

The future is very promising for biologic materials to regenerate the periodontal tissues

An interview with Dr David Cochran

Dr. Cochran, what is the ultimate goal of periodontal therapy?

The ultimate goal of periodontal therapy is to maintain the teeth in a healthy functional state for the life of the patient. Research over the last few years demonstrates that such an outcome has far reaching implications for the patient. For example, healthy teeth mean that the patient has less inflammation in their bodies and this has been shown to reduce the risk of many other potential systemic problems.^{16,17} This topic has also been discussed among periodontal societies trying to understand the influence of inflammatory gum disease on cardiovascular problems, control of diabetes and even preterm births for example.¹⁸

In other words, the risk for systemic problems is decreased when a patient maintains healthy teeth. We do not always think about it but healthy teeth also influence what we can eat.

This also has significant ramifications, for example: healthy teeth allow us to masticate (chew) our food well which reduces the risk for gastrointestinal problems¹⁹ and therefore increases one's quality of life.

Lastly, a nice healthy smile promotes high self-esteem which is certainly helpful. All of these issues have been discussed in the literature and reinforce the critical importance of a healthy periodontal condition.

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What advances have been made in periodontal therapy?

I would say that there have been two major advances in periodontal therapy that have resulted in paradigm shifts in our field. The first advance was the realization that the periodontal tissues could be regenerated versus simply repairing the tissue after periodontal disease has occurred and that periodontal regeneration can be enhanced with materials like Emdogain and other protein products¹. (Figures 1 – 8).

In the old days we used to clean around people's teeth both non-surgically and surgically and try to reduce inflammation and simply try to prevent further loss of the periodontal structures. Now we know that we can not only reduce inflammation and prevent further tissue loss, we can now actually regrow some of the periodontal tissues and the protein factors such as those found in Emdogain can help us do this better and more predictably.⁵

Another product on the market derived from blood platelets takes advantage of a single protein growth factor plus bone graft to help regenerate periodontal tissues while the powerful bone morphogenetic protein factor found in our bone tissue and used in spinal fusion as well as the leg bones is now used in the oral cavity to grow bone in the sinus and in extraction sites so that dental implants can be placed.

The future is sure to bring more proteins to stimulate periodontal tissue regeneration. For example, in collaboration with researchers at Straumann, we have been analyzing some of the proteins that make up Emdogain and shown that they have powerful effects on both angiogenesis^{5,6,7} – the growth of new blood vessels which is necessary for any new tissue growth – and osteoinduction⁸ – the formation of new bone.

In addition, some interesting periodontal regeneration studies have been conducted in Japan on another protein

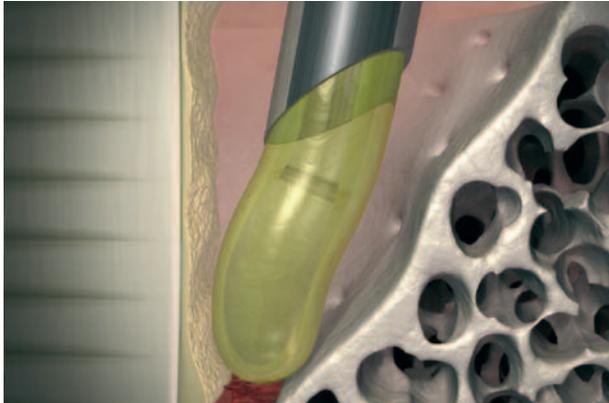


Figure 1: When Straumann® Emdogain is applied the enamel matrix derived proteins precipitate on the root surface to form a matrix layer.



Figure 2: The matrix stimulates the attraction and proliferation of periodontium.

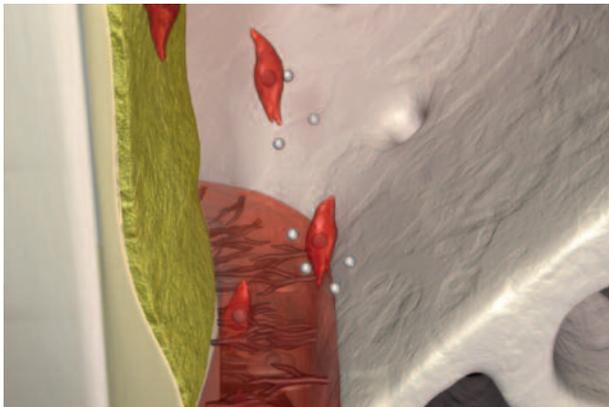


Figure 3: The cells secrete natural and specific cytokines and autocrine substances promoting the necessary proliferation.

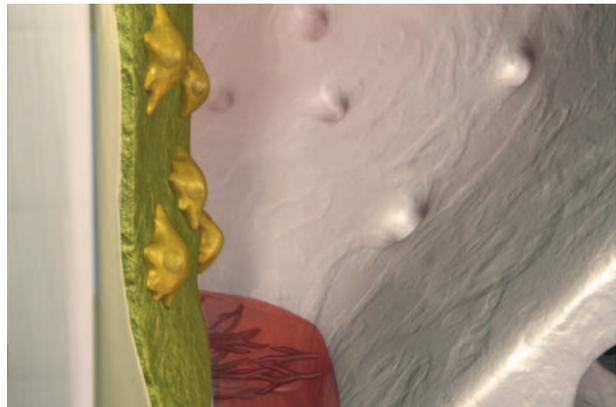


Figure 4: Supporting cells are attracted and differentiate into cementoblasts which start with the formation of the cement matrix in which the periodontal fibers will be fixed.

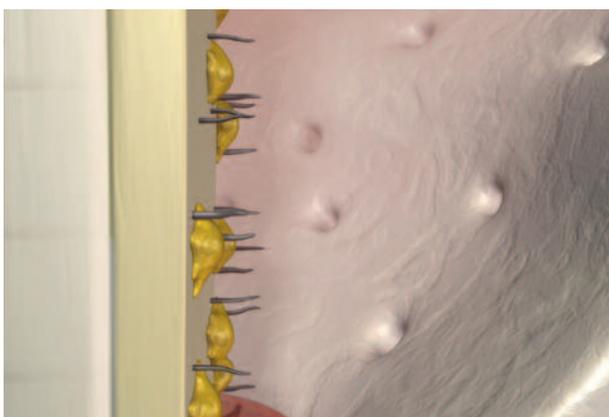


Figure 5: The newly formed cement layer increases in thickness, extending the periodontal ligament.

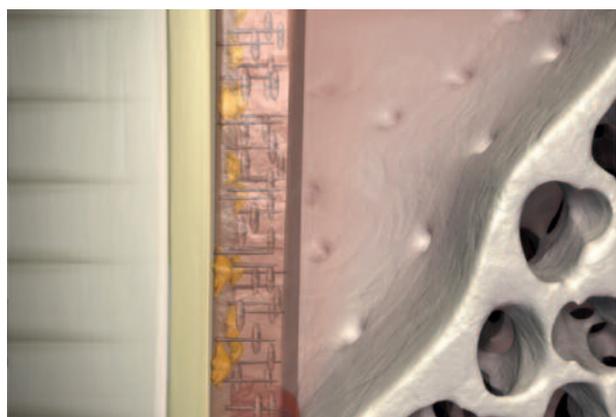


Figure 6: Within months, the defect fills with newly formed periodontal ligament.

growth factor – the fibroblast growth factor – which also facilitates the growth of blood vessels and is currently in clinical trials.

Furthermore, another protein factor related to bone morphogenetic protein that also stimulated periodontal regeneration – the growth and differentiation factor – has

been studied in Europe and within our group. All of these studies suggest that the future is very promising for biologic materials to regenerate⁹ the periodontal tissues including bone, cementum and the periodontal ligament.

The second advance was the knowledge that periodontal tissue loss occurred due to inflammation and not due to the



Figure 7: As the periodontal ligament is formed, new bone continues to develop.

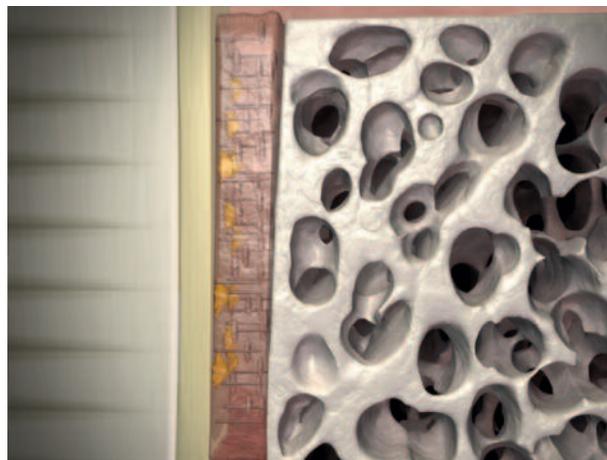


Figure 8: Straumann® Emdogain facilitates the regeneration of the complex dental structure of the periodontium, building a new functional attachment.

bacteria that live around the teeth. Corollation being that periodontal inflammation can have effects on systemic health as I noted above.^{10,11}

We used to understand that systemic problems influenced the teeth, but only recently did we understand that the teeth – actually periodontal inflammation – influenced the rest of the body.

In other words it's now a two way street with the teeth influencing the body as well as the body influencing the teeth. A good example of this was that for years periodontists knew that patients with uncontrolled diabetes had lots of infections with pus around their teeth and lots of bone loss thus, their systemic disease – diabetes – influenced the health of their teeth. Now we understand that periodontal disease can influence the patient's ability to control their sugar level meaning that the condition of the teeth can influence the body's ability to control their diabetes.²⁰

What are the potential benefits of using Straumann® Emdogain in periodontal therapy?

The use of Emdogain to stimulate periodontal regeneration has been extremely well documented in the literature for over 15 years. These studies include in vitro, animal and human clinical trials and reveal that there are positive effects on the cells that are responsible for the regeneration of the cementum, bone and periodontal ligament. Studies in animals show histologically that all the periodontal tissues are regenerated.⁵

In fact in studies that we performed in baboons, significant new cementum, bone and periodontal ligament

was formed well above a notch in the root placed at the base of the periodontal defects. In some cases these tissues virtually filled the entire defect. Other histological results demonstrated that when Emdogain was added to autogenous bone grafting around wider defects around the baboon teeth, significant stimulation of tissue regeneration occurred.¹² Other studies have shown that Emdogain not only stimulates bone and cementum formation, it also stimulates the growth of new blood vessels (angiogenesis), a process required for any new tissue formation.^{6,7}

To summarize, two important aspects are noteworthy in regards to Emdogain. One is that this is a very well documented periodontal regenerative material in the literature having more documentation¹⁵ certainly than any other protein used for periodontal regeneration and two, that this material alone and combined with bone grafts has sufficient convincing evidence of safety and efficacy that the FDA has approved it for use in multiple indications.*

What would be your recommendations to practitioners who perform periodontal surgery? In spite of knowing a lot about the effects of the proteins that comprise Emdogain, much less is known about the clinical application of this material and how it may be optimized in its use. Meticulous scaling and root planing is certainly recommended followed by the use of the neutral divalent cation chelator, ethylene diamine tetra-acetic acid**.

Following this, the Emdogain is first applied on the root and on the bony margins of the defect when the bleeding has been controlled. If a bone graft is used, secondly place the graft in a dappen dish and coat the graft particles with

* Intrabony, Mandibular class II furcation and Recession defects. ** Straumann® PrefGel™

Emdogain prior to placing it in the defect around the tooth.

Lastly, it is a good idea to place any Emdogain left over the defect and under the periodontal flaps since we know that the Emdogain proteins will promote healing by stimulating new blood vessels.^{6,7}

A number of years ago we published a paper showing that when Emdogain is added to allograft bone grafts, you increase the osteoinductive effect of the graft.¹³ For this reason and all of the positive effects associated with these proteins when combined with a bone graft, adding some allograft or autogenous bone to the procedure appears to be a prudent part of the therapy.

Emdogain will soon be available in a smaller size. In which indications would you use it?

I am excited about the availability of a smaller size of Emdogain. This size should allow the clinician to use the material more often since it will be less costly when added to bone grafting procedures. In addition, the smaller size will allow its use in smaller defects and for soft tissue grafting procedures involving even one or two teeth. Because these proteins have been so well documented for so long, it only makes sense to take advantage of the proteins to enhance a patient's regenerative periodontal outcomes.

How important is the combination of Emdogain and bone grafts for a positive clinical outcome?

As noted above, we have shown using histology from animal experiments that Emdogain combined with bone grafts can stimulate the osteoinductive – and presumably the cementoinductive – effect of the bone graft.¹³

Furthermore, in severe periodontal defects in the baboon, we observed that the periodontal regeneration achieved was really remarkable. New cementum formation was prominent in the notch of the root and extended very far coronally.¹² Dr. Robert Schenk taught me that new bone formation requires a solid base such as a bone graft particle or an osteoconductive implant surface such as SLA.¹⁴ Our studies have indicated that allograft bone particles or autogenous bone graft particles are very effective at providing that base for new tissue

formation^{5,10-12,14}. Thus when I have an opportunity in my periodontal regenerative procedures, I try to add some bone graft. Adding the graft with Emdogain also helps to stabilize the wound clot and in combination with Emdogain's proven effect on angiogenesis, seems to me to be the most effective procedure to stimulate periodontal regeneration.

Are there any other thoughts you would like to share on the topic?

My final thoughts are that our main goal is to improve the care of our patient treatments. Emdogain is a mixture of proteins that has over 15 years of examination in studies supporting its positive effects on periodontal regeneration. In recent studies where we have taken certain proteins out of the Emdogain mixture suggest that these proteins have potent effects on bone and cementum and on the ability to grow blood vessels into the wound⁶.

Interestingly – although the bone forming activity may involve some bone morphogenetic proteins – the majority of this effect seems to come from different proteins in Emdogain such as enamelin and ameloblastin, two enamel proteins that most of us don't know much about. Most of our studies also suggest that the combination of the proteins in Emdogain is more effective than the separated components or even some of its components combined.

Our studies thus far reinforce that Emdogain is a powerful material to stimulate periodontal regeneration but, at the same time, we have a lot to learn about these proteins and their clinical application^{5,10-12,14}. It is a really exciting time for periodontics and I feel that we are on the tip of the iceberg in producing even more predictable and effective therapy for our patients and helping them to maintain their natural dentition.

Doctor Cochran, thank you for this interview.

References: The complete list of references to this text can be viewed on: www.straumann.com/stargetref.pdf

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