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STRUCTURE STUDIES OF AMALGAM II. EFFECT OF BURNISHING ON THE MARGINS OF OCCLUSAL AMALGAM FILLINGS

by
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INTRODUCTION

Burnishing of amalgam has so far generally been considered contra-indicated (1-3). *Sweeney* (1944) condemns burnishing, stating that the soft material on the surface of the filling is pushed ahead of the burnisher, and this weak amalgam deposits itself on the margins and in the sharp angles of the cavity. *Phillips* (1953) also warns that burnishing draws excess mercury to the margins, weakening them and making them more susceptible to tarnish and corrosion.

These opinions, however, seem to be based mainly on speculations and are not supported by experimental evidence showing the effect of burnishing.

The present study was planned to investigate the effect of burnishing upon the structure and the mercury content of occlusal margins of amalgam fillings.

MATERIALS AND METHOD

Cylindrical cavities 4 mm in diameter and 4 mm deep and with a cavo-surface angle of 120° were prepared in acrylic resin blocks 12 mm in diameter and 10 mm high.

The same commercial amalgam alloy was used for all experiments. Alloy and mercury was mixed in the proportion 1.120/1.034 g. Using a Wig-L-Bug mechanical amalgamator the mix was triturated 25 sec. with pestle and then 2 sec. without pestle in the capsule. The mix was divided into 6 increments and each increment was packed into the cavity by 30 thrusts of a 2 mm circular serrated condenser under a controlled condensation pressure of 2 kg. Soft mercury-rich excess was removed after condensation of each increment. The packing was finished within five minutes.

In Group A, 10 cavities were over-filled. Excess material on one side of the cavity was removed by repeated burnishing from center to margin of the filling by means of a burnisher with spherical head 3 mm in diameter under a pressure of 2 kg. Excess material from the other side of the filling was carved away with a sharp knife.

In Group B, 10 cavities were filled flush with the cavity margin. One side of the filling was burnished, while the other side was left untouched.

The amalgam fillings in the cavities were embedded in an epoxy and polystyrene resin mixture and sectioned through the axis of the cylindrical specimens. The sectioned surfaces were polished by hand on # 220, 320, 400 and 600 carborundum paper under running water, and finally finished with diatomaceous powder on a metallographic polishing machine. After cleaning with water and alcohol, the specimens were etched for 15 sec. with a 30 per cent nitric acid and then washed for at least 30 min. under tap water.

Microphotographs of the sections of the filling margins were uniformly enlarged (approximately 225 times) and copied on paper 6 × 9 cm. These photos were mounted on a radiogram viewing box and covered with translucent millimeter paper. The number of cross points of the millimeter paper found on the residual grains and micro-pores were counted and compared with the number of those found on the matrix in the field indicated in Figure 1 (cfr. *Jørgensen & Kanai, 1964*).

After finishing this study of the specimens, all 20 specimens in group A and B were resectioned at a level one half millimeter

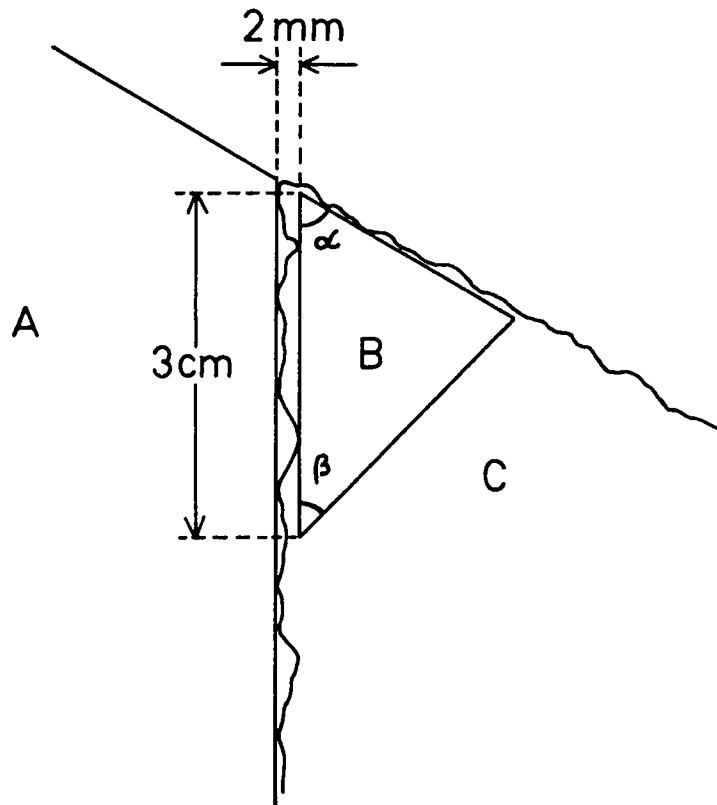


Fig. 1. The triangular area of the amalgam margins measured. On the magnified photos the two mm wide zone indicated on this illustration was omitted. Magnification 225 times. A, cavity wall. B, measured marginal area, C, amalgam filling. $\alpha = 60^\circ$. $\beta = 45^\circ$.

deeper than the first section. The new sections were studied in the same way as described above.

RESULTS

The results from Group A are shown in Table I and Fig. 2.

As shown in the table, the percentage of residual grains in burnished margins appears slightly higher than in unburnished margins; the difference, however, is not statistically significant at the 5 % level of significance. Micro-pores are evidently less frequent in burnished than in unburnished margins.

Table 1

Areas in percent of residual grains, micro-pores, and matrix found in sections of unburnished or burnished amalgam margins. Cavities overfilled

	Unburnished margins	Burnished margins
Residual grains	7.0 ± 1.2	9.2 ± 1.0
Micro-pores	5.4 ± 1.5	0.8 ± 0.4
Matrix	87.6 ± 2.1	90.0 ± 1.0

Figures show group means (N = 20) and standard deviations.

The results from Group B are shown in Table 2 and Fig. 3. In this group the percentage of residual grains in the burnished margins is higher than in the unburnished margins with significant difference. Micro-pores are again definitely less frequent in the burnished margins.

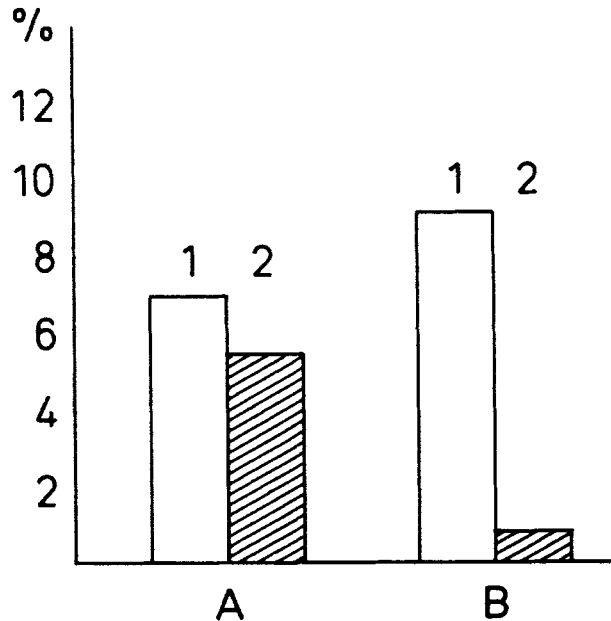


Fig. 2. Graphic comparison of the areas of residual grains and micro-pores found in sections of unburnished or burnished amalgam margins with cavities overfilled. A, unburnished margins. B, burnished margins. 1, residual grains. 2, micro-pores.

Table 2

Areas in percent of residual grains, micro-pores, and matrix found in sections of unburnished or burnished amalgam margins. Cavities filled flush with the margin

	Unburnished margins	Burnished margins
Residual grains	6.0 ± 1.1	10.6 ± 1.4
Micro-pores	5.0 ± 0.9	1.1 ± 0.4
Matrix	89.0 ± 1.8	88.3 ± 1.5

Figures show group means (N = 20) and standard deviations.

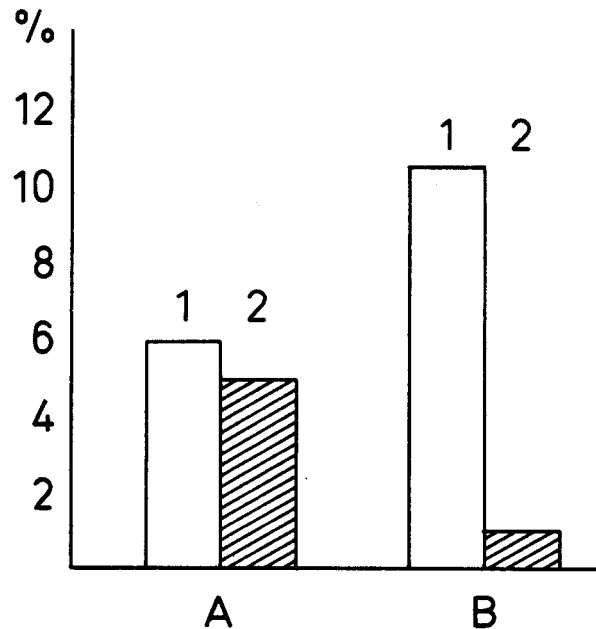


Fig. 3. Graphic comparison of the areas of residual grains and micro-pores found in sections of unburnished or burnished amalgam margins. Cavities filled flush with the margins. A, unburnished margins. B, burnished margins. 1, residual grains. 2, micro-pores.

SUMMARY

The effect of burnishing upon the structure of occlusal margins of amalgam fillings was investigated by measuring the area of residual grains and of micro-pores in metallographic preparations.

The studies show the following results:

Burnishing has a tendency to increase the relative content of residual alloy grains (i.e. decrease residual mercury), especially when the cavities are not overfilled.

Micro-pores were remarkably decreased by burnishing. Thus, burnishing seems to improve the properties of occlusal amalgam margins.

RESUMÉ

ETUDES SUR LA STRUCTURE DE L'AMALGAME

II. ACTION DU BRUNISSAGE SUR LES BORDS DES OBTURATIONS
OCCLUSALES D'AMALGAME

L'action du brunissage sur la structure des bords occlusaux des obturations d'amalgame a été étudiée en mesurant la surface des particules résiduelles et des micro-pores sur des préparations métallographiques.

Les résultats suivants se sont dégagés:

Le brunissage a tendance à augmenter la proportion des particules résiduelles déalliage (c'est-à-dire à diminuer le mercure résiduel), particulièrement lorsque les cavités ont été obturées sans excès d'amalgame.

Les micro-pores ont été considérablement diminuées par le brunissage. Ainsi, le brunissage semble améliorer les propriétés des bords occlusaux d'amalgame.

ZUSAMMENFASSUNG

GLÄTTEN VON OKKLUSALEN AMALGAMKANTEN

Der Effekt des Glättens der Kanten okklusaler Amalgamfüllungen ist durch die Messung der Fläche von Residualkörnern und von Mikroporositäten in metallographischen Präparaten untersucht worden.

Die Untersuchungen ergeben, dass das Glätten eine Tendenz zeigt, den Gehalt an Residualkörnern zu vergrößern (d.h. den Gehalt an Quecksilber herabzusetzen), besonders, wenn die Kavitäten nicht überfüllt werden; das Glätten bewirkte in allen Fällen eine wesentliche Herabsetzung der marginalen Porosität der Füllungen.

Das Glätten der Kanten okklusaler Amalgamfüllungen scheint somit deren Qualität zu verbessern.

REFERENCES

1. *Blackwell, R. E.*, 1955: *Black's Operative Dentistry*, 9. ed. Vol. 2, p. 288.
2. *Sweeney, J. T.*, 1944: Manipulation of Amalgam to Prevent Excessive Distortion and Corrosion. *J. Amer. dent. Ass.*, 31: 375—380.
3. *Phillips, R. W.*, 1953: *Amalgam — Its Properties and Manipulation*. N. Y. *J. Dent.*, 23: 105—109.
4. *Jørgensen, K. D. and S. Kanai*, 1964: Strukturundersøgelser af Amalgam. 1. Korrelation mellem Struktur og Fysiske Egenskaber. *Tandlægebladet*, 68: 659—668.

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