Effect of opacifier and pigments on hardness of maxillofacial silicones

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Abstract

Objective: This study aimed to investigate the effects of an opacifier on the Shore A hardness of two pigmented maxillofacial silicones.

Materials and Methods: Two commonly used maxillofacial silicones; VST-50 and LSR-05 were pigmented with 0.2% w/w yellow silicone intrinsic pigment. Kaolin powder calcined, an opacifier, was combined with the pigmented silicone in different percentage weight. Fifty-six square-shaped specimens (n=7) were divided into 6 groups, in addition to control groups, for each silicone. Each silicone was divided into three groups (0%, 5%, 10%) according to the weight of opacifier. The hardness of the specimens was investigated using a Shore A durometer. A 1-way ANOVA and Tukey's HSD post-hoc test were performed for the Shore A hardness of VST-50 and LSR-05 at α=.05.

Results: The mean Shore A hardness of VST-50 for control, 0%, 5%, and 10% groups were 32.03± 0.89, 31.22± 1.91, 30.13 ± 1.72and 27.01 ± 1.52 respectively. For LSR-05, the mean Shore A hardness were 12.97 ± 1.11, 13.03 ± 0.98, 13.14 ± 0.87 and 11.30 ± 1.11 for control, 0%, 5% and 10% groups respectively. For VST-50 and LSR-05, values of Shore A hardness were the lowest for the 10% group. The Shore A hardness decreased significantly (α =0.05) for the 10% opacifier group compared to other groups.

Conclusions: LSR-05 had lower Shore A hardness than VST-50 in all groups. An addition of 10% weight of opacifier caused a significant difference on Shore A hardness of VST-50 and LSR-05 silicones.

Keywords: maxillofacial silicone, shore a hardness, opacifier, pigments, maxillofacial prosthesis, physical properties.

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Introduction

Maxillofacial prosthetic materials are used to replace facial parts lost due to congenital or acquired diseases. Silicone elastomer is the material of choice, because it offers biological, physical and mechanical properties better than other materials.[1] One of the most important factors relative to clinical success of maxillofacial prosthesis is its ability to reproduce color, texture, form and translucence of surrounding tissue making it inconspicuous to any observers. To achieve this it is necessary to add colors to silicone, as they are mostly available in transparent form. Coloration techniques are basically divided into two groups: intrinsic or extrinsic.[2] In addition, recently pigmentation involves adding opacifier to silicone base material to reduce discoloration by blocking the UV rays.[3] The physical and mechanical properties important for success of prosthesis include tear strength, hardness, tensile strength, color stability and elongation.[4] The aim of this study was to evaluate the effect of opacifier when combined with silicone intrinsic pigment on the Shore A hardness of two maxillofacial silicone having different range of hardness, VST-50 and LSR-05.

Materials and Methods

Two maxillofacial silicones, VST-50 and LSR-05 (Factor II Inc, Lakeside, AZ, U.S.A) were used to fabricate the specimens. Kaolin powder calcined (Factor II Inc, Lakeside, AZ, U.S.A), a widely used UV- protecting inorganic oxide was used as opacifier. Silicone intrinsic pigment- yellow was used to color the silicone. Table 1 provides information of all materials used in this study

A total of fifty-six samples were fabricated in six groups (n= 7) by variously combining opacifier at different percent weight with yellow silicone pigment at 0.2% weight for both silicones. The control group was fabricated for both silicones with no pigment or opacifier added. The opacifier was added at 0%, 5%, and 10% by weight. The specimen fabrication is explained in Figure 2.

Group I: VST-50 Pigment 0.2% Opacifier 0%

Group II: VST-50 Pigment 0.2% Opacifier 5%

Group III: VST-50 Pigment 0.2% Opacifier 10%

Group IV: LSR-05 Pigment 0.2% Opacifier 0%

Group V: LSR-05 Pigment 0.2% Opacifier 5%

Group VI: LSR-05 Pigment 0.2% Opacifier 10%

The specimens were tested with Shore A Hardness Tester – H17A (Wallace Instruments, 5856 Corporate Ave., Suite 220, Cypress, CA 90630, U.S.A.) according to specifications of ASTM- D2240 (Figure 3). Five points at least six mm apart were measured for each specimen, and at least twelve mm away from the edges (Figure 3).

Table 1 Materials used in this study

Product	Manufacturer	Lot No
VST-50	Factor II Inc, AZ, USA	S 12U14R07
LSR-05	Factor II Inc, AZ, USA	S 31001
Kaolin powder calcined	Factor II Inc, AZ, USA	090600
Yellow Color FI - 202	Factor II Inc, AZ, USA	B041211

Results

The mean hardness values and standard deviations for VST-50 and LSR-05 are presented in Table 2 and 3 respectively. The one-way ANOVA showed that there was significant difference between the means to groups for VST-50 and LSR-05.

Tukey HSD was used for comparing means of Shore A hardness among different groups to significant level (α = 0.05) which showed that there was significant difference in 10% group for VST-50 and LSR-05.

Discussion

Hardness is resistance of the prosthesis to indentation or puncture. It also is related to measure of flexibility. An ideal material should possess properties more or less similar to facial tissue[5]. The material should be resistant and durable, further it should be soft and flexible to comply with facial movements. Silicone with higher values of hardness will give lifeless appearance even after sculpture and adaptation. Review of literature reveals that ideal hardness value to mimic facial tissues is in range of 25 to 35 Shore A units.[6] However, Sanchez et al reported that a value less than 25 is desirable in selected cases and can be good choice for fabricating facial prosthesis.[7]

It has been reported that addition of pigments and opacifier may alter the physical and mechanical properties of silicones.[8] The result of this study is comparable to previous study showing that incorporating 10% of kaolin calcined powder significantly affects the Shore A hardness of both VST-50 and LSR-05 silicones.

Opacifiers such as kaolin powder calcined are considered inorganic materials. These inorganic dry coloring agents contain metal atoms and can be considered impurities when mixed with silicone elastomers. These impurities can inhibit with vulcanization of silicone, reducing mechanical strength of silicone bone thus reducing hardness.[9]

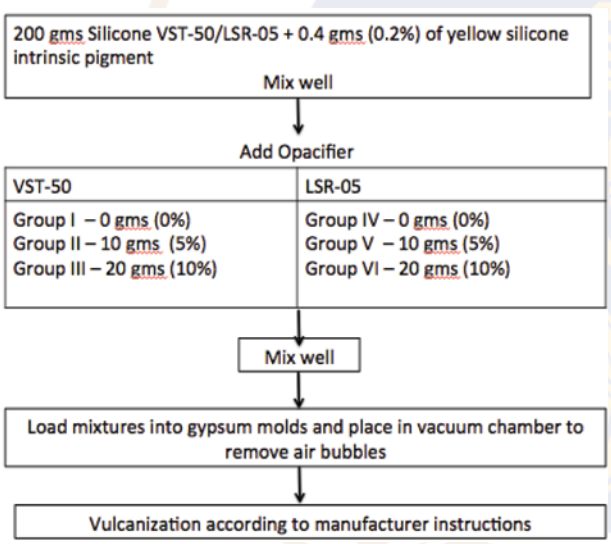

Figure 2 Specimen fabrication

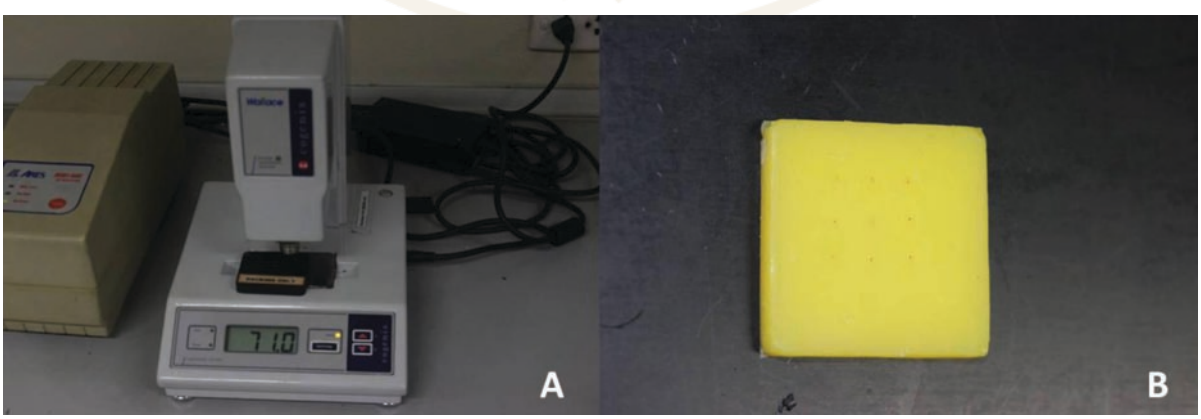

Figure 3 Shore A Hardness tester and sample specimen
A = Shore A hardness tester, B = Specimen sample with marked points

Table 2 Mean and Standard deviation of Shore A hardness of VST-50.

Silicone	Mean ± S.D
Control Group = VST-50 No pigment no opacifier	32.03 ± 0.89 [a]
Group I = VST-50 Pigment 0.2% opacifier 0%	31.22 ± 1.91 [a]
Group II = VST-50 Pigment 0.2% opacifier 5%	30.13 ± 1.72 [a]
Group III = VST-50 Pigment 0.2% opacifier 10%	27.01 ± 1.52 [b]

Values followed by the same superscript do not differ statistically by Tukey's test (α = .05).

Table 3 Mean and Standard deviation of Shore A hardness of LSR-05.

Silicone	Mean
Control Group = LSR-05 No pigment No opacifier	12.97 ± 1.11 [a]
Group IV = LSR-05 Pigment 0.2% Opacifier 0%	13.03 ± 0.98[a]
Group V = LSR-05 Pigment 0.2% Opacifier 5%	13.14 ± 0.87 [a]
Group VI = LSR-05 Pigment 0.2% Opacifier 10%	11.30 ± 1.11 [b]

Values followed by the same superscript do not differ statistically by Tukey's test (α = .05)

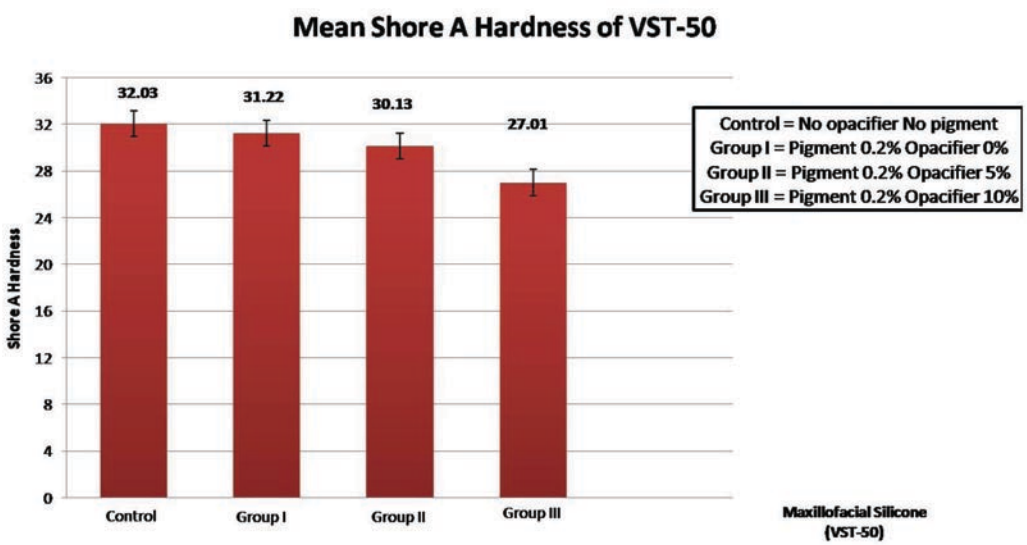

Figure 4 The mean and standard deviation of Shore A hardness of VST-50 at different groups.

From the results obtained in this study, it is possible to predict the effects of opacifier on the Shore A hardness in both silicones. Also, no research study has evaluated Shore A hardness of silicone VST-50 and LSR-05. Therefore, the results could not be compared or discussed with other studies.

Conclusion

In conclusion, within the parameters of this study design, materials used and within the limitations of the study it can be concluded:

1. The change in Shore A hardness of VST-50 and LSR-05 maxillofacial silicone depends on amount of opacifier incorporated.

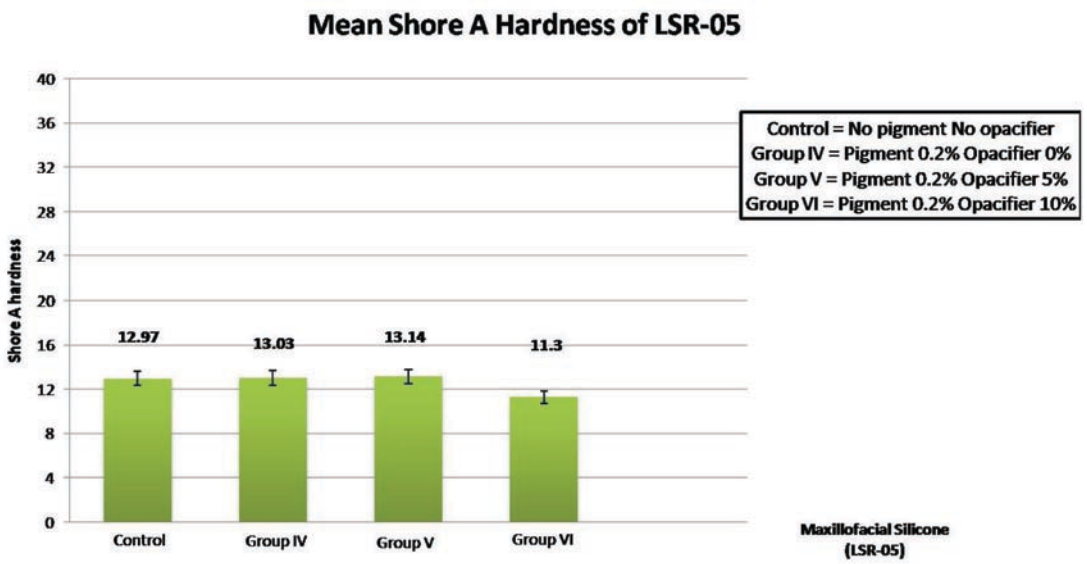

Figure 5 The mean and standard deviation of Shore A hardness of LSR-05 at different groups.

2. The Shore A hardness of VST-50 and LSR-05 was significantly reduced with incorporation of 10% weight of opacifier.

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International Abstract

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A pilot study to assess oral health literacy by comparing a word recognition and comprehension tool.

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Abstract

BACKGROUND:

Oral health literacy is important to oral health outcomes. Very little has been established on comparing word recognition to comprehension in oral health literacy especially in older adults. Our goal was to compare methods to measure oral health literacy in older adults by using the Rapid Estimate of Literacy in Dentistry (REALD-30) tool including word recognition and comprehension and by assessing comprehension of a brochure about dry mouth.

METHODS:

75 males and 75 females were recruited from the University of Connecticut Dental practice. Participants were English speakers and at least 50 years of age. They were asked to read the REALD-30 words out loud (word recognition) and then define them (comprehension). Each correctly-pronounced and defined word was scored 1 for total REALD-30 word recognition and REALD-30 comprehension scores of 0-30. Participants then read the National Institute of Dental and Craniofacial Research brochure "Dry Mouth" and answered three questions defining dry mouth, causes and treatment. Participants also completed a survey on dental behavior.

RESULTS:

Participants scored higher on REALD-30 word recognition with a mean of 22.98 (SD = 5.1) compared to REALD-30 comprehension with a mean of 16.1 (SD = 4.3). The mean score on the brochure comprehension was 5.1 of a possible total of 7 (SD = 1.6). Pearson correlations demonstrated significant associations among the three measures. Multivariate regression showed that females and those with higher education had significantly higher scores on REALD-30 word-recognition, and dry mouth brochure questions. Being white was significantly related to higher REALD-30 recognition and comprehension scores but not to the scores on the brochure.

CONCLUSIONS:

This pilot study demonstrates the feasibility of using the REALD-30 and a brochure to assess literacy in a University setting among older adults. Participants had higher scores on the word recognition than on comprehension agreeing with other studies that recognition does not imply understanding.

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Geriatrics education in U.S. dental schools: where do we stand, and what improvements should be made?

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Abstract

The number of adults above sixty-five years of age in the United States will expand considerably over the next thirty years. However, many dentists believe that their dental education did not adequately prepare them to treat an older adult population. Consequently, it is important to review dentalcurricula to determine where these gaps in education may occur and what can be done to address them in order to improve access to care. In this study, information was gathered from the websites of sixty-two U.S. dental schools in order to understand the types of geriatric courses offered. This review revealed that while most schools (89 percent) provide their predoctoral students with some education in geriatrics, only fourteen (22.6 percent) offer clinical training specifically for older adult care. In addition, forty-three schools (69 percent) include a geriatric component in either their General Practice Residency or Advanced Education in General Dentistry programs or have a certificate program in geriatric dentistry. Only about 23 percent of the schools offer a continuing education course in geriatrics at any one time. Previous studies have shown that clinical training is the most effective method of increasing students' confidence in treating older patients. Consequently, dental schools should work to incorporate clinical experience into geriatric education to prevent widening an existing gap in older adult oral health care.

KEYWORDS:

access to care; aging; dental education; elderly care; geriatric dentistry; medically compromised care; older adult care; oral health care for the underserved; patients with special needs