IMPRESSION DIMENSIONAL CHANGE OF POLYVINYL SILOXANE LIGHT AND MEDIUM BODY MATERIAL BY USING PERFORATED TRAY

(PERUBAHAN DIMENSI CETAKAN BAHAN CETAK POLYVINYL SILOXANE LIGHT DAN MEDIUM BODY DENGAN MENGGUNAKAN SENDOK CETAK BERLUBANG)

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Abstract

Generally impression materials including elastomer impression materials show dimensional changes after impression taking. There are many investigations that show these dimensional changes with several causal factor possibilities proposed by the authors. The actual causal factor has not been elucidated yet. The aim of this study was to find out the behaviour and dimensional changes occured in two types of elastomeric impression consistency materials by using perforated tray. Light and medium body types of polyvinyl siloxane impression materials were used in this study. Impression consistency materials were tested with the method noted at the ANSI/ ADA specification no.19-2000. Design of study post-test only. Impression was taken by using perforated metal tray on frustum conical metal master die (n= 10 impressions/material). The dimensions of samples were measured by using digital calliper (Mitutoyo, Japan) at base, top area and height. The dimensional changes were calculated from master and stone die measurement. The results showed that there were dimensional changes occured in all of observed areas. Light body type showed dimensional changes at base, top area and height as many as (+) 0.032 ± 0.016 mm, (-) 0.136 ± 0.045 mm and (+) 0.112 ± 0.022 mm, respectively. Medium body type showed dimensional changes at base, top area and height as many as (+) 0.009 ± 0.013 mm, (-) 0.090 ± 0.016 mm and (+) 0.085 ± 0.010mm, respectively. In conclusion, there were significant differences between light and medium body types of polyvinyl siloxane impression materials caused the quantity of dimensional changes on impression ($p < 0.05$). Stress releasing passes through the holes on perforated tray may take a possible role to cause different direction of dimensional changes on impression.

Keywords: elastomeric impression material, dimensional change

Abstrak

Umumnya bahan cetak termasuk bahan cetak elastomer memperlihatkan perubahan dimensi setelah pengambilan cetakan. Banyak penelitian yang memperlihatkan perubahan dimensi ini yang disebabkan berbagai kemungkinan faktor penyebabnya namun faktor penyebab yang sebenarnya belum jelas. Tujuan penelitian ini adalah untuk mengetahui perubahan dimensi yang terjadi pada dua jenis konsistensi bahan cetak elastomer dengan sendok cetak berlubang. Pada penelitian ini digunakan bahan cetak *polyvinyl siloxane* tipe *light* dan *medium body*. Konsistensi bahan cetak diperiksa mengikuti cara yang tercantum pada spesifikasi ANSI/ADA no. 19-2000. Desain penelitian dilakukan *post-test only*. Cetakan diambil dengan menggunakan sendok cetak berlubang-lubang pada kerucut terpancung terbuat dari logam sebagai *master die* (n= 10 cetakan/ bahan cetak). Dimensi sampel diukur dengan menggunakan *digital calliper (Mitutoyo, Japan)* pada daerah dasar, puncak dan tinggi sampel. Perubahan dimensi dihitung dari pengukuran *master* dan *stone die*. Hasil penelitian menunjukkan perubahan dimensi terjadi pada semua daerah pengukuran. Tipe *light body* memperlihatkan perubahan dimensi pada daerah dasar, puncak dan tinggi masing-masing sebesar (+) 0,032 ± 0,016 mm, (-) 0,136 ± 0,045 mm dan (+) 0,112 ± 0,022 mm. Tipe *medium body* memperlihatkan perubahan dimensi pada daerah dasar, puncak dan tinggi masing-masing sebesar (+) 0,009 ± 0,013 mm, (-) 0,09 ± 0,016 mm dan (+) 0,085 ± 0,010 mm. Sebagai kesimpulan, terdapat perbedaan yang signifikan di antara bahan cetak *polyvinyl siloxane* tipe *light body* dan *medium body* dalam menyebabkan besaran perubahan dimensi cetakan ($p < 0,05$). Pelepasan tekanan melalui lubang-lubang pada sendok cetak kemungkinan berperan dalam menyebabkan perbedaan arah perubahan dimensi pada cetakan.

Kata kunci: bahan cetak elastomer, perubahan dimensi

INTRODUCTION

Impression taking of teeth and surrounding soft tissues of mouth is usually used in oral treatment. Dimensional changes commonly occured during impression taking or thereafter. Dimensional changes of impression lead to inaccurate model or die produce unfit restoration. Precise working cast can only be obtained on the basis of an accurate impression of teeth and surrounding tissues. It had been reported that dimensional changes depended on the type of impression materials, different storage times, impression techniques and etc. All of the types of impression materials include elastomeric impression materials show dimensional changes on its impression.[1-6] Markovic et al. reported the dimensional changes occured in impression of elastomeric materials (addition-cured and condensation-cured silicones) but not exceeded than 1%.[7] Chen et al. also detected dimensional changes in several impression materials included elastomeric impression materials.[8] Other researchers Faria et al. explained that there were dimensional changes on the impression of alginate, polysulfide, polyether, condensation silicone and addition silicone elastomeric impression materials. The results led to the conclusion that different impression materials and techniques influenced the stone casts' accuracy.[9]

Elastomeric impression materials have several types of consistencies such as light, regular, heavy body and putty. There was no investigation about the comparison of dimensional changes occured in several types of consistencies of elastomeric impresssion materials yet. Ceyhan et al. performed the investigation of dimensional changes on several viscosity of impression materials but did not compare them each other.[10] The different consistencies of impression materials have different flow properties as well during impression taking and may be enable to produce different dimensional changes on impression.[1,2]

The aim of this study was to find out the behaviour and dimensional changes occured on the two types of consistencies of polyvinyl siloxane impression materials by using perforated tray.

MATERIALS AND METHODS

Light and medium body types Polyvinyl Siloxane (Exaflex, GC, Japan) were used in this study. Consistency assay was performed by following a method explained in Revised ADA Spec. No.19 for Non-aqueous, Elastomeric Dental Impression.[11] Dough of light body and medium body type Polyvinyl Siloxane as many as 0.5ml was used under 500gr. The value of consistency was determined by measuring diameter of three dough specimen by using digimatic calliper (Mitutoyo, Japan).

Impressions of frustum of cone shape metal master die were made by using light and medium body type Polyvinyl Siloxane. Metal master die has 8.16 mm base diameter, 6.63 mm top diameter and 10mm height. Perforated metal tube with 10mm in diameter and 15mm height in size was used as tray. The holes were made at 1 and 9mm above the base of metal tube tray. Impression immediately poured after impression taking by using type 3 dental stone (Moldadur®, Heraeus Kulzer GmbH, Germany). Measurement was found by using *Digimatic caliper* (Mitutoyo, Japan) at 1mm over the base area, 1mm below the top area and height of metal master and dental stone dies. Mann-Whitney test was used in statistical analysis.

RESULTS

The consistencies of light and medium body type polyvinyl siloxane were observed and the light body average was 34.45 mm ± 0.087 and 32.25 mm ± 0.188 for medium body. The consistency of light body type showed different from the medium body type of polyvinyl siloxane impression materials (Table 1).

Table 1. Consistencies of light and medium body type polyvinyl siloxane

Test No.	Consistency of Polyvinyl Siloxane Impression Materials					
	Light Body			Medium body		
	Major Diameter (mm)	Minor Diameter (mm)	Average (mm)	Major Diameter (mm)	Minor Diameter (mm)	Average (mm)
1.	34.79	33.92	34.35	32.50	32.14	32.32
2.	34.88	34.06	34.47	32.58	32.12	32.53
3.	34.98	34.07	34.52	32.43	31.97	32.20
Total Average			34.45 ± 0.08			32.25 ± 0.18

Compared with the master die the dimensional changes at the base area on light body type was 0.032mm ± 0.016 and medium body type impression 0.009mm ± 0.013 both were longer than

master die. On the contrary at top area the dimensional changes on light body type showed was 0.136mm ± 0.045 and medium body impression 0.090mm ± 0.016 both were shorter than master die. Di-mensional changes of height were longer 0.112mm ± 0.022 on light body and 0.085mm ± 0.010 on medium body than master die (Table 2).

Table 2. Dimensional changes of impression

Measurement area	n	Dimensional Changes: Light Body Mean ± SD (mm)	n	Medium body Mean ± SD (mm)
Base area	10	(+) 0.032 ± 0.016	10	(+) 0.009 ± 0.013
Top area	10	(-) 0.136 ± 0.045	10	(-)0.090 ± 0.016
Height	10	(+) 0.112 ± 0.022	10	(+) 0.085 ± 0.010

Note:(-) : reduction in size
(+) : elongation in size

DISCUSSION

The rate value of consistency of light body type at was 34.45 mm compared with medium body type 32.25 mm, light body type showed more fluidity than medium body type. Table 2 showed the dimensional changes occured in all of observed areas. There were significant differences between light body and medium body type of polyvinyl siloxane impression materials caused the quantity of dimensional changes occured at base, top area and height ($p< 0.05$). These findings are incomformity with what have been reported by Sumadhi and Kurniati. There were no significant differences on dimensional changes of impression by using light body and putty type elastomer impression materials. There was antagonistic direction of dimensional changes at the base area observation but not in this research.

In this study, the direction of dimensional changes showed the difference at the top, base area and height. At the top area dimensional changes caused reduction in size meanwhile at the base area and height caused elongation in size. These findings were coincidence with phenomena detected by Sumadhi. There was different direction of dimensional changes on impression by using perforated tray compared with unperforated tray. The holes on perforated tray allow the impression materials flow out through coincide with pressure release. These findings tend to assume the role of pressure release pass through the holes on the tray caused dimensional changes on impression.[13] This assumption collateral with Anusavice et al. that stated dimensional changes might occur during gelation process of hydrocolloids impression materials, certain stresses arose during impression taking.[1] Masri also stated that all impression materials produced pressure during impression taking.[14] Stress releasing pass through the holes on perforated tray might facilitate the possibility caused the direction of dimensional changes on impression. This study has no exact data about the pressure or stress occurred during impression taking in an attempt to elucidate its role causes dimensional changes on impression and need observation moreover. The furthermore investigation is needed to elucidate the actual causing factor of dimensional changes on impression.

It can be concluded that there were significant differences of dimensional changes of light body type and medium body type of polyvinyl siloxane impression materials.

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