender et al, Clin Oral Investig. Nov 7 2015 E-pub, University of Zurich
Ender et al, J Prosthet Dent. Nov 6 2015 E-pub, University of Zurich
Boeddinghaus et al, Clin Oral Investig

The aim of study was to evaluate the precision of fully digital implant-prosthetic reconstruction ASTRA TECH Implant System™ EV in dental office using Trios® 3Shape Dental Systems digital intraoral scanner, 3D print and CAD /CAM techniques to create prosthetics components.

Methods and Materials

Prospective study of 20 implants AstraTech EV was prepared. The range of patients at implants surgery moves from 18 to 35 years. Multidisciplinary therapy by the surgeon, orthodontist, and prosthodontist before implant insertion was monitored. 3Shape TRIOS® 3 - a three in one digital impression solution and 3D printed model were used before computer-aided design and computer-aided manufacturing. The CAD /CAM techniques - abutments (Dentsply Int.), Zircon Zahn (Prettau® Zirconia) were used to establish a framework. The aesthetic appearance was checked mainly from the point of view vertical position of framework and loss of bone marginal support. For every patient we checked step upper and lower jaw digital impression, occlusion, create prosthetics components including digital models in articulator, and CAD/CAM reconstruction. Rescanning of 3D print model and X-ray image after reconstruction helped to evaluate the results.

Implantation loco 45 - AstraTech EV 4,2 / 12 mm.

Patient rehabilitation.

Results

Case reports demonstrate the functional and esthetic results. A good or acceptable aesthetic appearance at the last observation was found in 98% subjects. 3D reconstruction of occlusion helped us to prepare optimal occlusion without problems with registration material. Also vertical position of the implant-supported crown was precise registered, especially in subjects with no incisor contact. Rescanning process and X-ray image after reconstruction confirmed the acceptance of digital impression and 3D print model in clinical praxis.

Patient rehabilitation step by step:

31years old women – generally healthy - AstraTech EV 4,2 / 12 mm loco 36.

Status 3-months post implantation.

3Shape TRIOS® 3 - see scanning process.

https://youtu.be/7jMP_ZiMeyw

Virtual model of lower dental arch.

Implant position in 3D virtual model with scan body.

3D print - upper and lower model.

3D print model with gingival mask.

Implant hybrid base in situ.

Computer-Aided Crown Design.

Full ceramic crown with hybrid base.

X-ray image after reconstruction.

Implant 36 in situ.

Conclusions

The aesthetic and functional result has been achieved. Very important was that during patient rehabilitation no need to change occlusal field adjustment. No biological and mechanical complications were found. Fully digital implant-prosthetic reconstruction provided a smooth, complication free and time effective treatment alternative to the conventional materials and methods. This system guaranties long-term and high functional and aesthetic stability of results in dental office.

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