



COMPARISON OF SURFACE ROUGHNESS OF AUTO GLAZED, REGLAZED AND CHAIR SIDE POLISHED SURFACE OF THREE TYPES OF FELDSPATHIC PORCELAIN- AN IN-VITRO STUDY

Prosthodontics

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ABSTRACT

OBJECTIVES

To evaluate and compare the average surface roughness of an auto glazed, reglazed and chair side polished surface of three commercial brands of feldspathic porcelain.

MATERIALS AND METHOD

Three feldspathic porcelain, namely VITA VMK94 (Vita Zahnfabrik, Bad Sackingen, Germany), Ceramco3 (DENTSPLY International Inc. Germany) and SHOFU VINTAGE Halo (SHOFU INC. Kyoto Japan) were selected to fabricate 30 specimens each. A medium-grit diamond rotary cutting instrument was used to remove the glaze layer, and then 10 specimens from each group were randomly selected and re-glazed and similarly 10 specimens from each group were polished using a well-defined sequence of polishing comprising of: Shofu porcelain polishing system, White gloss disc/polishing wheel and finally with small buff wheel with pumice slurry.

RESULTS

The surface roughness of the specimens (Ra values) were measured using surface profiler and values were The results show that there is no statistically significant difference between the surface roughness of reglazed and chair-side polished surface. In addition, both reglazed and chair-side polished surfaces are better than the auto glazed surface.

CONCLUSION

Polishing an adjusted porcelain surface with the suggested sequence of polishing will lead to a finish similar to a re-glazed surface. Therefore chair-side polishing can be a good alternative to reglazing for finishing adjusted porcelain surface.

CLINICAL SIGNIFICANCE

This study establishes that chair side polishing renders the surface of the porcelain a lot less rough than reglaze or auto glaze. Lesser the surface roughness lesser is the wear caused and hence lesser is the plaque accumulation.

KEYWORDS

Autoglaze; reglaze; chair side polishing; porcelain

1. INTRODUCTION

Porcelain has become the material of choice over past few years¹. The reason for the increased demand is its superior esthetics^{1,2}. Glazed, polished porcelain surfaces are very well tolerated by the gingival tissue, as it discourages the accumulation of plaque³. Many a times, situations arise when occlusal or proximal adjustments are to be done prior to cementation of the prosthesis⁴, thus leading to discontinuity of the glaze layer. This renders the restoration unesthetic and rough, which attracts more plaque and leads to enamel wear of opposing and adjacent tooth¹. In such instances the depleted restoration is either reglazed or chair side polished. Reglazing is said to change the surface properties of the porcelain and is also time consuming⁵. Several reports have documented the use of different polishing techniques of ceramic restorations and supported the use of polishing as an alternative for glazing⁶.

Hence this study was planned with the objective of (a) to quantitatively compare the surface roughness of an auto glazed, reglazed and chair side polished porcelain surfaces of feldspathic porcelain (b) to propose or recommend an efficient and effective sequence for the polishing of porcelain restorations.

2. MATERIALS AND METHOD

Three feldspathic porcelains, namely VITA VMK94 (Germany, Bad Sackingen), DENTSPLY Ceramco3 (DENTSPLY International Inc. Germany) and SHOFU VINTAGE Halo (SHOFU INC. Kyoto Japan) were selected. Enamel powder of all the three manufacturers was used to fabricate 30 specimens each (Fig-1).



Fig-1 Enamel powder of VITA, DENTSPLY, SHOFU

A mold of brass metal was fabricated in the shape of shade guide tabs. It consists of two metal plates in rectangular shape. Upper metal plate has the mold in the shape of shade tab at one end with the following dimensions: (Fig-2)

Length—10 mm

Width—4 mm

Height—4mm to 2mm, short at open end



(Fig-2 Brass metal mould)

This upper plate is attached at one end of lower plate which allows it to slide on either side.

Total of 90 specimens were fabricated, 30 in each group namely VITA, DENTSPLY and SHOFU. Each group was further subdivided into auto glazing; reglazing and CSP with 10 sample each respectively.

Fabrication of the specimens was done by weighing the equal amount of porcelain powder for each specimen and mixing it with distilled water according to manufacturer's instructions. Blotting paper was used to remove excess water.

The mixed mass was loaded into the mold in small increments. For proper condensation of powder, the mold was given a gentle vibration after each increment with the serrated handle of tweezers to eliminate air bubbles. After complete condensation of the powder in the brass mold, the upper plate was slid over the lower plate and the condensed mass was gently removed from the mold and placed on the sagger tray. The tray was then placed in the porcelain firing furnace (VITA VACUMAT 40T) and fired according to manufacturer's recommendations. The specimens were allowed to cool and then finished with a medium-grit diamond points on both sides to remove any irregularities. The specimens were then soaked in distilled water for 5 min. Then all the specimens were placed in the furnace to obtain an auto glazed surface. 10 specimens from each group were selected; surface roughness was evaluated using a surface profiler at this stage to act as control group. A diamond stylus (2 micro meter tip radius) was used under a constant measuring force of 0.7 mN. The instrument was calibrated and set to travel at a speed of 0.6 mm/s with a traversing length of 2.0 mm during testing. The surface profiler was used to determine roughness profile of each specimen.

The 30 specimens from each type of ceramic were randomly divided into two groups. One group was for reglazing and the other was for chair side polishing system. A medium grit sintered diamond point (SHOFU) attached to a straight hand piece of micromotor, was used to remove the glaze from one half of each specimen. The grinding was done at a constant speed and with constant number of strokes by single operator. 10 specimens from each type of ceramic were randomly selected and then subjected to reglazing with add on glaze following manufacturer's recommended procedure and temperature.

Remaining 20 specimens were subdivided into groups of 10 specimens and were subjected to chair side polishing with well-defined sequence of a polishing system. The other side of the auto glazed specimens, which were randomly selected, was used as a control group. Each specimen was marked with two different colour marker ink on either sides to differentiate between auto glazed and reglazed surface.

A well-defined sequence of polishing was utilized for chair side polishing as follows:

1. Shofu Porcelain polishing system (Shofu Dental Corp., Menlo Park, California (Fig-3) consisting of Dura-white stones for contouring, standard Ceramiste points for smoothening of surfaces and preparing them for polishing, Ultra Ceramiste points for polishing, and final polishing using the Ultra II Ceramiste points.
2. White gloss disc/polishing wheel.
3. Silicone cone
4. Small buff wheel was used with pumice slurry.



(Fig-3 SHOFU porcelain adjustment kit)

The specimens were then cleaned in ultrasonic cleaner, dried with a blast of air, and stored in a dust-free container at room temperature. The specimens were then tested for surface roughness with Surface Profiler (Fig-4).



(Fig-4 Testing of specimen by surface profiler)

The average values of these measurements were considered to be the Ra values. The Ra values were statistically analysed by ONE- way ANOVA test followed by POSTHOC test ($\alpha=0.05$).

3. RESULTS

For evaluation of average surface roughness the samples were tested using Surface Profiler (ZEISS SURFCOM 130A) (Fig-4). The collected data was then subjected to statistical analysis for calculating the means of surface roughness values with their respective standard deviation.

For all the three porcelain materials, there was no statistically significant difference between the surface roughness of reglazed and chair-side polished surface. Both reglazed and chair-side polished surfaces are better than the auto glazed surface.

4. DISCUSSION

The wear of dental hard tissue is a natural and unavoidable process. However, when opposed by ceramic, it may lead to accelerated wear of enamel^{3,7}. The rate of wear further increases if it is opposed by unglazed or rough porcelain restoration⁵. Self-glazing of an adjusted ceramic surface is the best way to achieve a smoothly finished and hygienic surface desired of dental porcelain surface. However, some clinical situations do not permit reglazing of prosthesis sometimes. These situations are when dentists opt for chair side polishing methods⁷. Chair side polishing of porcelain is an important consideration. In various dental procedures, often, chair side adjustment prior to cementation of prosthesis depletes the surface glaze layer and creates a roughened surface².

There is documentation of studies done in the past few years in support of the fact that reglazing and CSP surfaces of porcelain yield better surface finish than the initial auto glazed surface. Patterson et al documented that smoothness of auto glazed porcelain is better than the polished porcelain surface⁴. Klausner H.L observed in their study that there is no statistically significant difference between the auto glazed and CSP surface of porcelain². As reglazing process is time consuming and requires additional appointment, whereas CSP can be performed efficiently in the dental office itself. The procedure is more helpful especially in cases where cementation has been done.

In previous studies it was advocated that all adjusted porcelain surfaces should be reglazed prior to cementation, whereas Owen Siobhan suggests that it is perfectly acceptable to finish and polish the adjusted restoration⁸.

Similarly in the study conducted by Jagger D. C et.al, the results showed that porcelain surface should be polished instead of reglazing after chair side adjustment¹. Wright M.D et al in their study also proved that CSP surface is smoother than auto glazed surface. This may be due to the fact that polishing may render the restoration less abrasive to the opposing dentition and can reduce chair side time needed for reglazing⁶.

Rosenstiel et al⁹ also demonstrated that fracture toughness of porcelain was greater than that of glazed porcelain. This indicates that polishing not only improves the surface roughness of ultra-low fusing porcelain but may also improve its physical properties. However, the efficiency of any polishing technique is dependent on having well-condensed porcelain, because porosities in the porcelain layer are not as efficiently eliminated during polishing as they are in a natural glaze firing. Therefore, a carefully controlled glaze cycle maintains the surface characteristics of porcelain, in turn making the surface aesthetic. But, polishing the surface creates a more rounded surface,

smoothing of the overall contours, with end result which lacks in definition and poor aesthetics. The results of the study conducted by Olivera A.B showed that polished ceramics produced less enamel wear than their glazed counterpart. They also advocated that using Shofu polishing kit for finishing and polishing following occlusal adjustments was advantageous¹⁰.

Srac D. et al stated that the use of adjustment kit alone or preceding polishing paste application created surfaces as smooth as glazed specimens¹¹. Sethi S. et al⁵ in their article concluded that CSP could be an effective alternative to reglazing.

The statistics of the present study shows that regardless of the brand, the surface roughness of the specimen after auto glazing is significantly different from reglazing and CSP. Whereas there is no significant difference between reglazing and CSP ($P > 0.05$). This proves that CSP could be an effective substitute to reglazing.

5. CONCLUSION

Irrespective of the brands used in the study auto glazing of the porcelain surface shows rougher surface than reglazed or chair side polished surface. There is no statistically significant difference between the surface roughness of reglazed and chair side polished surface. Chair side polishing can be a good substitute to reglazing of altered porcelain surface.

Declaration of interest: none

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