Impact of Masking Sheets on Dimensional Accuracy of Thermoformed Appliances and Deformation of 3D-Printed Models

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Objectives

Retainers play a fundamental role in preventing orthodontic relapse and maintaining satisfactory alignment after orthodontic treatment. With the growing use of thermoformed appliances in clinical practice and the increasing demand to improve their appearance, thermoformed retainer manufacturers, such as Taglus Tuff, recommend thermoforming onto 3D-printed models with masking sheets to preserve optical clarity. However, masking sheets can cause statistically significant deformations in the dimensional accuracy of thermoformed retainers depending on masking sheet placement on models[1]. This study investigates the impact of masking sheets on appliance deformation by comparing the dimensional accuracy of 3D-printed models before and after the thermoforming process.

Methods

Forty models were 3D printed at a layer height of 100 μm using a Gray Die+Model 2 resin with a SprintRay Pro 95 printer. Thermoformed appliances were fabricated with Taglus Tuff film (0.8 mm thickness) with a Biostar VA pressure molding machine. Appliances were fabricated for 4 different groups (n=10/group): masking sheet on intaglio and cameo surfaces, masking sheet on intaglio surface, masking sheet on cameo surface, and no masking sheet on either surface. 3D-printed model surfaces were optically scanned before and after thermoforming. With Geomagic Control X software, superimpositions of model scans before and after thermoforming were generated with a tolerance of ±0.250 mm. Statistical analysis of the data involved general linear models with post-hoc Tukey Contrasts.

Results

While significant differences in the percentage of surface data points in tolerance bounds were observed among groups ($p < 0.001$), all groups demonstrated greater than 99.9% in bounds.

Conclusion

The use of masking sheets and their placement while thermoforming does not cause clinically significant deformations in 3D-printed models after thermoforming. Accordingly, model deformation likely does not contribute to inaccuracies of thermoformed appliances while thermoforming with masking sheets on Taglus Tuff film.

References:

1. Pelehac, A. (2024). *Effect of Masking Sheet on the Dimensional Accuracy and Translucency of a PETG Thermoformed Retainer* [Masters of Science in Dentistry Thesis]. UTHealth Houston School of Dentistry.