JCBPS; Section B; August 2017 – October, 2017, Vol. 7, No. 4; 1307-1314. E- ISSN: 2249 –1929

[DOI: 10.24214/jcbps.B.7.4.130714.]

Journal of Chemical, Biological and Physical Sciences

An International Peer Review E-3 Journal of Sciences

*Available online at*www.jcbsc.org

Section B: Biological Sciences

CODEN (USA): JCBPAT Research Article

CAD / CAM dental implant planning and surgical guide fabrication

Angelina Vlahova[1], Viktor Hadzhigaev[2], Christo Kissov[3], Georgi Todorov[4], Rada Kazakova[5], Stefan Zlatev[6]

[1] Assoc. Prof., PhD, DMD, Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria

[2] Assist. Prof., DMD, Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria

[3] Prof., PhD, DMD, Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria

[4] Prof., PhD, DMD, Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria

[5] Assist. Prof., PhD, DMD, Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria

[6] Assist. Prof., DMD, Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria

Received: 13 September 2017**; Revised:** 22 September 2017; **Accepted:** 30 September 2017

Abstract: Modern Prosthetic Dentistry and Dental Implantology can benefit from the use of digital technologies, in particular CAD / CAM. The aim of this study is to present dental implant planning and surgical guide design and fabrication. Preliminary implant planning is the key of the final Prosthodontics success.

Keywords: CAD / CAM, dental implant planning, surgical guide

INTRODUCTION

CAD / CAM technologies are a part of the modern Aesthetic Dentistry and in particular of Dental Implantology [1]. Preliminary planning of the implants placement is the key of the final success of the Prosthetic treatment [2]. CAD / CAM technologies have opportunities for implant planning, surgical guide fabrication and design of provisional and permanent implant-supported restorations[3].

The aim of this study is to present CAD / CAM dental implant planning and surgical guide fabrication.

MATERIAL AND METHODS

Special CAD / CAM applications, such as 3Shape Implant Studio®, present opportunity for a combination between the data obtained by a cone beam computer tomography (CBCT) **(Fig. 1)** and an intraoral scan **(Fig. 2).** Optimal implants position planning can be facilitated by making the CBCT of the patient wearing a special denture with radiocontrast teeth **(Fig. 3).** After that the prognostic outlines of the teeth crowns positions of the final restoration are visible **(Fig. 4).** First, the CBCT scan in DICOM format and the intraoral scans have to be imported and compared one to another **(Fig. 5).** Second, the implant system with its modifications - the length, diameter and the type of every implant are chosen from the Implant Library **(Fig. 6).** The software ensures an individual choice and digital placement of every implant **(Fig. 7).** After the virtual placement of all the implants **(Fig. 8)** a surgical guide can be designed **(Fig.9).** The procedure is finalized with an appropriate drilling protocol with information for the type, diameter and length of the implants, the types, length and diameters of the drills, their speed and use sequence and etc. The surgical guide made by 3D printing of medical polymer with metal sleeves for drills support is present on **Fig. 10**.

Figure 1: CBCT scan.

Figure 2: Intraoral scan.

Figure 3: Removable denture with radiocontrast teeth made of acrylic resin mixed with $BaSO_4$.

Figure 4: Outlines of the prognostic teeth crowns of the final restoration visible on the CBCT scan.

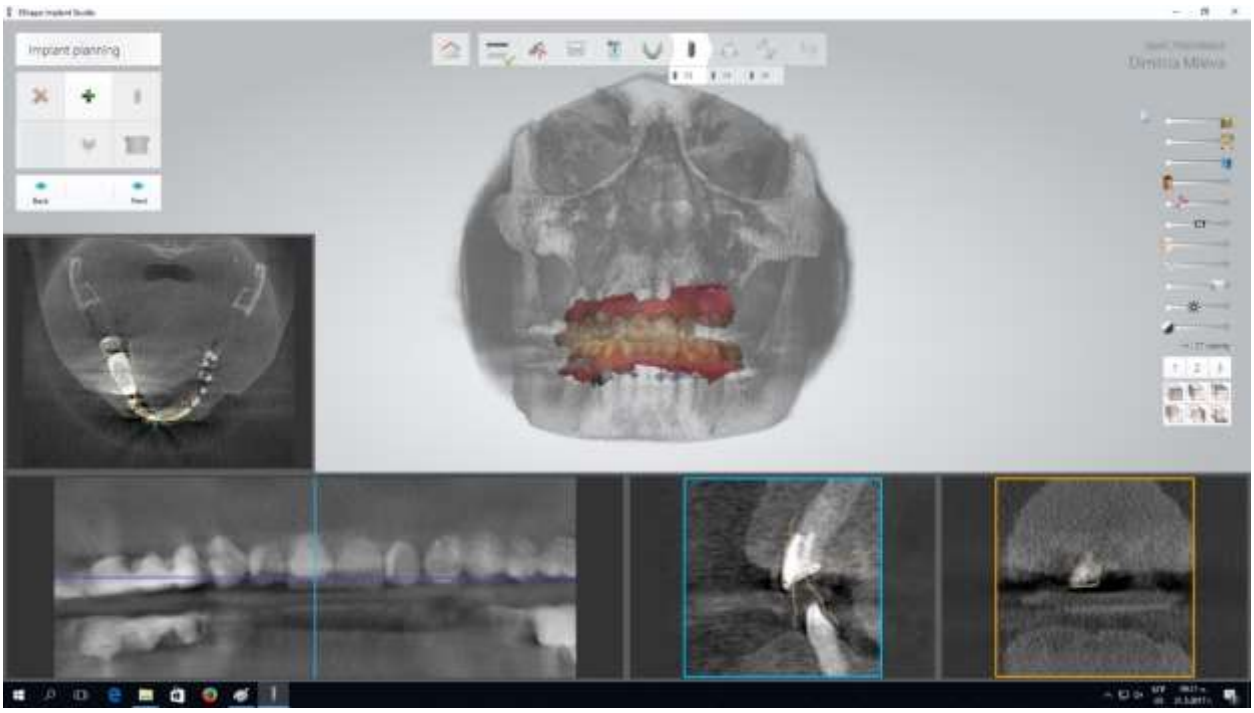

Figure 5: Apposition between the data of the CBCT and the intraoral scans**.**

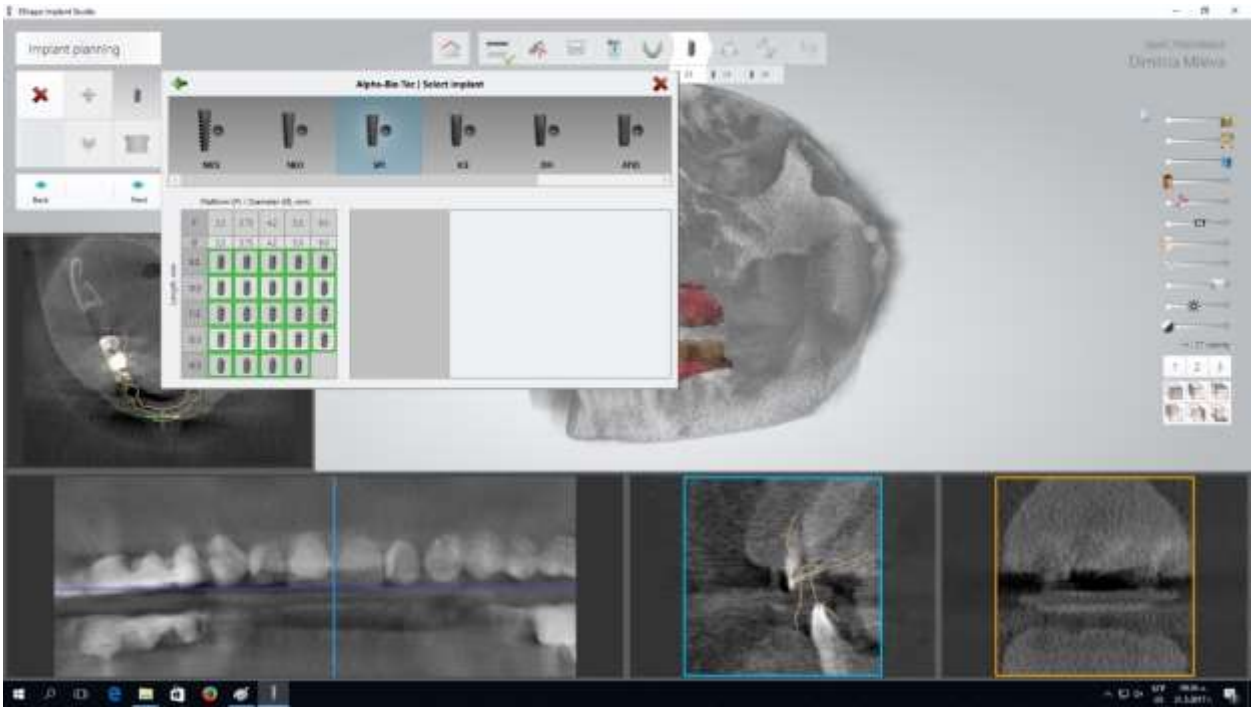

Figure 6: Implant Library.

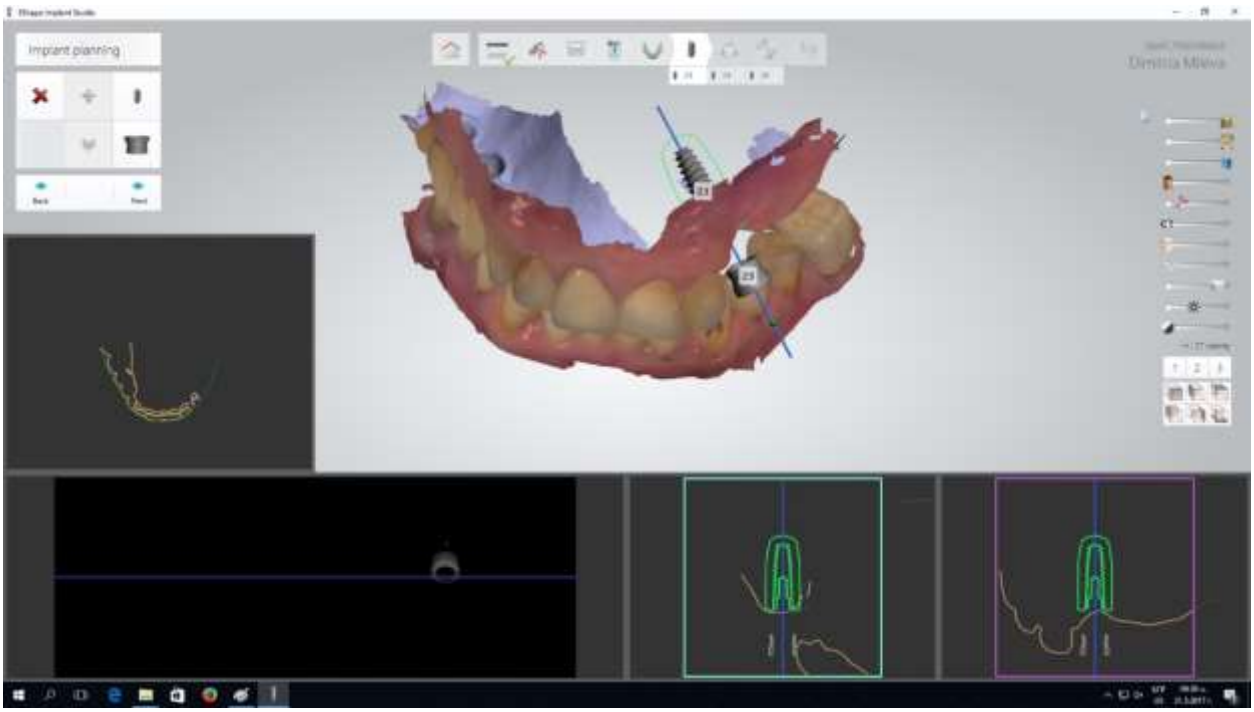

Figure 7: An individual choice and a digital placement of every implant.

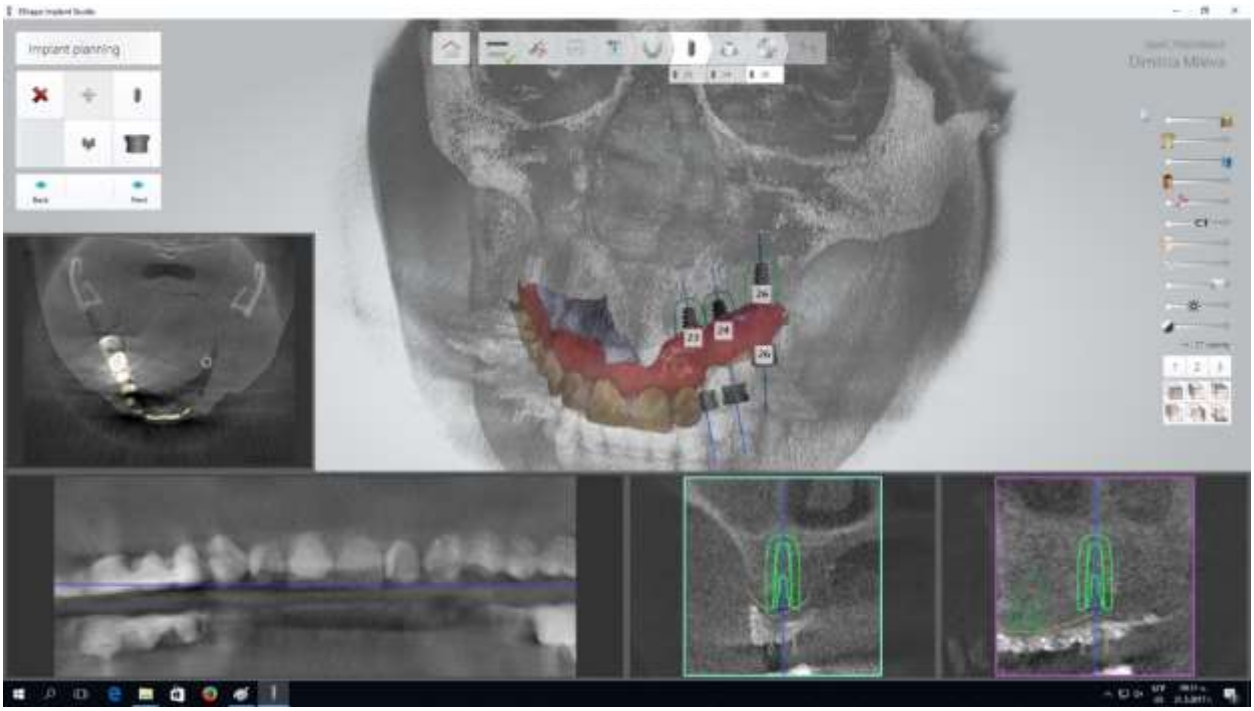

Figure 8: Virtual establishment of the optimal positions of all the implants.

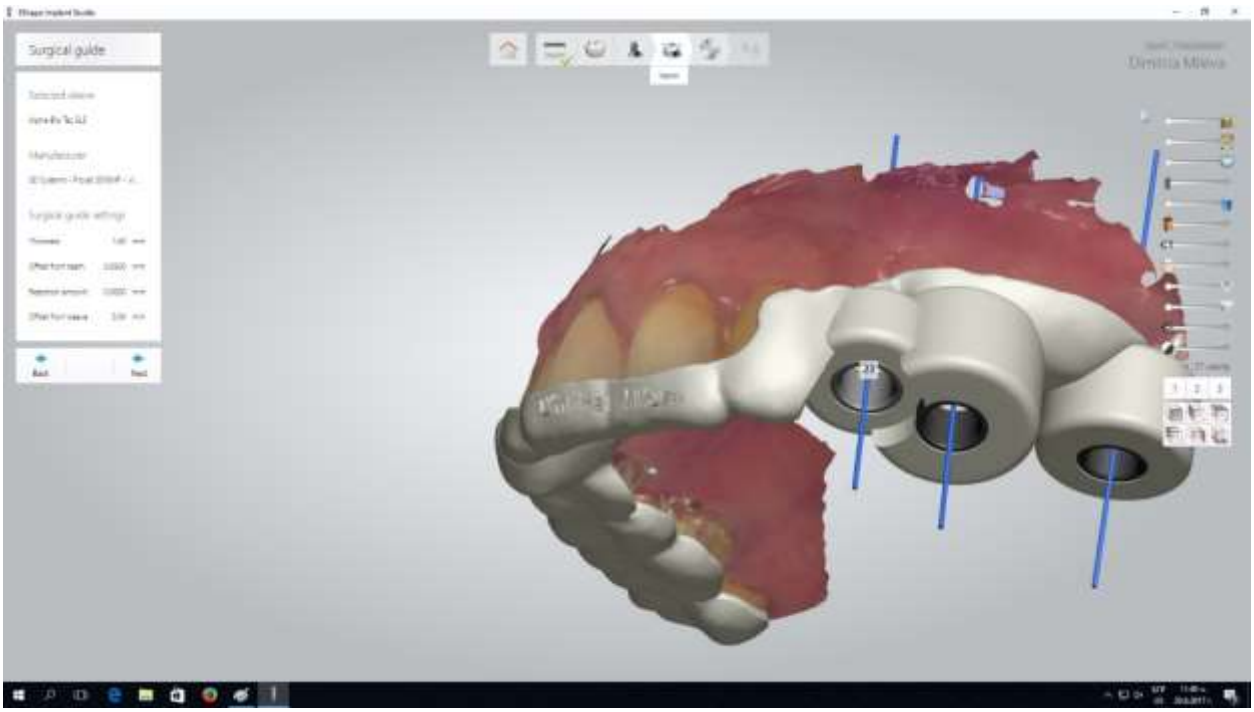

Figure 9: Surgical guide design.

Figure 10: Real surgical guide made by 3D printing of medical polymer with metal sleeves for drills support.

RESULTS AND DISCUSSION

The surgical procedure controlled by the preliminary digital planning and surgical guide is easy and predictable and the risk of complications is minimized.

CAD / CAM implant planning and surgical guide fabrication is an extremely precise method [4] and ensures optimal implants positioning according to the Prosthodontic needs [5]. But this method requires additional examinations, such as CBCT and intraoral scans, and needs additional instruments (special elongated surgical drills for implant placement with stoppers) and accessories (3D metal sleeves for surgical guides). All of these increase the fee of the dental treatment.

CONCLUSION

In conclusion, we are recommending CAD / CAM implant planning and surgical guide fabrication in every case when the patient has indications and good motivation for realization of this method.

ACKNOWLEDGEMENT

This publication is partially funded by a grant of Medical University – Plovdiv, Bulgaria (University Project № 03 / 2017). The clinical case was made in the CAD / CAM Center in the Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria.

REFERENCES

1. Хр. Кисов, Р. Казакова, А. Влахова. CAD/CAM революцията в стоматологичната професия. СДК и НУС, 2014, 13, 2, 39-42.
2. RE Matta, B Bergauer, W Adler, M Wichmann, HJ Nickenig. The impact of the fabrication method on the three-dimensional accuracy of an implant surgery template. J Craniomaxillofac Surg. 2017 Jun;45(6):804-808
3. L Arcuri, C Lorenzi, F Cecchetti, F Germano, M Spuntarelli, A Barlattani. Full digitalworkflow for implant-prosthetic rehabilitations: a case report. Oral Implantol (Rome). 2016 ,8(4):114-121
4. A Lanis, O Álvarez Del Canto. The combination of digital surface scanners and cone beam computed tomography technology for guided implant surgery using 3Shape implant studio software: a case history report. Int J Prosthodont.2015,28(2):169-78.
5. A. Vlahova, V. Hadzhigaev, R. Kazakova, S. Alexandrov, D. Shopova. Prosthetic complications in implant treatment: A clinical case. Oral Presentation. 18th Congress of BASS, Skopje, Macedonia, 2013, 25 - 28. 04. 2013. Abstract Book, p. 158

Corresponding author: Assoc. Prof. Angelina Vlahova, PhD, DMD

Department of Prosthetic Dentistry, Faculty of Dental Medicine,
Medical University – Plovdiv, Bulgaria
E-mail: a_vlahova@yahoo.com.
Online publication Date: 30.09.2017