



REVIEW ARTICLE

## Use of enamel matrix–derived proteins in periodontal procedures: Clinical evaluation of Emdogain

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### ABSTRACT

**Introduction:** chronic periodontitis compromises the supporting dental tissues, generating interest in regenerative biomaterials such as Emdogain.

**Objective:** to analyze the clinical efficacy of Emdogain in periodontal procedures and its impact on tissue regeneration.

**Methods:** a systematic review of the scientific literature was conducted across different databases, using an algorithm with keywords and Boolean operators to identify relevant sources. The selected studies, after applying rigorous inclusion and exclusion criteria, were critically evaluated regarding timeliness, methodological quality, and thematic relevance, and coherently integrated into the final synthesis of the review.

**Development:** evidence shows that Emdogain promotes the formation of new periodontal ligament, root cementum, and alveolar bone. Clinical studies reported an average reduction of 3,5 mm in periodontal pockets and a gain of 2,8 mm in clinical attachment. Its application is associated with lower morbidity, improved healing, and absence of additional surgeries. Compared with other biomaterials, Emdogain demonstrated superiority, especially when combined with connective tissue grafts. However, its efficacy decreases in extensive periodontal defects and in smokers, limiting its predictability in complex cases.

**Conclusions:** emdogain represents an effective and less invasive alternative for periodontal regeneration, with favorable clinical and histological outcomes. Nevertheless, further research is required to optimize its application and define combined protocols for complex defects.

**Keywords:** Bone and Bones; Periodontics; Proteins; Regeneration.

## INTRODUCTION

Enamel matrix-derived proteins (EMD), specifically Emdogain, have proven to be an effective tool in periodontal tissue regeneration and in promoting healing in various surgical procedures.<sup>(1)</sup> Its use has gained popularity in periodontal, mucogingival, and implantological treatments due to its ability to enhance cellular proliferation and regenerate tissues such as bone, cementum, and periodontal ligament.<sup>(2)</sup>

Chronic periodontitis is a prevalent disease that, if not adequately treated, can lead to tooth loss and a significant decline in patients' quality of life.<sup>(3)</sup> EMD, by offering a regenerative alternative, has revolutionized the therapeutic approach toward complete restoration of lost periodontal structures. The use of EMD in combination with other regenerative materials has shown promising results, highlighting its importance in modern dentistry.<sup>(4)</sup>

Enamel matrix derivative is primarily composed of amelogenins—proteins crucial for enamel formation and development. These proteins stimulate cellular proliferation in the periodontal ligament and osteogenic cell differentiation, thereby promoting periodontal tissue regeneration. Emdogain, a commercial product based on these proteins, has been the subject of numerous studies demonstrating its efficacy in regenerative procedures.<sup>(5)</sup>

Despite advances in periodontal regeneration with EMD, challenges and limitations remain. EMD application in complex defects—such as Grade III furcation lesions—does not always yield predictable regeneration.<sup>(6)</sup> Additionally, variability in clinical outcomes may be influenced by factors such as substrate topography and combination with other graft materials. These inconsistencies highlight the need for further research to optimize techniques and maximize EMD benefits across diverse clinical scenarios.<sup>(7)</sup>

The objective of this study was to determine the efficacy of enamel matrix-derived proteins in periodontal regeneration through a literature review, providing an evidence-based, comprehensive perspective to guide optimal clinical use.

## METHODS

A systematic bibliographic review was conducted following PRISMA 2020 guidelines to evaluate the clinical efficacy of Emdogain in periodontal regeneration. The search period spanned from 2019 to 2024, encompassing recent clinical studies and reviews.

Information sources included PubMed, Cochrane Library, Scopus, Web of Science, Embase, and the institutional library of Uniandes. Secondary references and gray literature were also reviewed. Languages considered were English and Spanish.

The search strategy employed keywords and MeSH terms: "Emdogain," "enamel matrix proteins," "periodontal regeneration," "mucogingival procedures," and "dental implants," combined with Boolean operators.

Inclusion criteria comprised publications from the last five years, clinical trials, controlled studies, and systematic reviews with complete data. Excluded were articles without full-text access, studies in other languages, and those not specifically addressing Emdogain use.

The selection process initially identified a broad set of studies. After duplicate removal and title/abstract screening, full texts meeting criteria were selected. Ultimately, three primary studies and several complementary reviews were included. The process was illustrated using a PRISMA flow diagram.

Data extraction and analysis were performed using comparative matrices, collecting variables such as author, year, design, intervention type, and clinical outcomes. A qualitative synthesis of findings was conducted, comparing Emdogain results with other biomaterials.

## RESULTS

The literature review on Emdogain use in periodontal regeneration revealed key findings highlighting its efficacy and limitations across clinical scenarios. The selected studies were:

- Universidad Regional Autónoma de los Andes. *Efficacy of Emdogain in periodontal regeneration: a clinical study.*<sup>(8)</sup>
- Universidad Católica de Santiago de Guayaquil. *Comparison of Emdogain with other biomaterials in periodontal regeneration.*<sup>(9)</sup>
- Study on combined use of Emdogain and connective tissue grafts in periodontal regeneration.<sup>(10)</sup>

### 1. Efficacy of Emdogain in Periodontal Regeneration

- Clinical studies: Emdogain demonstrated significant improvements in clinical attachment levels, periodontal pocket depth reduction, and bone restoration. Average pocket depth reduction was 3,5 mm, with a 2,8 mm gain in clinical attachment level.<sup>(8,9)</sup>
- Histological studies: New periodontal ligament, acellular cementum, and alveolar bone formation were observed after 4 months of treatment.<sup>(9)</sup>

### 2. Clinical Benefits

- Emdogain offers simplicity in application, reduced morbidity, no need for secondary surgeries, decreased postoperative inflammation, and improved healing. Studies reported better clinical attachment levels, reduced pocket depths, and effective radiographic bone restoration.<sup>(9,10)</sup>

### 3. Limitations and Challenges

- Emdogain shows limitations in wide and deep periodontal defects due to mucoperiosteal flap collapse, inadequate pre- and postoperative plaque control, and reduced outcomes in smokers. Some studies indicated minimal or no gain in keratinized tissue.<sup>(9,10)</sup>

### 4. Comparison with Other Treatments

- Comparative studies revealed that Emdogain provides superior clinical attachment levels and pocket depth reduction compared to other periodontal treatments. Combination with connective tissue grafts enhanced root surface adhesion and more effective periodontal regeneration.<sup>(9)</sup>

### 5. Specific Findings

- Uniandes study: Demonstrated Emdogain's efficacy in mandibular Class II furcation defects, with 3,5 mm pocket depth reduction and 2,8 mm clinical attachment gain.<sup>(8)</sup>
- UCSG study: Found Emdogain superior in regenerating periodontal bone defects, with significant improvement in radiographic bone density and periodontal integration.<sup>(9)</sup>

- Combined therapy study: Showed that Emdogain with connective tissue grafts promoted greater gingival and periodontal regeneration in severe gingival recession, improving both aesthetics and function.<sup>(10)</sup>

**Table 1.** Key Results of Emdogain Use in Periodontal Regeneration.

Aspect	Results
Clinical Efficacy	<ul style="list-style-type: none"> <li>- Pocket depth reduction: 3,5 mm</li> <li>- Clinical attachment gain: 2,8 mm</li> </ul>
Histological Outcomes	<ul style="list-style-type: none"> <li>- Formation of new periodontal ligament, cementum, and bone</li> </ul>
Benefits	<ul style="list-style-type: none"> <li>- Simple application</li> <li>- Lower morbidity</li> <li>- Improved healing</li> </ul>
Limitations	<ul style="list-style-type: none"> <li>- Reduced efficacy in large defects</li> <li>- Diminished results in smokers</li> </ul>
Comparison with Other Treatments	<ul style="list-style-type: none"> <li>- Superior attachment and pocket reduction</li> <li>- Enhanced efficacy with connective tissue grafts</li> </ul>
Specific Studies	<ul style="list-style-type: none"> <li>- Uniandes: Efficacy in Class II furcation defects</li> <li>- UCSG: Improved bone density</li> <li>- Combination therapy: Greater gingival/periodontal regeneration</li> </ul>

*Gancino J. Key results of Emdogain use in periodontal regeneration. Universidad Regional Autónoma de Los Andes; 2024.*

## DISCUSSION

This review highlights Emdogain's efficacy in periodontal tissue regeneration. Overall, Emdogain showed significant improvements in clinical attachment levels and periodontal pocket depth reduction—consistent with prior studies.<sup>(8)</sup> A key finding was the formation of new periodontal ligament, acellular cementum, and alveolar bone evident by four months, reinforcing its regenerative potential in chronic periodontitis treatment.<sup>(9)</sup>

Compared to other periodontal biomaterials, Emdogain proved superior—especially when combined with connective tissue grafts. This combination not only improved root surface adhesion but also promoted more effective gingival and periodontal regeneration, particularly in severe gingival recession cases.<sup>(10)</sup>

These findings align with earlier research. For instance, Li's study suggested that Emdogain combined with bone grafts outperforms other treatments in periodontal tissue regeneration.<sup>(11)</sup> Additionally, Schenk had previously demonstrated enamel matrix proteins' capacity to induce dental support tissue regeneration, supporting recent results.<sup>(12)</sup>

Gestrelus emphasized Emdogain's biomimetic mechanism—where enamel-derived proteins mimic natural tooth support development processes, enabling more organized and effective periodontal regeneration.<sup>(13)</sup> This mechanism is corroborated by Heijl's studies showing new periodontal ligament fiber and cementum formation—outcomes not always achieved with conventional barrier membranes.<sup>(14)</sup>

Compared to bone or connective tissue grafts, Emdogain offers clear advantages in forming functional periodontal structures and improving clinical attachment and pocket depth reduction.<sup>(8,9)</sup> However, Cortellini noted that Emdogain's efficacy may be influenced by defect morphology, surgical technique, and systemic factors like smoking.<sup>(15)</sup>

## CONCLUSIONS

Scientific literature confirms that enamel matrix-derived proteins—particularly Emdogain—are an effective resource for periodontal regeneration, achieving average 3,5 mm pocket depth reductions and 2,8 mm clinical attachment gains, while promoting new periodontal and bone tissue formation. However, its effectiveness may be limited in complex periodontal defects and by factors such as plaque control and smoking, underscoring the need for further research to optimize its use and evaluate combination therapies. Overall, Emdogain emerges as a valuable tool for treating chronic periodontitis and other periodontal defects.

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