Summary of: Sealing ability of mineral trioxide aggregate, glass ionomer cement and composite resin when repairing large furcal perforations

G. Lodiene,¹ M. Kleivmyr,² E. Bruzell³ and D. Ørstavik⁴

FULL PAPER DETAILS

¹Ph.D. student and Endodontist, Faculty of Odontology, Department of Dental and Oral Pathology, Kaunas University of Medicine, Kaunas, Lithuania; ²Endodontist, ⁴Senior Scientist, University of Oslo, Faculty of Dentistry, Institute of Clinical Dentistry, Department of Endodontics, Oslo, Norway; ³Professor and Head Department of Endodontics, NIOM – Nordic Institute of Dental Materials, Haslum, Norway
*Correspondence to: Mrs Greta Lodiene
Email: lodieneg@gmail.com

Online article number E7
Refereed Paper – Accepted 17 June 2010
DOI: 10.1038/sj.bdj.2011.198
©British Dental Journal 2011; 210: E7

Objective To evaluate the sealing ability of different repair materials and the pathway of bacterial penetration after closure of large pulp chamber floor perforations. **Materials and methods** Perforations were made in the furcation area of extracted human molars and sealed with either mineral trioxide aggregate (MTA), glass ionomer cement or resin composite. The bacterial leakage method was used with *Enterococcus faecalis* as microbial tracer. The time of leakage (in days) was recorded for each specimen. Statistical analysis of bacterial leakage was performed using the survival analysis and pairwise comparison of groups. A p-value less than 0.05 was considered statistically significant. Leaking specimens were prepared and inspected for the presence of bacteria by a scanning electron microscope (SEM). **Results** The percentage of leaking samples was significantly higher in resin composite than in the other groups and the negative control group ($p < 0.05$). SEM inspection revealed the presence of bacteria in all leaking specimens. Bacteria were observed along the filling-dentine interface as well as in dentinal tubules at some distance from the filling. **Conclusions** The resin composite material leaked significantly more than the MTA and glass ionomer cements when used to repair large furcation perforations. Bacteria could penetrate into dentine even at a distance from the perforation filling.

EDITOR'S SUMMARY

I would hazard a guess that for undergraduates now, as when I was studying, the mention of dental materials brings forth a sigh, a groan or grimace. It is not the most exciting of subjects, especially compared to the challenges of clinical endeavour and yet, ironically, without the materials and the science behind them we would be seriously hard-pushed to provide such positive treatment options as we do.

The difficulties of researching and reporting developments in new materials include the speed with which they reach the market coupled with the need to see them tested over a long period of time to ensure that they can stand up to the extreme environment of the oral cavity. Mineral trioxide aggregate (MTA) has now been available for some time and has been used in various applications in endodontic, pulpal and now periodontal disease processes. The growing body of evidence from a broad range of stud-

ies seems to indicate that the material has much to commend it and this paper underlines its potential value in repairing defects involving furcations, including furcal perforations.

Microbiology also has an important part to play in this work and indeed in the success or otherwise of the treatment. We tend to forget that virtually everything we do in clinical dentistry is driven by the behaviour of microorganisms, whether it is in the ravages of caries or periodontal diseases the underlying causes are directly related to the activity of these unseen but ever present adversaries to oral health.

A paper of this sort is therefore valuable not only for its useful results which point the way towards improved treatment options and therefore increased oral health but also because it serves to remind us that the professional work that we undertake is based on a foundation of more than one discipline. This is furthered by our own knowledge

and appreciation of the underlying biological, chemical and physical principles, despite what we might think of the subjects when we are students!

The full paper can be accessed from the *BDJ* website (www.bdj.co.uk), under 'Research' in the table of contents for Volume 210 issue 5.

Stephen Hancocks
Editor-in-Chief

DOI: 10.1038/sj.bdj.2011.174

TO ACCESS THE BDJ WEBSITE TO READ THE FULL PAPER:

- BDA Members should go to www.bda.org.
- Click the 'login' button on the right-hand side and enter your BDA login details.
- Once you have logged in click the 'BDJ' tab to transfer to the BDJ website with full access.

IF YOUR LOGIN DETAILS DO NOT WORK:

- Get a password reminder: go to www.bda.org, click the login button on the right-hand side and then click the forgotten password link.
- Use a recommended browser: we recommend Microsoft Internet Explorer or Mozilla Firefox.
- Ensure that the security settings on your browser are set to recommended levels.

IF YOU HAVE NOT YET SIGNED UP TO USE THE BDA WEBSITE:

- Go to www.bda.org/getstarted for information on how to start using the BDA website.

IN BRIEF

- Comparison of the sealing properties of three commonly used materials for repair of large perforations.
- Bacteria could penetrate into dentine even distant from the perforation filling.
- Teeth repaired with mineral trioxide aggregate were more resistant to bacterial leakage.

COMMENTARY

Furcation perforations in multirooted teeth may lead to the loss of periodontal attachment in the adjacent area. Independent of the cause, prompt and proper sealing of such perforations is important for the prognosis of the affected tooth. The requirements for the repair material are the same as for other materials implanted in teeth and the rest of the human body. Several materials have been tested for their sealing properties in such perforations, but different methods and materials make comparisons difficult. The value of leakage studies has also been discussed, due to limitations related to methodological issues and the low power of the statistical tests applied. With this in mind, the sealing ability of mineral trioxide aggregate (MTA) has been studied extensively and have been shown to be similar or superior to other test materials. Some recent publications have studied the use of MTA for the sealing of furcation perforations by testing the leakage of protein along the material.

The paper by Lodienè *et al.* is another *in vitro* study testing the sealing effect of MTA in furcation perforations. However, they have moved from tracer-penetration of dyes or protein molecules of different sizes to bacterial penetration (*Enterococcus faecalis*), giving a more clinically relevant situation.

The study showed that grey and white MTA (Pro Root®) and resin-modified glass ionomer cement (Vitremer) had better sealing properties against *Enter. faecalis* in furcation perforations

as compared to resin composite (Retroplast™). They also found bacterial penetration through intact dentine, but the methodology was unable to discriminate between vital and dead bacteria in the tubules (identified by scanning electron microscopy). Thus, the paper raises a new important hypothesis that underscores the complexities of such leakage studies. Further studies are needed to identify the important path for bacteria, either through furcation canals or dentine tubules, or along the dentine-material interface. This would be of utmost importance for the clinical handling of such perforations. Further, the indicated pathway through furcation canals or dentinal tubules may, to some degree, explain the conflicting findings of several studies regarding the possible antibacterial effect of MTA.

Asgeir Bårdsen
Associate Professor, Department
of Clinical Dentistry – Endodontics,
Faculty of Medicine and Dentistry,
University of Bergen, Norway

AUTHOR QUESTIONS AND ANSWERS**1. Why did you undertake this research?**

Perforations from the pulp to the surrounding periodontium caused by resorptive defects, caries and iatrogenic events during endodontic treatment are most undesirable damages. Healing prognosis is influenced by factors such as the dimensions of the perforation, time delay before the repair, location of the perforation, ability to seal the defect and materials used. MTA has received particular attention as a perforation repair material. It is known that the apical plug using MTA should be 3–5 mm. It was of interest to evaluate the sealing ability of the materials used for furcation perforation repair, knowing that the thickness of the dentine in that area is less than 3 mm. The large perforations were chosen because of their poor prognosis in the clinical situation.

2. What would you like to do next in this area to follow on from this work?

We have decided to focus more on the biocompatibility of endodontic sealer materials. A few years ago we investigated three sealers with respect to mouse fibroblast cytotoxicity by two fairly simple screening assays and found that the sealer that consisted of more than one methacrylate monomer was more toxic than the one consisting of one such monomer and the material that was epoxy polymer-based.¹ We have already performed a new study looking into the mode of cell (rat submandibular salivary gland) death caused by extract sealers consisting of different polymers.

1. Lodienè G, Morisbak E, Bruzell E, Ørstavik D. Toxicity evaluation of root canal sealers *in vitro*. *Int Endod J* 2008; **41**: 72–77.