*Corresponding author

Oscar Figueras-Alvarez, Universitat Internacional de Catalunya, Barcelona, Spain

Short Communication

A Digital Technique to Fabricating Removable Complete Dentures with a Printed Denture Duplicate from a Digital Scan of Patient's Old Complete Denture

Oscar Figueras-Alvarez*, Magí Brufau-de-Barberà, Arnau Brufau-Cochs, Josep Cabratosa-Termes and Francisco Real-Voltas

Department of Prosthodontics, Universitat Internacional de Catalunya, Barcelona, Spain

Abstract

The intraoral digital scan consists of stitching many photographs to build a three-dimensional mesh, which may not be suitable for mobile tissues, resulting in challenging for making removable complete dentures. This technique describes a straightforward protocol for making removable complete dentures by using a printed denture duplicate obtained from the digital scan of the patient's old denture.

Introduction

The use of the intraoral scanner is expanding in clinical practice due to advantages such as saving shipping and manufacturing time and impression material [1-6]. Most patients prefer a digital scan to a conventional impression [1-2,5]. The intraoral digital scan consists of stitching many photographs per second to build a three-dimensional mesh [7-8]. This system works well to register static tissues such as teeth or attached gingiva. However, it is not so successful for mobile tissues, such as those at the buccal vestibule and the floor of the mouth, [9] resulting in challenging for making removable complete dentures. This protocol aims to show a straightforward protocol for making removable complete dentures by using a printed denture duplicate obtained from the digital scan of the patient's old denture.

Technique

a. Mold the old patient's denture border with modeling plastic impression compound (Impression Compound; Kerr, Brea, CA). Functionalize the buccal vestibule by activating the frenums and the muscle insertions and pulling the lip. Functionalize the lingual part by asking the patient for moving the tongue up, out, and to the right and left.

b. Make the final impression in light occlusion using light body polyvinylsiloxane (PVS) silicone (Virtual light body; Ivoclar Vivadent, Schaan, Liechtenstein), white-zinc oxide paste (Impression Paste; SS White, Lakewood, NJ), or polysulfide (Permlastic; Kerr, Brea, CA). If light body PVS silicone or polysulfide is used, previously apply the adequate adhesive. After the setting of the impression material, remove the material that looks like excess, which is very fine or extends beyond a reasonable margin. Vestibular leftovers may be essential to increase retention on many occasions. Remove only the excess material.

c. Make a 360-degree digital scan with an intraoral scanner (Trios 3; 3Shape, Copenhagen, Denmark) of the patient's old denture with the modeling plastic impression compound and the final impression. A 360-degree digital scan is a digital scan of both the outer and inner (basal) part of the removable complete denture (Figure 1). It is performed extra-orally with an intraoral scanner. After the scanning, remove the impression materials, and give the denture back to the patient. In case of making a removable complete denture only in one arch, make an intraoral digital scan of the antagonist.

d. Make a 3D impression of the scanned denture and the antagonist. If the 3D printer is not available, request printing to the dental laboratory or a 3D printing center. Provide the printed denture duplicate with an occlusion rim by applying wax (Modern materials bite blocks; Kulzer, South Bend, IN) or light-curing resin (Triad VLC; Dentsply Sirona, York, PA) on the printed teeth (Figure 2). If the light-curing resin is used, apply adhesive (Triad Bonding Agent; Dentsply Sirona, York, PA) previously.

e. Register all necessary intraoral and extraoral parameters in the printed denture duplicate by modeling the occlusion rim. Record the occlusion with the condyles in centric relation with the adequate vertical dimension of occlusion, obtained previously by substracting 2 to 4 mm from the rest vertical dimension. Adjust the occlusal plane and the buccal corridors exposure and model the wax or resin to achieve adequate lip support. Mark on the wax or resin rim of the printed denture duplicate, with a wax knife or a felt pen, the midline, the line of the outermost part of the nasal wings, the lip line at rest, and the lip line in the maximum smile.
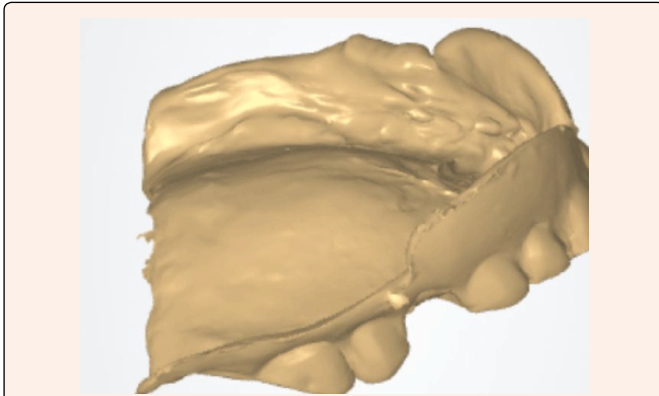
Figure 1: 360-degree digital scan of patient's old denture with modeling plastic impression compound and final impression.
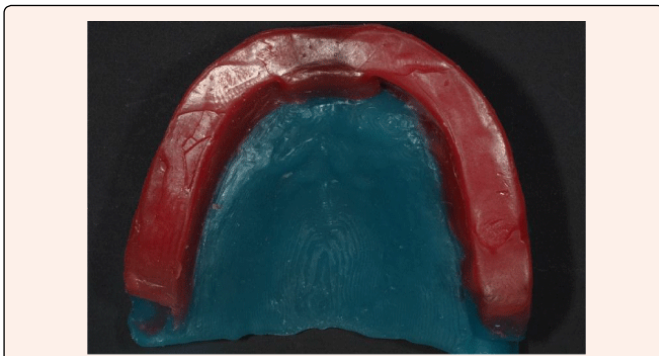
Figure 2: Printed denture duplicate with wax occlusion rim.

Figure 3: Trial denture mounted in semi-adjustable articulator.

Figure 4: Detail of trial denture in printed denture duplicate.

f. Make a facebow record if customized articulator mounting is desired. Ensure that the upper arm of the facebow is parallel to the pupillary line or the ground to avoid canting of the occlusal plane. Select teeth shape, and color.

g. Box the adjusted printed denture duplicate with box wax (Modern materials boxing wax; Kulzer, South Bend, IN) or by placing it in a standard impression tray with alginate (Cavex cream alginate; Cavex, Haarlem, The Netherlands). Pour it with type IV gypsum (Vel-Mix classic die stone; Kerr, Brea, CA). Mount the adjusted printed denture duplicate in a semi-adjustable articulator with the facebow record or a standard positioner. The values of the condylar guidance and the Bennett angle can be programmed with protrusive and lateral intraoral records, respectively. They can also be adjusted with the articulator recommended standard values.

h. Arrange teeth at the adjusted printed denture duplicate tray following the recorded parameters. (Figure 3 & 4).

i. Perform trial denture, checking the adequate static and dynamic occlusion, the correct vertical dimension of occlusion, the satisfactory buccal corridors exposure, and the pleasing aesthetics both at rest and at smiling.

j. Flask the teeth try-in and process the complete denture with heat-activated polymerizing resin (Polihot; Polident, Volcja Draga, Slovenia). Finish and polish.

k. Deliver the finished denture to the patient. Check the occlusion and the other intraoral and extraoral parameters described in the previous steps. Ensure the lack of pressure areas. Program the follow-up.

Discussion

This manuscript describes a protocol for making new complete dentures from old ones using a digital scan, simplifying impressions making. This protocol saves impression material and provides the patient with a better experience [5]. A limitation of this technique is the need for an adequate extension of mucosal support in the patient's existing denture, which will be replicated at the printed denture duplicate. The use of a semi-adjustable articulator is recommended since it allows a standard or customized mounting, which provides a more precisely adjusted occlusion [10-12]. A classic confection of the complete prosthesis with processes such as flasking, wax elimination, acrylic packing or processing, deflasking, finishing, and polishing, is described in this protocol. Digital scans can currently be mounted digitally in a virtual articulator by using either a facial scan or a CBCT scan [13,14]. Then, virtual teeth arrangement can be performed digitally, with the help of extraoral photographs or facial scans [4,6,13-14]. At that time, the designed denture can be milled from blocks of acrylic resin (Pink CAD/CAM disk; Polident, Volcja Draga, Slovenia) or pink and white PMMA materials (Polident full denture PMMA disk; Polident, Volcja Draga, Slovenia), thus obviating the need of physical casts and the processing with heat-activated polymerizing resin [15,16] When using pink and white PMMA disks, a milling strategy is needed. The disk should be placed in such a position that when milling teeth, the disk is at the white portion, and when grinding the basal part of the denture, the disk is at the pink part [15]. However, nowadays, these methodologies are not habitually used because they are not within reach of most dental laboratories since they require a significant economic investment. Nevertheless, CAD/CAM technologies for fabricating complete dentures will become more prevalent in a nearby future [15]. The technique described in the manuscript is currently accessible to any dental laboratory, allowing the incorporation of complete dentures fabrication into a digital flow.

Summary

This protocol, accessible to the majority of dental laboratories, describes a straightforward protocol for making removable complete dentures with the use of a printed denture duplicate obtained from the digital scan of the patient's old denture, overcoming the difficulty of intraorally scanning mobile tissues.

References

1. Can Wang, Yi-Fei Shi, Pei-Jin Xie, Jun H (2020) Accuracy of digital complete dentures: A systematic review of in vitro studies. J Prosthet Dent S0022-3913(20): 30047-30050.

2. Cheng CW, Ye SY, Chien CH, Chun J, Panos P, et al. (2020) Randomized clinical trial of a conventional and a digital workflow for the fabrication of interim crowns: An evaluation of treatment efficiency, fit, and the effect of clinician experience. J Prosthet Dent S0022-3913(18)31031-X.

3. Kihara H, Hatakeyama W, Komine F, Kyoko F, Jun Y, et al. (2020) Accuracy and practicality of intraoral scanner in dentistry: A literature review, J Prosthodont Res 64(2): 109-113.

4. Hsu Mr, Driscoll CF, Romber E (2019) Accuracy of dynamic virtual articulation: trueness and precision. J Prosthodont 28(4): 436-443.

5. Kim JE, Hong YS, Kang KJ, Jee H, June S (2019) Accuracy of scanned stock abutments using different intraoral scanners: an in vitro study. J Prosthodont 28(7): 797-803.

6. Mai HN, Lee DH (2020) A digital technique to replicate edentulous arches with functional borders and accurate maxillomandibular relationship for digital complete denture. J Prosthodont 29(4): 356-359.

7. Prudente MS, Davi Lr, Nabbout KO, Ceilo J, Flavio D, et al. (2018) Influence of scanner, powder application, and adjustments on CAD-CAM crown misfit. J Prosthet Dent 119(3): 377-383.

8. Hong SJ, Lee H, Paek J, Ahran P, Kung R, et al. (2019) Combining Conventional Impressions and Intraoral Scans: A Technique for the Treatment of Complete Denture Patients with Flabby Tissue. J Prosthodont 28: 592-595.

9. Beretta M, Poli PP, Tansella S, Marco A, Meoli A, et al. (2020) Cast-free digital workflow for implant-supported rehabilitation in a completely edentulous patient: a clinical report. J Prosthet Dent S0022-3913(20): 30014-30017.

10. Palaskar JN, Joshi N, Gullapalli P, Pooja S (2020) Comparative evaluation of sagittal inclination of the occlusal plane with Frankfort horizontal plane in facebow transfers to semiadjustable and fully adjustable articulators. J Prosthet Dent 123(2): 299-304.

11. Yoon SN, Oh KC, Lee SJ, Jung S (2020) Tissue surface adaptation of CAD-CAM maxillary and mandibular complete denture bases manufactured by digital light processing: A clinical study. J Prosthet Dent S0022-3913(19): 30738-30733.

12. Dudani MT, Hindocha AD (2015) Correction of deviation of a partially resected mandible using a palatal ramp with the aid of a semi-adjustable articulator. J Prosthodont 24(1): 87-91.

13. Lepidi L, Hen Z, Ravida A, Lan T, Li J (2019) A full-digital technique to mount a maxillary arch scan on a virtual articulator. J Prosthodont 28(3): 335-338.

14. Hong SJ, Choi Y, Park M, Janghyun P, Ahran P, et al. (2020) Setting the sagittal condylar inclination on a virtual articulator using intraoral scan of protrusive interocclusal position and cone beam computed tomography. J Prosthodont 29(2):185-189.

15. Kalberer N, Mehl A, Schimmel M, Frauke M, Murali S (2020) CAD-CAM milled versus rapidly prototyped (3D-printed) complete dentures: An in vitro evaluation of trueness. J Prosthet Dent 121(4): 637-643.

16. Infante L, Yilmaz B, McGlumphy E, Israel F (2014) Fabricating complete dentures with CAD/CAM technology. J Prosthet Dent 111: 351-355.