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ORIGINAL ARTICLE

Comparison of the surface roughness of gypsum models constructed using various impression materials and gypsum products

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KEYWORDS
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surface roughness

Abstract *Background/purpose:* This study compared the surface roughness of gypsum models constructed using various impression materials, gypsum products, and storage times before repouring.
Materials and methods: Three alginate impression materials, four commercial silicone impression materials, and three types of gypsum product (MG crystal rock, Super hard stone, and MS plaster) were used. Impression materials were mixed and poured into five plastic rings (20 mm in diameter and 2 mm high) for each group, and the surfaces of the set gypsum product models of 63 groups, which were poured immediately, and 1 hour and 24 hours later, were assessed using a surface roughness tester. One-way ANOVA and Bonferroni's comparison tests were used for the statistical analyses.
Results: The surface roughness: (1) was greater for most specimens constructed from alginate impression material (2.72 ± 0.45–7.42 ± 0.66 μm) than from silicone impression materials (1.86 ± 0.19–2.75 ± 0.44 μm); (2) differed with the type of gypsum product when using alginate impression materials (surface roughness of Super hard stone > MG crystal rock > MS plaster), but differed little for silicone impression materials; and (3) differed very little with the storage time before repouring.

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Conclusion: The surface roughness of stone models was mainly determined by the type of alginate impression material, and was less affected by the type of silicone rubber impression material or gypsum product, or the storage time before repouring.

Introduction

Most dental prostheses and orthodontic appliances are fabricated after taking an impression and making a dental model. Thereafter, dental technicians can perform a series of procedures on the model to construct individualized dentures, cast crowns, or orthodontic appliances. A crucial factor in the success of this process is having a model that is both accurate and possesses a smooth surface. The surface roughness of models affects the surface roughness of the cast restorations; therefore it may affect their fit or retention to prepared teeth.[1] Previous studies concentrated on factors affecting model accuracy, including storage temperature changes,[2,3] impression techniques,[4–6] the use of individual trays,[7–10] the types of impression material and model materials used,[11–13] and the stone pouring time.[14,15] However, only a few studies have dealt with how stone models are affected by the repouring and storage times.[16,17]

The elastic impression materials currently used in dental clinics can be categorized into two groups: (1) hydrocolloid materials, with alginate being the most widely used by clinicians;[13] and (2) rubber-based impression materials, comprising polysulfide, polyether, condensation silicone, and addition silicone. Silicone rubber appears to be the most popular type.[11,16] Alginate is cheaper than rubber-based impression materials and is derived from an edible plant, making it safer than rubber. In addition, some articles have reported that stone casts constructed from alginate impressions are as accurate as rubber-based impressions.[18,19] Our previous study also found that alginate impression materials were as accurate as elastomeric impression materials in the first poured model.[20] However, very few studies compared the effects of repouring and storage times on the surface roughness. Hence, we thought it would be interesting to assess the smoothness of repoured-stone model surfaces constructed with alginate and rubber-based impression materials after different storage times.

This study compared the effects of impression materials, storage times before repouring, and dental stones on the surface roughness of stone models.

Materials and methods

Materials

All of the materials used in this study are listed in Table 1. This study included three alginate impression materials: Algiace Z (Sankin Kogyo, Tokyo, Japan), Cavex (Cavex, Haarlem, The Netherlands), and Jeltrate (Dentsply Asia, Hong Kong). According to promotional material, Jeltrate has a high algin content and provides quality impressions without excessive flow; Algiace Z has excellent compatibility with agar and can be used with any type of plaster; and Cavex can be used for double pours. Four commercial silicone impression materials were used: Aquasil LV (Dentsply, Chicago, IL, USA), Coltex fine (Coltene/Whaledent, Mahwah, NJ, USA), Exaflex injection type (GC America, Chicago, IL, USA), and Take 1 wash (Kerr, Romulus, MI, USA). According to the manufacturers' information, Aquasil has high strength and resistance to permanent deformation; Coltex has excellent physical properties and consistent quality; Exaflex has outstanding physical properties, optimum handing, and accuracy; and Take 1 has excellent dimensional stability, and outstanding wear strength. All of the materials are asserted to have good properties by their manufacturers, but the most popular materials were randomly chosen for the study to obtain general conditions corresponding to a clinical state. This study included three commercial gypsum products: MG crystal rock (Maruishi

Table 1 Materials used in this study.

Materials	Types of materials	Manufacturers
Impression materials		
Algiace Z	Alginate	Sankin Kogyo KK, Tokyo, Japan
Cavex	Alginate	Cavex, The Netherlands
Jeltrate	Alginate	Dentsply Asia, Hong Kong
Aquasil LV	Addition type silicone	Dentsply, Chicago, IL, USA
Coltex fine(light body)	Condensation type silicone	Coltene/Whaledent Inc., Mahwah, NJ, USA
Exaflex regular (injection type)	Addition type silicone	GC America Inc., Chicago, IL,USA
Take 1(wash type)	Addition type silicone	Kerr Co., Romulus, MI, USA
Gypsum products		
MG crystal rock	Type IV stone	Maruishi Gypsum Co., Tokyo, Japan
Super hard stone	Type IV stone	Chi Shi Co., Taipei, Taiwan
MS plaster	Type II stone	Chi Shi Co., Taipei, Taiwan