

A study into the performance of a gallium-based restorative material

Dental post-operative sensitivity associated with a Gallium-based restorative material by S. M. Dunne and R. Abraham *Br Dent J* 2000; 189: 310-313

Introduction

This study forms part of a 2-year longitudinal clinical trial to compare the performance of a gallium-based restorative material (Galloy) with a high copper, mercury based (Dispersalloy) control material.

Method

Following Ethical Committee approval, 25 Galloy restorations and 25 Dispersalloy controls were placed in 14 adult patients, by a single operator. The cavities were of moderate size, indicating the use of amalgam as the restorative material. All restorations were polished within 1 week of placement, photographed and a silicone impression of the tooth and restoration recorded. In addition, a visual analogue scale (VAS), indicating the extent of any post-operative sensitivity, was completed by each patient for each restoration, immediately prior to polishing. A score of 0 indicated no sensitivity, while a score of 10 indicated the greatest possible sensitivity. At 6-month recall, the VAS scores, silicone impressions and photographs were repeated.

Results

The mean sensitivity scores for the Galloy and Dispersalloy restorations at 1 week were 5.1 (+/-3.4) and 1.0 (+/-1.5), respectively and at 6 months, 1.8 (+/-3.0) and 0.2 (+/-0.1)

respectively. The differences between these means at 1 week and at 6 months were significant ($P < 0.01$).

Conclusion

Galloy restorations were associated with a much greater severity of post-operative sensitivity than Dispersalloy restorations.

In Brief

- The use of gallium alloys as a dental restorative was suggested in 1928.
- Concern about possible toxicity of mercury containing amalgam has awakened interest in mercury-free alternatives.
- Early gallium alloys expanded excessively, particularly if contaminated by moisture.
- In 1994 a non-palladium gallium alloy (Galloy) was introduced with a claim of lower setting expansion.
- This paper reports the initial results of a longitudinal clinic trial involving Galloy.
- In comparison with Dispersalloy controls, Galloy restorations were associated with excessive post-operative sensitivity and a high incidence of tooth cusp fracture.

Comment

Gallium-based alloys have been introduced to the dental market as mercury-free amalgam substitutes. This paper describes the findings of an ongoing longitudinal clinical trial designed to compare the performance of a gallium-based restorative material (Galloy) with a high copper, mercury-based (Dispersalloy) control material. In the current study Galloy restorations were placed in moderate sized Class I, II and MOD cavities including three pin-retained restorations. Galloy restorations were associated with a much higher incidence and severity of post-operative sensitivity than the control restorations. It was reported that two of the Galloy restorations were removed at the request of a patient within the first 6 months as a result of extreme and persistent sensitivity. In addition, four Galloy restored teeth suffered tooth cusp fracture by the 6-month recall. The high incidence of post-operative sensitivity noted at 1 week recall for the Galloy restorations (21 out of 25 restorations in 14 patients)

versus the Dispersalloy controls (11 out of 25) was reduced in most but not all cases at 6-month recall.

This was in marked contrast with the previously reported findings of Osborne and Summitt (1996).² The difference was attributed to the differences in cavity size/types in the two investigations. The authors attributed the marked post-operative sensitivity and the high incidence of tooth cusp fracture of the Galloy-restored teeth to excessive alloy expansion.

Continued growth of adherent corrosion products has been linked to stress build-up contributing to post-operative sensitivity and tooth fracture as a result of massive internal and external corrosion in a chloride containing medium (as in saliva). Clinically, such catastrophic effects were not observed until some time after restoration placement.³

Despite conforming to current international standard specifications for limits of dimensional change under dry test conditions (+0.02% limit) Galloy demonstrated

an expansion of 21.5%, which is well above the limit set.

Current international specification test standards may have to be revised to include a laboratory corrosion test in view of the adverse clinical experiences reported with Gallium containing alloys.

- 1 Sarkar N K, Moiseyeva R, Berzings D W, Osborne J W. Long-term corrosion of a Ga containing restorative material. *Dent Mat* 2000; 16: 97-102.
- 2 Osborne J W, Summitt J B. 2-year clinical evaluation of a gallium restorative alloy. *Am J Dent* 1996; 9: 191-194.
- 3 Osborne J W. Photoelastic assessment of the expansion of direct placement Gallium restorative alloys. *Quintessence Int* 1999; 30: 185-191.

A C Shortall

Senior Lecturer/Honorary Consultant in Restorative Dentistry, The School of Dentistry, The University of Birmingham, and

F J Shaini

Postgraduate Student/Honorary Clinical Assistant, The School of Dentistry, The University of Birmingham