353 Changes of marginal fit related to margin design in porcelain-fused-to-metal restorations

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Introduction and Aim of the Study

Recent studies revealed an alteration of the marginal fit of noble porcelain-fused-to-metal (PFM) restorations along with the firing processes (Schäfer et. al.,1997) The aim of this in-vitro study was to investigate the changes of the marginal fit of PFM crowns along with firing cycles related to margin design of the non noble metal framework.

Materials and Methods

Two designs of metal framework (metal margin with buccal chamfer (D1, n = 15, Fig. 1a), metal margin without chamfer (D2, n = 30, Fig. 1b) were fabricated on 5 identical master dies (Wiron 99®, Bego, Bremen, Germany) with 0.5 mm (buccal) to 0.3 mm (mesial, oral, distal) chamfer finishing line.

The alloy used for the metal framework was Wirobond C® (Bego, Bremen, Germany). Ceramic facings (Vita omega®, Vita, Bad Säckingen, Germany) were fired onto 15 metal frameworks of D1 and D2 according to the instructions of the manufacturers. Another 15 frameworks without chamfer (Fig. 1c) acted as a control (C) and were only subjected to the firing cycles.

The changes of the marginal fit were analyzed at four points (mesial, distal, oral, vestibular) after (1) the fabrication of the metal framework, (2) the dentine bake and (3) the final firing.

Two different changes of the marginal fit were determined:
- Changes of the *width of the gap* by means of an indirect silicone relining technique. The point of measurement was located 20 μm inside the gap (Fig. 2a).
- Changes of the *maximum vertical width* of the gap (direct method, Fig. 2b).

The specimens obtained were analyzed utilizing a computer assisted method:
- Video digitizing of the specimens at a magnification of 6.6 (Stemi SV11, Zeiss, Oberkochen, Germany, Camera TK-1070E, JVC, Tokyo, Japan, internal frame grabber of PM 8500, Apple Computer, Cupertino, USA)
- Measurements with NIH Image 1.59 (resolution of the system 5 μm)

Statistical analysis (paired and unpaired t-test corrected according to Bonferroni) was performed using StatView 5.0 (SAS Institute Inc., Cary, NC, USA).

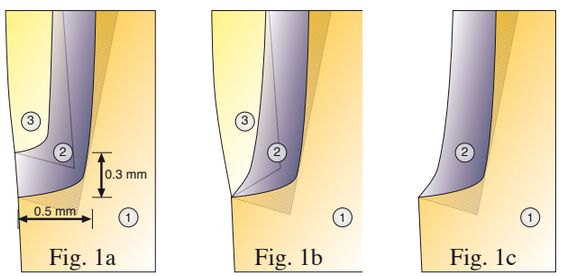

Fig. 1 Framework design

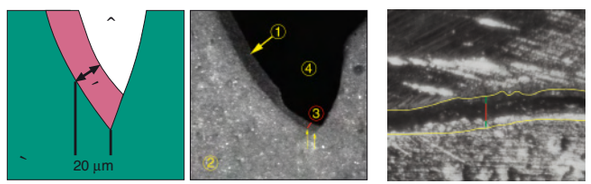

Fig. 2a

Fig. 2b

left: scheme of the indirect silicone relining technique:
1 Sila soft® 2 Sta SealF®
3 width of the gap 4 empty space (metal margin)
red line: point of measurement

right: original view of the digitized region (original resolution 640*480 pixels, interpolated for printing purposes)

Vertical width of the gap:
lower yellow line: finishing line
upper yellow line: metal margin
red line: "internal" gap
green line: "vertical" gap

Fig. 2 Measurements of the marginal gap

Results

Reliability of the method

The coefficient of variation (CV) was calculated for each point of measurement and varied between 0.03 and 0.3 (3 to 30%; SD = 0.5 to 10 μm).

Marginal fit: width of the gap (Fig. 3)

No significant difference ($p>0.05$) in the width of the gap could be ascertained between all metal frameworks before firing, as well as after the dentine bake and the final firing.

All deviations of the marginal fit were much smaller than the clinically acceptable tolerance of 100 μm (*J. McLean, 1971; B. Fransson, 1985*).

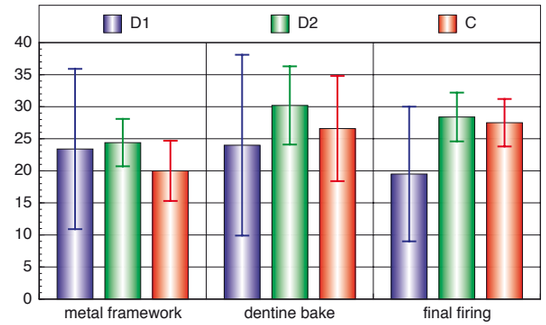

Fig. 3 *Width of the gap* during the firing processes

Marginal fit: maximum vertical width of the gap (Fig. 4)

The *vertical width of the gap* of D1 was significantly ($p<0.01$) smaller than that of D2 and C.

No changes of the *vertical width of the gap* could be seen for D1 along with the firing processes of the ceramic facings.

For any stage of firing, no significant difference could be seen between the *maximum vertical gap* and the *width of the gap* for D1.

The firing of ceramic facings onto the metal framework of D2 had no consequences for the *maximum vertical gap*.

The firing of the metal framework alone (C) did not affect the *vertical width of the gap*.

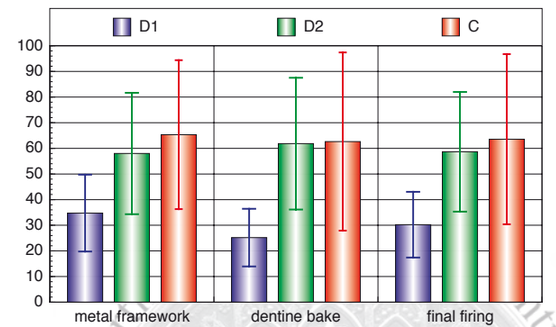

Fig. 4 *Vertical width of the gap* during the firing processes

Conclusions

Wirobond C® showed no changes of the marginal fit related to the margin design of the metal framework and to the firing processes if the thickness of the metal margin is not smaller than 0.3 mm.

The metal framework of D1 showed significantly smaller vertical gaps than D2 and C at all stages of the fabrication of the crowns.

According to previous studies using noble alloys, the firing of the non noble alloy Wirobond® resulted in a comparable clinical fit of the crown margin.