

CONTINUING EDUCATION

The University of Southern California School of Dentistry Orthodontic Alumni Association will award 3 hours of Continuing Education credit for reading this issue of JCO and answering at least 12 of the following 16 questions correctly. Take this test online at www.jco-online.com (click on Continuing Education); payment of \$25 is required by VISA or MasterCard. The test may be retaken once if not passed on the first attempt. Correct answers will be supplied immediately, along with a printable certificate. Tests will be accessible on the JCO website for 12 months after publication. A subscription to JCO is not required to earn C.E. credits. For information, contact Dr. Robert Keim, (213) 740-0410; e-mail: editor@jco-online.com. CER No. 08-2006-18001.

Learning Objectives

After completion of this exercise, the participant will be able to:

1. Discuss the effects of model orientation in a three-dimensional printer on the accuracy of printed models.
2. Convert a raw, exported STL file to a processed digital model ready for 3D printing.
3. Describe the steps involved in converting to a fully digital office laboratory.
4. Outline a digital orthodontic workflow from intraoral scanning to appliance fabrication and delivery.

Article 1

Short, M.M.; Favero, C.S.; English, J.D.; and Kasper, F.K.: *Impact of Orientation on Dimensional Accuracy of 3D-Printed Orthodontic Models* (pp. 13-20)

1. A stereolithographic 3D printer works by means of:
 - a) laser activation of a photopolymeric resin
 - b) fused deposition modeling
 - c) polyjet photopolymerization
 - d) digital light processing
2. In this study, the greatest average absolute surface deviation was found in the:
 - a) Flat group
 - b) Perpendicular group
 - c) 20° group
 - d) control group
3. A higher z resolution is generally suggested for smooth transitions on surfaces with diagonal relationships to the print platform because:

- a) the models are printed at a constant layer height in the z direction
 - b) the xy resolution of the printer is influenced by the laser spot size and accuracy
 - c) the two-dimensional planes may show deviations along their external borders
 - d) both a and c
4. In this study, the 20° models required more time and resin to print because of:
 - a) more models fitting on the build platform
 - b) border inaccuracies affecting the cusp tips and incisal edges
 - c) the software adding a base and supports
 - d) both a and c

Article 2

Kravitz, N.D.; Groth, C.; and Shannon, T.: *CAD/CAM Software for Three-Dimensional Printing* (pp. 22-27)

5. STL is believed to be an abbreviation for:
 - a) stereolithography
 - b) Standard Tessellation Language
 - c) Standard Triangulation Language
 - d) any of the above
6. STL describes a 3D model's surface by using an array of linked triangles to:
 - a) recreate the surface geometry
 - b) represent colors
 - c) detect errors in the surface mesh
 - d) create an open-source code
7. Cleaning the mesh involves:
 - a) recreating the surface geometry
 - b) eliminating extraneous or redundant surface structures

- c) patching up voids in the impression material
 - d) scratching away excess artifacts with a knife
8. Hollowing the digital model involves:
- a) recreating the surface geometry
 - b) eliminating extraneous or redundant surface structures
 - c) removing internal filler, leaving only a shell for support
 - d) creating a text box and dragging it to the desired location

Article 3

Groth, C.; Kravitz, N.D.; and Shirck, J.M.: *Incorporating Three-Dimensional Printing in Orthodontics* (pp. 28-33)

9. Without a laser welder, the office laboratory will need to:
- a) send out impressions for model fabrication
 - b) replicate 3D-printed models in gypsum for appliance fabrication
 - c) solder metal appliances to avoid any model distortion
 - d) all of the above
10. Hard-drive storage capacity of the dedicated laboratory computer workstation should be at least:
- a) 16GB
 - b) 128GB
 - c) 500GB
 - d) 1.5TB
11. The first step in submitting a digital case to an outside lab is to:
- a) connect the intraoral scanner to the preferred destination laboratory
 - b) complete the online prescription
 - c) upload a sketch or photograph of the prescribed appliance
 - d) label the digital models for 3D printing
12. Compared to the use of gypsum casts, fabrication and delivery of a metal appliance made from

3D-printed models requires:

- a) four fewer appointments
- b) two fewer appointments
- c) the same number of appointments
- d) two more appointments

Article 4

Christensen, L.R.: *Digital Workflows in Orthodontics* (pp. 34-44)

13. Orthodontic portals that accept 3D intraoral scans include all of the following except:
- a) Invisalign
 - b) ClearCorrect
 - c) Incognito
 - d) OrthoCare
14. To make a customized maxillary expander from a digital design, the required parts are:
- a) laser-melted in cobalt chromium or titanium
 - b) laser-soldered to the anchor teeth
 - c) printed with a stereolithographic laser printer
 - d) attached with a laser placement device
15. In digital indirect bonding, the transfer trays are made by:
- a) printing them in a biocompatible flexible material
 - b) forming them over 3D-printed models with a pressure-forming material or silicone medium
 - c) sending the digital prescription to an outside laboratory
 - d) any of the above
16. Customized Memotain retainer wires are fabricated from a digital intraoral scan by:
- a) laser-melting in cobalt chromium or titanium
 - b) milling from a block of polymethyl methacrylate
 - c) machine-cutting from a flat sheet of nickel titanium
 - d) printing in a biocompatible flexible material