



Comparing the Surface Matching Accuracy of Conventional and CAD/CAM Methods of Fabricating Complete Denture Bases: A Pilot Study

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Introduction

Complete dentures can be processed using a variety of techniques. The ultimate goal of each technique is to produce a completed prosthesis that exhibits retention, stability, and support through minimal amounts of processing distortions. To optimize these desirable characteristics, it is important to determine which technique will provide the most accurate and predictable adaptation of the denture base to the edentulous ridge. Therefore, the purpose of this pilot study was to compare four processing techniques for the purpose of comparing the fit of the denture base to a master cast.

Material & Methods

- An edentulous maxillary master cast was fabricated with morphology that closely resembled an ACP Type A classification of residual ridge morphology (Figure 1a). This master cast was duplicated using silicone based duplication material, and twelve stone casts were made using a Type IV scannable dental stone. Each stone cast was then scanned using a Dental Wings iSeries scanner outputting an STL file.
- A master complete denture was fabricated and used to create a mold into which wax patterns of dentures were created to standardize thicknesses and tooth positions. Three dentures were fabricated for each of four techniques (Pack and Press, Pour, Injection, and CAD/CAM) in accordance with the material manufacturer's guidelines.
- After the dentures were processed (Figure 3), the intaglio surface of each denture was scanned (Figure 1b). The STL file of each denture was superimposed on the corresponding master cast STL file to create a surface color map using surface matching software, Geomagic Control (Figure 2).
- Using this software, measurements were made at 40 points for each of the twelve dentures (Figure 1c). These measurements provided the basis for evaluation of fit discrepancies in the following areas: posterior palatal seal, palate, crest of the ridge, 6mm from the denture border and at the apex of the denture border.



Figure 1. (a) Maxillary master cast (b) Denture in scanner (c) 40 measuring points

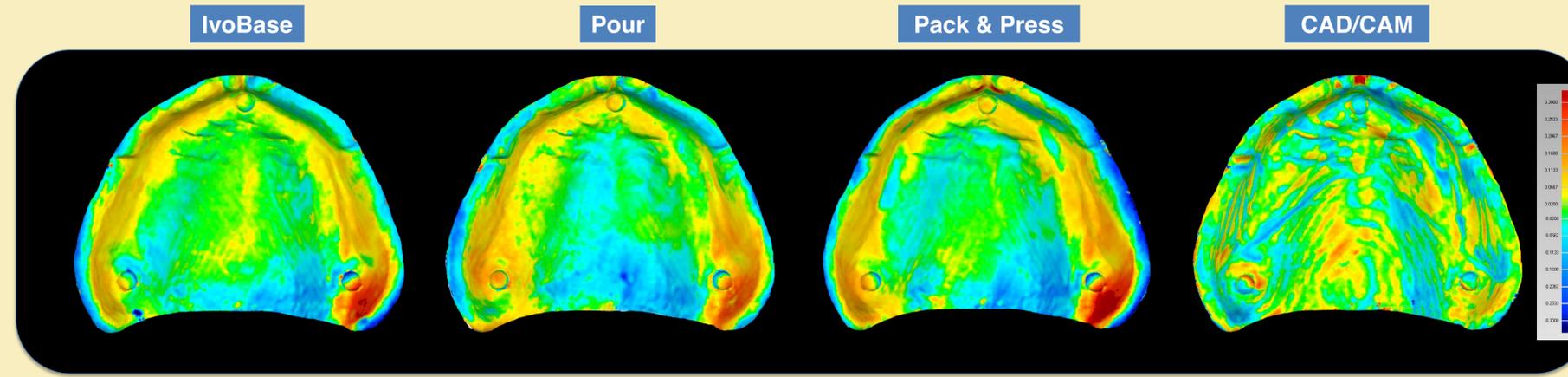


Figure 2. Color map of the surface matching differences between the four processing techniques and the casts on which they were fabricated. Yellow to red indicates impingement of denture base with cast. Blue indicates space between denture base and cast. Green indicates denture base is in contact with cast.

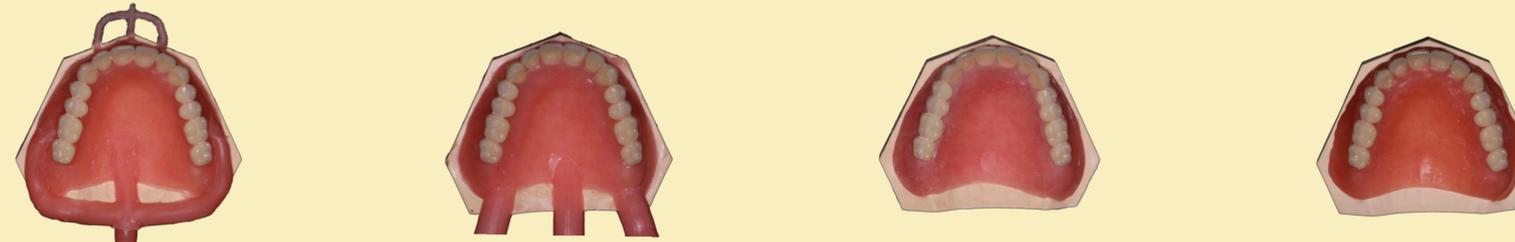
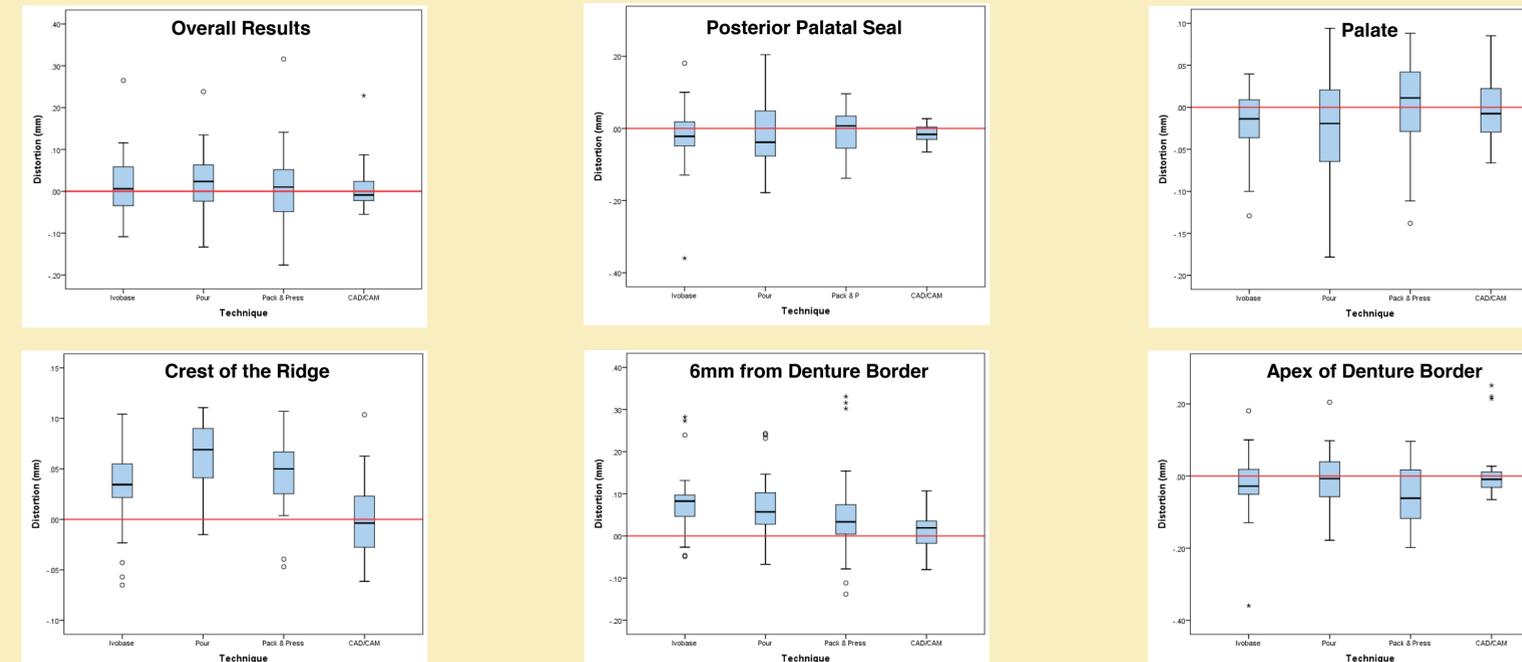


Figure 3. Example of dentures after processing with different techniques



Box Plot Results

- The red line represents contact between the denture base and the edentulous ridge.
- All measurements above the red line represent impingement of the denture base on the edentulous ridge.
- All measurements below the red line represent a space between the denture base and the edentulous ridge.
- CAD/CAM dentures exhibited closer adaptation to the edentulous ridge as determined by Overall Results, Posterior Palatal Seal, Crest of the Ridge, 6mm from Denture Border, and Apex of Denture Border.
- In the Palate, comparable adaptation occurred with all four techniques. With the Palate and Crest of the Ridge, the overall range of distortion was smaller with the IvoBase technique.

Discussion

- The posterior flange area, distal to the buccal frena, exhibited greater distortion with all of the conventional techniques. It is not known why the distortion was greater on one side of the denture than the other side.
- It is likely that better adaptation of the denture base to the master cast will lead to fewer sore spots for the patient and therefore fewer clinical adjustments.

Conclusions

- When measurements were made at specific locations throughout the denture base, the overall mean values were comparable. However, the range of "misfit" was greater with the conventional techniques than with the CAD/CAM denture bases.
- The overall color maps indicate that complete denture bases milled from pre-polymerized blocks of resin have more uniform adaptation than those fabricated using conventional techniques.
- The color maps indicate more uniform adaptation of the posterior palatal seal with CAD/CAM denture bases. Therefore the use of a posterior palatal seal may not be as advantageous with CAD/CAM denture bases as it is with conventional techniques.
- More research to come with a larger sample size

A Special Thank You

- Global Dental Science
- Dr. Nadim Baba
- Dr. Charles Goodacre