Pilot Crossover Clinical Trial Comparing 3DRPD'S Laser-Sintered Removable Partial Denture (RPDS) with Conventional Casted RPDS

Objective: The purpose of this study was to compare the clinical performance of removable partial dentures (RPDs) fabricated using traditional (casting) methods with a new generation of RPDs made with CAD/CAM laser-sintering technology by 3DRPD. The two types of RPDs were evaluated in a crossover clinical trial in which patient satisfaction, and prosthetic complications were assessed for both types of dentures.

Methods: Five patients participated in this 1 month pilot clinical trial. Each patient was randomly provided with one of the treatment options to try it for one month then replaced it (crossover) with the other option for an additional one month. The clinical performances of the conventional casted and laser-sintered RPDs were evaluated and visual analogue scale (VAS) questionnaires were completed by each patient at 1, 2, and 4 weeks after denture delivery.

Results: VAS questionnaires indicated that patients were more satisfied with laser-sintered RPDs than with conventional RPDs. All parameters assessed in the questionnaires including general satisfaction, ease of cleaning, aesthetics, speech, comfort, stability, chewing, and function scored higher in laser-sintered RPDs than in conventional RPDs at 2 and 4 weeks after delivery. The number of adjustments placed by dentists on dentures upon delivery was similar (5 adjustments) in both treatment options. The number of problems reported by patients, such as tissue irritation and denture instability, was lower with laser-sintered RPDs (5 problems) than with conventional RPDs (10 problems).

Conclusion: Laser-sintered RPDs seem to provide better comfort, speech, stability, and function; and cause fewer problems than conventional casted RPDs.

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Characterization of alloys produced with new system for processing dental prosthesis

Abstract:

Removable partial dentures (RPD) are traditionally made of casted alloys using the lost-wax technique. Laser-sintering is a new additive manufacturing technique for processing RPD metal frameworks that can produce RPDs frameworks quickly with high precision and at low cost. The objective of this study was to characterize the mechanical, crystallographic, and biocompatibility properties of RPD Cobalt-Chromium (Co-Cr) alloy processed by laser-sintering technique and compare them to those of conventional casted Co-Cr alloy. Methods: Co–Cr samples were fabricated by either conventional casted (CC) or laser-sintering (LS) technique. The mechanical and physical properties of the alloys (i.e. strength, elastic modulus, fatigue behaviour, microhardness, crystallography, and porosity) were evaluated using three-point bending test, Vickers hardness measurements, X-ray diffraction (XRD), Pycnometry, micro–computed tomography (micro-CT), and Scanning Electron Microscopy (SEM). The releases of toxic metal ions from Co-Cr alloys was measured using inductively coupled plasma atomic emission spectroscopy (ICP-AES).

The alloys biocompatibility was assessed by Alamar Blue viability assay and cytotoxicity lactate-dehydrogenase (LDH) assay on human epithelial cells. Results: LS alloy showed higher rigidity, porosity, and fatigue resistance compared to CC alloy ($p<0.05$). Both materials had similar flexural strength, micro-hardness, and biocompatibility ($p>0.05$). The toxic ion release and biocompatibility assay reveled that both groups had similar behaviour.

Conclusion: Both laser-sintered and conventional casted Co-Cr alloys are biocompatible; however, laser-sintered Co-Cr alloys are more precise and present better fatigue resistance than casted alloys. Accordingly, it could be anticipated that laser-sintered RPD could presents clinical benefits over casted ones in term of fitting and mechanical stability.

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