Summary of: Regenerative endodontics

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FULL PAPER DETAILS

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Background Significant advances in our understanding of the biological processes involved in tooth development and repair at the cellular and molecular levels have underpinned the newly emerging area of regenerative endodontics. Development of treatment protocols based on exploiting the natural wound healing properties of the dental pulp and applying tissue engineering principles has allowed reporting of case series showing preservation of tissue vitality and apexogenesis. **Aim** To review current case series reporting regenerative endodontics. **Results** Current treatment approaches tend to stimulate more reparative than regenerative responses in respect of the new tissue generated, which often does not closely resemble the physiological structure of dentine-pulp. However, despite these biological limitations, such techniques appear to offer significant promise for improved treatment outcomes. **Conclusions** Improved biological outcomes will likely emerge from the many experimental studies being reported and will further contribute to improvements in clinical treatment protocols.

EDITOR'S SUMMARY

Regenerative endodontics uses the concept of tissue engineering to restore root canals to a healthy state. As tooth retention, rather than extraction or 'replacement', is the ultimate goal of endodontic treatment, achieving a healthy root canal in this way could provide dentists with the holy grail of endodontic treatment.

In 1930, Herman[1] introduced calcium hydroxide to the field of endodontics and as we know it is still commonly used as a dressing for the treatment of vital pulp to stimulate tissue repair.

In 2006, the US National Insitutes of Health defined regenerative medicine as 'the process of creating living, functional tissues to repair or replace tissue or organ function lost due to age, disease, damage, or congenital defects'.

So, you could say that dentists practised regenerative medicine (in endodontic treatments) over 70 years before it was ever even defined as a field!

Thus, the profession is clearly well placed to advance the field of regenerative medicine. This review provides a frank and honest discussion of the current treatment approaches in the field of regenerative endodontics. The authors, Tony Smith and Stéphane Simon, are keen to stress that the field of regenerative endodontics has been supported by extensive research in pulp biology – providing a deep understanding of the molecular and cellular events involved in pulp repair. You could say that behind every exciting new breakthrough are painstaking mechanistic investigations.

The distinction between repair and regeneration is also highlighted by the authors. They point out that at the moment regenerative endodontics provides more of a reparative than regenerative therapeutic strategy. However, they also illustrate through a review of real cases in the literature that new regenerative treatments already offer improved clinical outcomes, by inducing healing of the tissues, stimulating bone regeneration and producing pain-free patients.

Thus, applying tissue engineering principles has been shown to result in the preservation of tissue vitality in the dental pulp. Interestingly, these tissue engineering and wound healing treatments are by nature more medical and do not require the same mechanical skill as current RCT procedures. This is likely to invoke a tidal wave of change in the endodontist's skill set.

Although, it is not quite 'ready for roll-out' to general practice, it is clearly a highly promising area of endodontics research and I look forward to seeing where regenerative endodontics will take us in the future.

The full paper can be accessed from the *BDJ* website (www.bdj.co.uk), under 'Research' in the table of contents for Volume 216 issue 6.

1. Hermann B W. Dentinobleration der Wurzelkanale nach der Behandlung mit Kalcium. *Zahnarzt Rundschau* 1930; **39:** 888.

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IN BRIEF
- Reviews advances in regenerative endodontics.
- Suggests regenerative endodontics as it is currently performed represents more of a reparative than regenerative therapeutic strategy.

COMMENTARY

This is an interesting review of a topic that has moved increasingly to the forefront in the specialty of endodontics. Regenerative endodontics is clearly attracting a great deal of attention from researchers and clinicians as the science of preserving or restoring pulp vitality advances.

The authors begin with an interesting treatment of regeneration and repair beginning with the difference between 'reactionary' dentine and 'reparative' dentin and a brief review of the nature of the odontoblast. They briefly review the sources for stem/progenitor cell recruitment and discuss the differentiation and secretory activity of odontoblast-like cells, pointing out the complexity of the bio-active molecules involved and their regulation.

Drs Simon and Smith correctly emphasise that regenerative endodontics as a clinical treatment strategy is supported by a limited, but rapidly increasing, number of case-series reports focusing on treatment of the immature tooth with pulp necrosis and stimulation of additional root development. As an endodontic clinician for 38 years who has laboured with apexification procedures over numerous cases with necrotic pulps and incompletely developed root apices, the resultant increased root thickness and reduced size of the canal space with regenerative endodontics gives great hope that young patients can avoid the loss of these teeth from root fracture.

The authors review the treatment variables involved in regenerative endodontics and note that with irrigants and intra-canal medicaments, growth factors, extent of pulp tissue removal, use of scaffolds, and even the type of tissue formed during regenerative procedures that there are still more questions than answers. However, to this reader, the most exciting prospect about regenerative endodontics is that a previous mechanical emphasis on canal shaping and obturation is being replaced with a biological emphasis on wound healing, tissue engineering, and preservation of the dental pulp. That is exceedingly clear after reading this paper.

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AUTHOR QUESTIONS AND ANSWERS

1. Why did you undertake this research?

Endodontics in the past two decades has been characterised by the evolution of technologies and devices for disinfection and filling of the root canal system. Evolving much slower, but with the potential for a paradigm shift, is the concept of connective/pulp tissue regeneration within the root canal. With the current tissue engineering concepts, vital pulp regeneration *in vitro* is already feasible with stem cell-based techniques or with cell homing concepts. With these approaches expected to develop and evolve, the orientation is likely to be more pharmacological and biological, and the procedures less invasive. Thus, in the endodontics of the future, these approaches are expected to complement the current treatment techniques.

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

In the following years, new concepts in endodontics will emerge and probably completely change the vision of the speciality. Lots of people didn't believe in this evolution four or five years ago, but mentalities start to change slowly but surely. The general dental practitioners are probably more interested in this new era of endodontics, because the biological approach will lead to a more medical approach for treatment of the disease and a less mechanical one. Training and teaching will be required to organise this U-turn in endodontics.