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Effect of SLM Platform Placement Orientation on RPD Framework Fit-Accuracy

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Objectives

The aim of this study was to compare RPD framework fit accuracy following variable placement orientation (PO) on an SLM building platform and stabilizing bar addition.

Methods

A custom RPD framework CAD was performed on a digitised (Trios-3 intraoral scanner, 3Shape™A/S, Copenhagen, Denmark) 3-D printed single experimental prototype resin-model of an edentulous maxilla bearing three custom 3D geometric tooth-form shapes. Co-Cr fine powder alloy (Mediloy S-Co, Bego, Germany) was processed through SLM (TruPrint Series 1000, Trumpf, Germany) into framework samples (n=24) by dividing into 3 building platform PO groups (n=8: Horizontal[H], Diagonal[D], Vertical[V]), further divided into 2 subgroups each (n=4: With stabilizing-bars[B], without bars[NB]).

Qualitative/quantitative fit-evaluation was then performed for all samples following virtual framework-to-model seating utilizing a previously developed custom digital protocol and a free inspection software (GOM-Inspect,2018-Hotfix5,Rev.115656, GOM GmbH, Braunschweig, Germany). Mean fitting distances were calculated from 220 equidistant vertical framework-to-model measuring locations per sample and groups were statistically compared (p=0,05, ANOVA-on-ranks, Kruskal-Wallis multiple-comparisons, Bonferroni adjustment)(IBM SPSS, Version:29.0.1.0(171), USA)

Results PO Sub-Group medians(Q1,Q3)(mm) were: HNB: 0.150(0.140,0.164), HB:0.136(0.121,0.152), DNB:0.230(0.219,0.241), DB:0.144(0.137,0.154), VNB:0.238(0.232,0.247), VB:0.171(0.166,0.176). Pairwise comparisons indicated only the following statistically significant (p<0,05) PO Sub-Group differences: HB-DNB, HB-VNB, DB-DNB, DB-VNB, HNB-DNB, HNB-VNB.

Conclusions

Preliminary results indicate that:

1. PO is important with Horizontal having the least negative impact on RPD framework fit accuracy regardless of stabilizing bar presence followed by Diagonal and Vertical.
2. Diagonal RPD framework fit accuracy can be significantly improved via bar addition.
3. No effect is expected on RPD framework fit accuracy when combining bars and Vertical PO.

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