Short Communication

The Effect of Glazed and Polished Ceramics on Human Enamel Wear

Anna Belsuzarri Olivera, PhD[a]/Edmir Matson, PhD[b]/Márcia Martins Marques, PhD[c]

This in vitro study compared the effect of glazed and polished dental ceramic on the wear of human enamel. Five ceramics were tested under standard load after 150,000 and 300,000 simulated chewing cycles. Wear was determined from collected digital data and analyzed before and after loading. Statistical comparisons were analyzed. Polished ceramics produced less enamel wear. The amount of enamel wear for opposing IPS Empress ceramic was significantly higher ($P < .001$) than wear provoked by the other ceramics. The enamel wear rate was higher at the first 150,000 cycles, and polishing increased ceramic roughness, except for the IPS Empress ceramic. Polishing of dental ceramics at the contact area produces less antagonistic enamel wear. *Int J Prosthodont 2006;19:547–548.*

Ceramic dental restorations are preferred when optimal esthetic results are desired. However, their abrasiveness against antagonistic natural teeth remains a cause of concern, and the resultant wear may be influenced by the superficial hardness and roughness of the ceramic material.[1–3] Occasionally, a glazed ceramic restoration requires chairside or intraoral adjustment and produces a surface that may be highly abrasive and potentially destructive to the antagonistic natural teeth.[2] Whenever the ceramic glaze is removed, further polishing is required to restore the appearance and smoothness of the ceramic surface.[2] The purpose of this study was to investigate the abrasive effects of glazed and polished ceramics on the wear of human tooth enamel and their correlation with the ceramic surface.

Materials and Methods

Five ceramic materials were selected: IPS Empress 2 (Ivoclar-Vivadent), IPS Empress (Ivoclar), Duceram Plus (Degussa, Dentsply), Duceram LFC (Degussa), and Symbio (Degussa). The selected antagonistic surfaces comprised ceramic specimens and natural cusps.

[a]*Assistant Professor, Department of Restorative Dentistry, School of Dentistry, University of São Paulo, São Paulo, Brazil.*
[b]*Professor, Department of Restorative Dentistry, School of Dentistry, University of São Paulo, São Paulo, Brazil.*
[c]*Associate Professor, Department of Restorative Dentistry, School of Dentistry, University of São Paulo, São Paulo, Brazil.*

***Correspondence to:** Dr Márcia Martins Marques, Universidade de São Paulo, Faculdade de Odontologia, Departamento de Dentística, Av Prof Lineu Prestes 2227, 005508-900 São Paulo, Brazil. Fax: +55 11 30917839. E-mail: mmmarques@usp.br*

Sixteen samples of each ceramic were produced in the shape of circular disks (8 × 3 mm) and fired and glazed according to manufacturers' recommendations.

The selected buccal cusps from 80 maxillary human premolars were employed with 2 experimental ceramic groups: *(1)* glazed ceramic with the glaze left intact (n = 8), and *(2)* polished ceramic with the entire visible glaze removed in an attempt to simulate the result of an intraoral adjustment (n = 8).

Both the cusps and ceramic disks were embedded into acrylic resin inside stainless steel holders that allowed attachment and removal of a wear machine, similar to one described by Suzuki et al.[4] The specimens were seated in a water bath at 37°C, under a load of 20 N, using a chewing rate of 1.3 Hz and 80 cycles/minute. Before each test, the occlusal surfaces of each enamel cusp and disk were traced using a digital technique (Contracer 218, Mitutoyo). The x, y, and z coordinates of surface points were collected before and after 150,000 and 300,000 cycles. The wear was determined by using a computer program (Formpak, Mitutoyo). The average ceramic surface roughness was recorded before wear testing using a surface analyzer (Surftest SJ 201 P, Mitutoyo).

The wear data were compared using analysis of variance and the Tukey test. The Pearson test was used to analyze the correlation between surface roughness and enamel wear ($P \geq .05$).

Results and Discussion

The results showed that polished ceramics produced less enamel wear than their glazed counterpart (Fig 1).

COPYRIGHT © 2005 BY QUINTESSENCE PUBLISHING CO, INC.
PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY.
NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM
WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

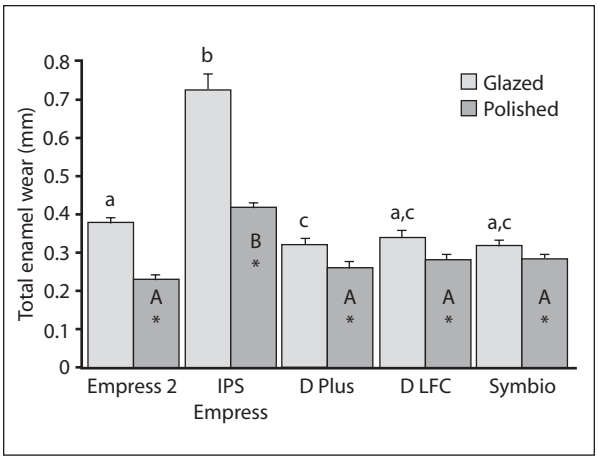

Fig 1 Mean ± SE of the wear of enamel antagonistic to glazed and polished ceramics after 300,000 cycles. Different letters show significant differences between glazed ceramics (lowercase) and between polished ceramics (uppercase). *Significant differences between glazed and polished ceramics.

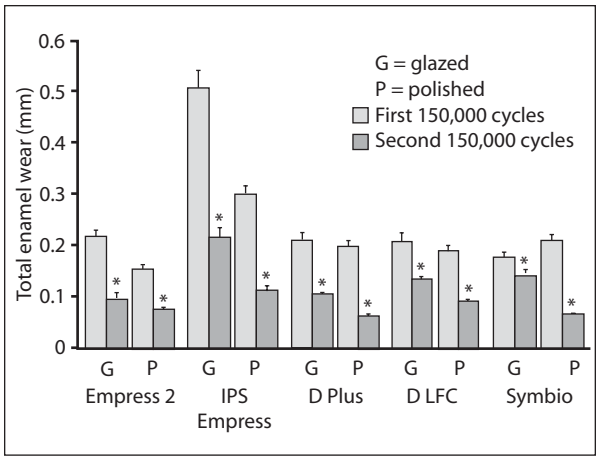

Fig 2 Mean ± SE of the wear of enamel antagonistic to glazed and polished ceramics after each round of 150,000 cycles. *Significantly different from the first 150,000 cycles.

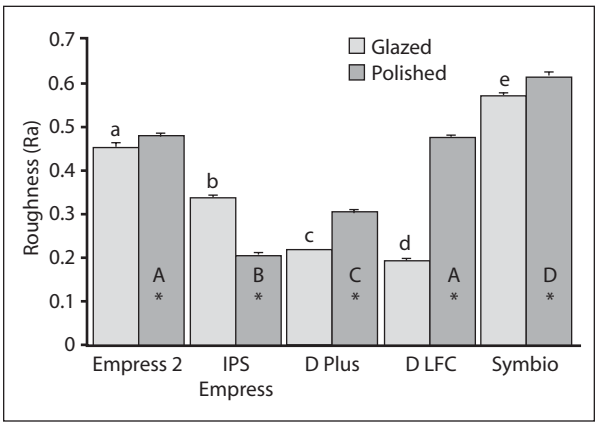

Fig 3 Comparison of surface roughness average (mean ± SE) of glazed and polished ceramics. Different letters show significant differences between glazed ceramics (lowercase) and between polished ceramics (uppercase). *Significant differences between glazed and polished ceramics.

This observation endorses a report by Jacobi et al[1] but disagrees with Al-Hiyasat et al.[2] The difference is probably methodologic, since our study employed a Shofu kit (Shofu Dental) for both adjustment and polishing, while the other studies used a polishing paste.

There may also be differences between the glaze hardness and the inner surface of the ceramic materials.[1] Segui et al[3] found that material hardness was poorly correlated with the abrasiveness of ceramic materials on human enamel. However, ceramic polishing may be an important factor in the reduction of superficial imperfections, thus resulting in less enamel wear.

Another important observation was that IPS Empress ceramic significantly increased the wear of opposing enamel (Fig 1). This may occur because this ceramic uses shade for a final coat, instead of a glaze. Consequently, shading surfaces should be avoided when enamel contacts the restoration.[5]

Greater enamel wear was noted after the first 150,000 cycles (Fig 2), which is in agreement with a previous study.[2] A possible explanation is the enlarged size of the contact area between the tooth cusp and the ceramic surface after 150,000 cycles.

Polished ceramics present a higher degree of roughness when compared to their glazed counterparts, except for IPS Empress (Fig 3). However, measurements of initial surface roughness revealed no correlation between glazed and polished ceramics and enamel wear. It appears that microstructural differences between the different ceramic materials may be more important than their superficial roughness.

Our findings suggest that following clinical occlusal adjustment, use of a Shofu kit for polishing and finishing is advantageous.

Acknowledgment

This work was supported by grants from Fundação de Amparo à Pesquisa do Estado de São Paulo, São Paulo, Brazil.

References

1. Jacobi R, Shillingburg HT, Duncanson MG. A comparison of the abrasiveness of six ceramic surfaces and gold. J Prosthet Dent 1991;66:303–309.
2. Al-Hiyasat AS, Saunders WP, Smith GM. Three-body wear associated with three ceramics and enamel. J Prosthet Dent 1999;82:476–481.
3. Segui RR, Rosenstiel SF, Bauer P. Abrasion of human enamel by different dental ceramics in vitro. J Dent Res 1991;70:221–225.
4. Suzuki S, Suzuki SH, Cox CF. Evaluating the antagonist wear of restorative materials. J Am Dent Assoc 1996;127:74–80.
5. Palmer DS, Barco MT, Pelleu Jr GB, McKinney JE. Wear of human enamel against a commercial castable ceramic restorative material. J Prosthet Dent 1991;65:192–195.

COPYRIGHT © 2005 BY QUINTESSENCE PUBLISHING CO, INC.
PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY.
NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM
WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

Copyright of International Journal of Prosthodontics is the property of Quintessence Publishing Company Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.