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Detail Reproduction and Type IV Gypsum Compatibility of Addition-Cured Silicone, Polyether & Hybrid Impression Materials.

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Introduction:

The hydrophobic nature of addition-cured silicone impression materials[1] has led to the development of improved formulations which claim to be more hydrophilic in that they provide improved wetting by enhancing flowability and reproduction of surface detail. Research is sparse as to how well these materials compare against one another and no one material is superior to the others in terms of detail reproduction and gypsum compatibility, both of which are key material properties. Studies indicate that polyether materials are most hydrophilic in behaviour[2,3] and little information is available regarding hybrid materials with regard to these parameters. There is also no current information available on the effects of autoclave sterilisation of impressions on the resultant surface detail reproduced on cast gypsum stone dies.

Aims:

To compare the detail reproduction and Type IV gypsum compatibility of addition-cured silicone, polyether and hybrid impression materials; and to investigate if there are any differences with these parameters caused by the autoclave sterilisation of an autoclavable addition-cured silicone material.

Materials and Methods:

The parameters of detail reproduction and gypsum compatibility were tested using a modification to the requirements described by ANSI/ADA Specification No.19 (2004) and ISO Specification No.4823 (2000)[4]. Impressions were made (n=315) of a stainless steel ruled test block using addition-cured silicone (Affinis® Precious, Hydrorise®, Aquasil Ultra), polyether (Impregum™ Penta™ Soft Quick) and hybrid (EXA'lence™, Indentium®) materials under standardised conditions and cast with Type IV gypsum die stone (Suprastone). Half the number of impression specimens made from Affinis® Precious (n=45) were subjected to autoclave sterilisation before casting with gypsum (Affinis® Precious Autoclaved group).

Two independent examiners analysed the reproduction of horizontal lines (75µm, 50µm, 20µm width sizes) on impression material and gypsum specimens for full continuous reproduction (Reading 0 or 1) under x12 magnification. The 20µm line quality on the gypsum specimens was then further examined under x50 magnification and scored using a devised qualitative scoring criterion (Scores 2 - 4). Inter-examiner and intra-examiner levels of agreement were assessed using Cohen's Kappa Coefficient. Qualitative data for the 20µm line were statistically analysed using the Kruskal-Wallis Rank and Mann-Whitney U tests.

Results:

All impression materials tested reproduced every line on impression specimens. Certain lines (50µm and 20µm) on gypsum specimens were not fully reproduced by the hybrid materials. Inter-examiner agreement for reading the reproduction of the 75µm, 50µm and 20µm lines was perfect and almost perfect (k=1.0, 1.0 & 0.86)[5] on gypsum specimens.

Intra-examiner agreement was almost perfect (k=0.87 & 0.94)[5] and inter-examiner agreement was moderate (k=0.46 & 0.44)[5] for the qualitative scoring of the 20µm line. Significant differences in quality of the 20µm line were found between all three classes of impression materials (P<0.001).

Conclusions:

All impression materials tested were capable of the detail reproduction of 75µm, 50µm and 20µm lines in full continuity, but not all exhibited similar Type IV gypsum compatibility with respect to the quality of the 20µm line reproduction. Autoclave sterilisation had no adverse effect on the detail reproduction and Type IV gypsum compatibility of Affinis® Precious autoclavable impression material.

References:

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