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Themed issue: pulp biology and clinical practice

Editorial

The tooth pulp is vulnerable to damage from a variety of insults including caries, trauma and tooth tissue loss. In addition, our everyday clinical efforts to remove dental caries, place restorations, or even orthodontically align teeth, may actually provoke a considerable response within the pulp–dentine complex. Fortunately for us and our patients, laboratory and clinical studies suggest that the tooth pulp has a remarkable propensity for healing and repair. This unique tissue has fascinated researchers and clinicians over the centuries, mostly because of its incredibly dense innervation, which predominantly comprises nociceptive (pain perceiving) nerve fibres. In recent years, however, there has been increasing recognition that pain perception is a secondary function of tooth innervation, and sensory nerves are likely to serve much greater importance in defence and healing mechanisms.

Pulpal biology is a rapidly advancing and exciting area of research, and one that is highly relevant to our clinical practice. This special issue of the *International Journal of Paediatric Dentistry* has focused on the tooth pulp and the impact of various clinical conditions and interventions on pulpal health and disease. The primary aim is to provide readers with a basic science update in relation to the tooth pulp, and to stimulate reflection as to how this knowledge applies to the clinical setting.

The first paper, by Dr Gopikrishna and his colleagues, explores one of the most challenging aspects of diagnostic dentistry: assessment of pulp vitality. An accurate diagnosis of pulp status is a key determinant in the success of any endodontic intervention. This comprehensive review describes, in detail, the methods employed to determine pulp sensitivity and vitality. The limitations of the different approaches are outlined and the rationale for determining pulpal vascularity is highlighted. Dr Gopikrishna has particular expertise in the area of pulse oximetry and presents interesting data to support its application in the assessment of pulp status.

As paediatric dentists, we have a special interest in the primary dentition and are uniquely placed to further understanding of primary tooth biology and pathology. It is extremely encouraging, therefore, to introduce the next two papers, which are both histological-based studies of primary teeth. Dr Kassa's work was undertaken as a master's degree at Leeds Dental Institute, UK, and seeks to determine whether there is any difference in the degree of pulpal inflammation between primary teeth with occlusal or proximal caries lesions. There is a good body of evidence to show that caries-induced pulpal inflammation increases with caries progression, but to date, the effect of caries site has not been considered. Dr Kassa's key findings suggest that pulpal inflammation may be more advanced in primary molars with proximal lesions than in teeth with occlusal lesions, where caries progression is greater than halfway through the total dentine thickness. This interesting result challenges us to consider our rationale for various pulp therapy regimens.

The immunohistochemical study by Dr Monteiro and her colleagues has been previously presented as an oral communication at the 2008 Congress of the European Academy of Paediatric Dentistry, where Dr Monteiro was the recipient of the Young Scientist Award. The aim of the investigation was to determine whether any changes occur in pulp innervation, immune cell accumulation, and vascularity in association with physiological root resorption. The study sample comprised non-carious primary molars at various stages of physiological root resorption. Interestingly, there were no significant differences in mean variables according to the degree of root resorption, although wide inter-sample variation was observed. The findings from this basic science study do have clinical relevance in terms of the potential of exfoliating teeth to respond to pain and injury. However, further study on carious teeth, at different stages of resorption, would appear to be indicated.

We then move onto a paper by Srinivasan, Waterhouse and Whitworth which provides a comprehensive review of mineral trioxide aggregate (MTA). The authors first present a wealth of literature, published from 1993 to 2008, on the physical and chemical properties of MTA, before describing its clinical applications

in paediatric dentistry. The use of MTA is now becoming widely accepted in the armamentarium of paediatric dentistry pulp therapies, and thus, it is essential that we have a sound understanding of its basic properties.

The papers by Baroudi *et al*. and Ben Tuc *et al*. clearly illustrate the potential for iatrogenic damage as a result of common clinical procedures. Baroudi's laboratory investigation measured changes in pulpal temperature during the polymerization of flowable and non-flowable composites using light-emitting diode and halogen light-curing units. Findings that temperature rises were particularly evident with the use of light-curing units, and flowable composites should alert clinicians to the possibility of heat-induced pulpal damage with prolonged exposure time. Ben Tuc's *in vitro* study also explored the potentially harmful effects of various light-curing units and three different compomers on human pulp cells. Interestingly, all compomer materials were found to be moderately cytotoxic to human pulp cells, the degree of which seemed to be greatest with the use of a light-emitting diode light-curing unit.

The final paper, by Sloan and Worthington, who are acknowledged experts in the field of stem cell biology, provides us with a valuable insight into the future direction of regenerative pulp research. The authors review the basic science that has led to the identification of stem/progenitor cells within the dental pulp, and describe the complex role of these cells in reparative dentinogenesis. It is clear that this new-found understanding may find novel applications in vital pulp therapies, but the authors state this is still an area of development. Nonetheless, the ability to manipulate the regenerative potential of the tooth pulp is something well worth waiting for.

I trust you will find this special issue of interest and educational benefit. I also hope it promotes a greater appreciation of the relevance of pulp biology to clinical paediatric dentistry.

Helen Rodd
Editor