**INTRODUCTION**

**“Talkin’ ‘bout regeneration”**

The English rock band, The Who, helped shape rock ‘n roll with their song, “My Generation” and, as a result of the historical artistic and significant value, was inducted in the Grammy Hall of Fame. In similar fashion, I think that in the near future, we will see historical and significant value in delivering true pulp regeneration.

True pulp regeneration is closer to reality than you may think, and not just for immature teeth with open apices. To achieve regeneration, there needs to be a biologic scaffold, numerous growth factors, and stem cells. Fortunately, these necessary elements are all contained within the blood, the cells of the apical papilla, and the dentinal tubules. If we can take advantage of the body’s natural mechanisms for healing, we can revitalize teeth. Research has shown that the blood contains mesenchymal stem cells (MSCs), many of the needed growth factors, and the physical structure (scaffold) required for reconstruction of the pulp. There are also stem cells in the periapical tissue called stem cells of the apical papilla (SCAPs) that, like the MSCs, can differentiate into pulp tissue. Many growth factors are trapped within the dentinal tubules during tooth development. These growth factors are released when the dentin is damaged by decay and play a major role in pulp repair and regeneration. These are also released when the dentin is demineralized with EDTA.

We have restorative materials such as MTA and bio-ceramic that promote regeneration and repair coronally. One stumbling block that researchers are running into is how to effectively clean the root canal system without damaging or destroying any of these cells or growth factors. If the cells entering through the apex encounter any bacteria or debris, they send signals that initiate an inflammatory response. This results in “repair” instead of “regeneration.” In the repair process, the body produces blood vessels, bone, and connective tissue. In regeneration, vital pulp tissue and odontoblasts are produced, restoring normal function. While repair is acceptable and preferred over gutta percha, restoring pulp tissue is ideal. An “ultraclean” environment is necessary in order to initiate the regeneration process; one that is free of biofilm, tissue remnants, or bacteria. That is the key to success in regenerative endodontics. Many different techniques have been tried with limited success. The current recommended protocol involves multiple appointments using triple-antibiotic pastes (TAP) as an intra-appointment medication. This technique can damage the stem cells, and it is nearly impossible to remove the TAP completely. The result is usually an inflammatory response and “repair,” as is evident in most of the research and case studies.

A new and exciting technology called the GentleWave® System has been developed that shows great potential for the level of cleaning and disinfection needed for regeneration. Sound waves with multiple frequencies are initiated at the tip of the GentleWave™ Treatment Instrument. These sound waves reverberate throughout the entire root canal system, breaking apart tissue and even biofilm from all of the canals, ramifications, isthmus, even all the way to the periradicular tissue. This, combined with fluid dynamics and continuous refreshment of treatment fluids, leaves the root canal system so ultraclean that the environment may be ideal for the regeneration process to occur. This appears to be the missing link in the regeneration chain and can often be done without even instrumenting the canals.

I’m excited that our future may involve not only saving more teeth, but also revitalizing them. Then we can focus our specialized knowledge and skills on regrowing nerves instead of removing them. There’s a lot of new technology being revealed on the AAE floor this year. I hope to see you there.