



# **LETTERATURA CLINICA**

PER LE INDICAZIONI TERAPEUTICHE



Straumann® Emdogain

COMMITTED TO  
**SIMPLY DOING MORE**  
FOR DENTAL PROFESSIONALS



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## 1 PRINCIPI FONDAMENTALI DELLA RIGENERAZIONE PARODONTALE CON LE PROTEINE DELLA MATRICE DELLO SMALTO

Lo scopo principale della terapia ricostruttiva parodontale è di salvare i denti. Il modo migliore per ottenere lo scopo è la rigenerazione dell'attacco funzionale completo.

Le proteine della matrice dello smalto sono responsabili dello sviluppo del cemento e del legamento parodontale nella fase di crescita del dente<sup>8</sup>. Applicate sulla superficie radicolare pulita del dente affetto da parodontite, rigenerano il paradenzio, il legamento parodontale e l'osso alveolare<sup>1, 2, 3, 4, 5, 105</sup> imitando i processi biologici dello sviluppo naturale del dente<sup>13, 14</sup>.



*Straumann® Emdogain si distribuisce uniformemente e precipita sulla superficie radicolare, formando una matrice extracellulare.*



*Straumann® Emdogain stimola l'attrazione e la proliferazione delle cellule mesenchimali dalla parte sana del paradenzio.*

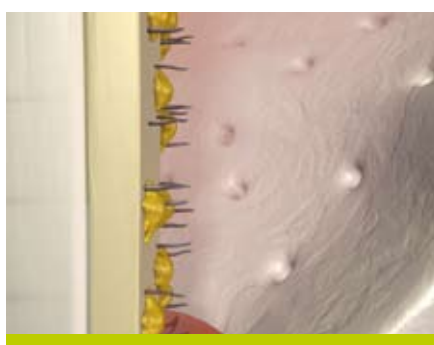


*Vengono secrete citochine naturali e sostanze autocrine che promuovono la necessaria proliferazione.*

Straumann® Emdogain è composto da una miscela di proteine della matrice dello smalto e loro derivati<sup>6, 9</sup> (EMD) e da propilene glicole alginato (PGA) come vettore. La proteina con massima prevalenza, l'amelogenina con i suoi derivati, potrebbe anche essere il fattore più importante dell'attività rigenerante degli EMD.<sup>7</sup>



*Attrazione e differenziazione rispetto ai cementoblasti, con formazione iniziale della matrice di cemento in cui si fisseranno le fibre parodontali.*



*Lo strato di cemento di nuova formazione aumenta di spessore. Le fibre del legamento parodontale si ancorano sulla superficie radicolare.*



*Nel giro di qualche mese, il difetto viene colmato da tessuto parodontale di nuova formazione.*



*Sullo strato di cemento e nel gap del difetto cresce nuovo osso alveolare.*



*Straumann® Emdogain rigenera la complessa struttura dentale del paradenzio, formando un nuovo attacco funzionale.*

Quando si applica Straumann® Emdogain, le proteine EMD precipitano dal PGA vettore sulla superficie radicolare. Questo processo di precipitazione avviene immediatamente a causa dell'aumento del pH e della temperatura, con gli EMD che formano una matrice extracellulare sulla superficie radicolare<sup>12, 14</sup>. Questa matrice influenza l'attacco<sup>11</sup> e la proliferazione<sup>10</sup> delle cellule e media la formazione di cemento sulla radice, fornendo così una base a tutti i tessuti occorrenti per un vero e proprio attacco funzionale.

1. Pimentel SP, et al. Enamel matrix derivative versus guided tissue regeneration in the presence of nicotine: a histomorphometric study in dogs.  
*J Clin Periodontol.* 2006;33:900–907.
2. Bosshardt DD, et al. Effects of enamel matrix proteins on tissue formation along the roots of human teeth.  
*J Periodontol Res.* 2005;40:158–167.
3. Sallum EA, et al. Enamel matrix derivative and guided tissue regeneration in the treatment of dehiscence-type defects: a histomorphometric study in dogs.  
*J Periodontol.* 2004;75:1357–1363.
4. Sakallioğlu U, et al. Healing of periodontal defects treated with enamel matrix proteins and root surface conditioning – an experimental study in dogs.  
*Biomaterials.* 2004;25:1831–1840.
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*J Periodontol.* 2003;74:1043–1055.
6. Veis A, et al. Amelogenin gene splice products: potential signalling molecules.  
*Cell Mol Life Sci.* 2003;60:38–55.
7. Maycock J, et al. Characterization of a porcine amelogenin preparation, Emdogain, a biological treatment for periodontal disease.  
*Connect Tissue Res.* 2002;43:472–476.
8. Sculean A, et al. Presence of an enamel matrix protein derivative on human teeth following periodontal surgery.  
*Clin Oral Investig.* 2002;6:183–187.
9. Zeichner-David M. Is there more to enamel matrix proteins than biomineralization?  
*Matrix Biol.* 2001;20:307–316.
10. Lyngstadaas S, et al. Autocrine growth factors in human periodontal ligament cells cultured on enamel matrix derivative.  
*J Clin Periodontol.* 2001;28(2):181–188.
11. Gestrelius S, et al. In vitro studies on periodontal ligament cells and enamel matrix derivative.  
*J Clin Periodontol.* 1997;24(9):685–692.
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*J Clin Periodontol.* 1997;24:678–684.
13. Hammarström L. Enamel matrix, cementum development and regeneration.  
*J Clin Periodontol.* 1997;24:658–668.
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*J Clin Periodontol.* 1997;24:669–677.

## 2 STRAUMANN® EMDOGAIN NEI DIFETTI INTRAOSSEI

Lo scopo principale del trattamento parodontale è quello di preservare i denti. Sebbene anche il debridement a lembo aperto (OFD) sia efficace nella riparazione del difetto parodontale, con miglioramento del tasso di sopravvivenza, l'uso addizionale di Straumann® Emdogain rigenera il tessuto parodontale e migliora significativamente l'esito<sup>15, 16, 17, 18</sup>. Il beneficio clinico di questa procedura si avverte nella conseguente stabilità a lungo termine del tessuto parodontale rigenerato, come riportato da diversi studi<sup>19, 31, 36, 62</sup> condotti su un periodo che arriva a 9 anni<sup>31</sup>.

Sono diversi i parametri clinici migliorati significativamente dall'impiego di Straumann® Emdogain rispetto all'OFD da solo: riduzione della profondità di sondaggio delle tasche parodontali (PPD)<sup>19, 20, 21, 22, 23, 24, 25, 27, 28, 29</sup>, livello clinico di attacco (CAL)<sup>19, 20, 21, 22, 23, 24, 25, 27, 28, 29</sup>, sanguinamento al sondaggio (BP)<sup>28</sup>, e riempimento del difetto osseo misurato mediante densità ossea radiografica<sup>19, 28, 29, 94</sup> o al rientro<sup>27, 36</sup>. Si è inoltre notato anche un miglioramento della capacità masticatoria del paziente<sup>21</sup>. È stato dimostrato un raddoppiamento<sup>25</sup> della probabilità di conseguire migliori risultati clinicamente significativi grazie al trattamento con Straumann® Emdogain. Una numerosa casistica<sup>31-61</sup> comprendente prove istologiche<sup>37, 54, 55, 75</sup> suffraga questi riscontri. L'esito è comunque influenzato da fattori clinici quali angolo del difetto<sup>39</sup>, abitudine al fumo, igiene orale ed età<sup>71</sup>.

L'uso di Straumann Emdogain è facile e sicuro, in quanto fornisce la flessibilità occorrente per trattare aree difficili, con applicazioni singole o multiple associate a chirurgia parodontale<sup>30, 38, 53</sup>.

### 2.1 Rassegne

15. Sculean A, et al. The application of enamel matrix protein derivate (Emdogain) in regenerative periodontal therapy: a review. *Med Princ Pract.* 2007;16:167-180.
16. Esposito M, et al. Enamel matrix derivative (Emdogain®) for periodontal tissue regeneration in intrabony defects. *Cochrane Database Syst Rev.* 2003;2:CD003875. Update in: *Cochrane Database Syst Rev.* 2005;4: CD003875.
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### 2.2 Studi clinici controllati

19. Heden G, et al. Five-year follow-up of regenerative periodontal therapy with enamel matrix derivative at sites with angular bone defects. *J Periodontol.* 2006;77:295-301.
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30. Zetterström O, et al. Clinical safety of enamel matrix derivative (EMDOGAIN) in the treatment of periodontal defects. *J Clin Periodontol.* 1997;24:697–704.
31. Sculean A, et al. Nine-year results following treatment of intrabony periodontal defects with an enamel matrix derivative: report of 26 cases. *Int J Periodontics Restorative Dent.* 2007;27:221–229.
32. Cortellini P, et al. A minimally invasive surgical technique with an enamel matrix derivative in the regenerative treatment of intrabony defects: a novel approach to limit morbidity. *J Clin Periodontol.* 2007;34:87–93.
33. Zucchelli G, et al. The papilla amplification flap for the treatment of a localized periodontal defect associated with a palatal groove. *J Periodontol.* 2006;77:1788–1796.
34. Harrel SK, et al. Prospective assessment of the use of enamel matrix proteins with minimally invasive surgery. *J Periodontol.* 2005;76:380–384.
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37. Majzoub Z, et al. Two patterns of histologic healing in an intrabony defect following treatment with enamel matrix derivative: a human case report. *Int J Periodontics Restorative Dent.* 2005;25(3): 283–294.

### 2.3 Studi di casi

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*J Periodontol.* 2004;75:1001–1008.
39. Tsitoura E, et al. Baseline radiographic defect angle of the intrabony defect as a prognostic indicator in regenerative periodontal surgery with enamel matrix derivative.  
*J Clin Periodontol.* 2004;31:643–647.
40. Sculean A, et al. Five-year results following treatment of intrabony defects with enamel matrix proteins and guided tissue regeneration.  
*J Clin Periodontol.* 2004;31:545–549.
41. Bonta H, et al. The use of enamel matrix protein in the treatment of localized aggressive periodontitis: a case report.  
*Quintessence Int.* 2003;34:247–252.
42. Kiernicka M, et al. Use of Emdogain enamel matrix proteins in the surgical treatment of aggressive periodontitis.  
*Ann Univ Mariae Curie Sklodowska [Med].* 2003;58:397–401.
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*Int J Periodontics Restorative Dent.* 2003;23(4):345–351.
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*Clin Oral Investig.* 2003;7:167–174.
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*J Periodontol.* 2002;73:501–504.
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*J Clin Periodontol.* 2002;29:433–439.
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*J Periodontol.* 2001;72:1695–1701.
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*J Periodontol.* 2001;72:190–195.
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*Compend Contin Educ Dent.* 2001;22:792–797.
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*Int J Periodontics Restorative Dent.* 2000;20:127–139.
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*J Int Acad Periodontol.* 2000;2:44–48.
53. Heard RH, et al. Clinical evaluation of wound healing following multiple exposures to enamel matrix protein derivative in the treatment of intrabony periodontal defects.  
*J Periodontol.* 2000;71:1715–1721.

54. Sculean A, et al. Clinical and histologic evaluation of human intrabony defects treated with an enamel matrix protein derivative (Emdogain). *Int J Periodontics Restorative Dent.* 2000;20:374–381.
55. Yukna RA. Histologic evaluation of periodontal healing in humans following regenerative therapy with enamel matrix derivative. A 10-case series. *J Periodontol.* 2000;71:752–759.
56. Heden G, et al. Periodontal tissue alterations following Emdogain® treatment of periodontal sites with angular bone defects. A series of case reports. *J Clin Periodontol.* 1999;26:855–860.
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59. Sculean A, et al. Treatment of intrabony periodontal defects with an enamel matrix protein derivative (Emdogain): a report of 32 cases. *Int J Periodontics Restorative Dent.* 1999;19:157–163.
60. Rasperini G, et al. Surgical technique for treatment of infrabony defects with enamel matrix derivative (Emdogain): 3 case reports. *Int J Periodontics Restorative Dent.* 1999;19:578–587.
61. Silvestri M, et al. Enamel matrix derivative in the treatment of infrabony defects. *Pract Periodontics Aesthet Dent.* 1999;11:615–618.

## 2.4 Straumann® Emdogain e la Rigenerazione Tissutale Guidata (GTR)

I confronti diretti tra GTR e Straumann® Emdogain nei difetti intraossei dimostrano che con il trattamento con Straumann® Emdogain si rileva un tasso molto inferiore di complicanze e morbidità nei pazienti.<sup>62, 64, 67, 72</sup> I risultati clinici con Straumann® Emdogain sono almeno equivalenti<sup>62, 65, 68, 75</sup> o migliori<sup>18</sup>. La stabilità a lungo termine del beneficio clinico in confronto diretto con la GTR è stata seguita per un massimo di 8 anni<sup>62</sup>. L'uso addizionale di una membrana nel trattamento rigenerativo con Straumann® Emdogain non solo non migliora l'esito, ma contribuisce anzi ad aumentare il fastidio postoperatorio per il paziente<sup>63</sup>.

62. Sculean A, et al. Treatment of intrabony defects with an enamel matrix protein derivative or bioabsorbable membrane: an 8-year follow-up split-mouth study. *J Periodontol.* 2006;77(11):1879–1886.
63. Sipos PM, et al. The combined use of enamel matrix proteins and a tetracycline-coated expanded polytetrafluoroethylene barrier membrane in the treatment of intra-osseous defects. *J Clin Periodontol.* 2005;32:765–772.
64. Sanz M, et al. Treatment of intrabony defects with enamel matrix proteins or barrier membranes: results from a multicenter practice-based clinical trial. *J Periodontol.* 2004;75:726–733.
65. Minabe M, et al. A comparative study of combined treatment with a collagen membrane and enamel matrix proteins for the regeneration of intraosseous defects. *Int J Periodontics Restorative Dent.* 2002;22:595–605.
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68. Silvestri M, et al. Comparison of treatments of intrabony defects with enamel matrix derivative, guided tissue regeneration with a nonresorbable membrane and Widman modified flap. A pilot study. *J Clin Periodontol.* 2000;27:603–610.
69. Pontoriero R, et al. The use of barrier membranes and enamel matrix proteins in the treatment of angular bone defects. A prospective controlled clinical trial. *J Clin Periodontol.* 1999;26(12):833–840.
70. Sculean A, et al. Comparison of enamel matrix proteins and bioabsorbable membranes in the treatment of intrabony periodontal defects. A split-mouth study. *J Periodontol.* 1999;70:255–262.

### 3 STRAUMANN® EMDOGAIN NEI DIFETTI DI FORCAZIONE

Nel trattamento chirurgico della forcazione di II grado, Straumann® Emdogain conduce a una rigenerazione significativa delle lesioni della forcazione<sup>72, 74</sup>. I risultati di studi clinici randomizzati che hanno posto a confronto Straumann® Emdogain e una membrana riassorbibile nel trattamento delle forcazioni di II grado hanno dimostrato una significativa riduzione della profondità di forcazione orizzontale. Clinicamente, il trattamento con Straumann® Emdogain ha ridotto il 78% dei difetti, il 18% dei quali completamente. La riduzione della forcazione nel trattamento con membrana è stato invece osservato solo nel 67% dei difetti, nel 7% dei quali in misura completa. È risultata ovvia una minore incidenza di complicanze postoperatorie in seguito al trattamento con Straumann® Emdogain rispetto a quello con GTR. A 1 settimana postoperatoria nel 62% dei pazienti trattati con Straumann® Emdogain il dolore era assente, rispetto a solo il 12% di quelli trattati con GTR. Inoltre, nel 44% non era presente alcun gonfiore, rispetto al 6% del gruppo di controllo con GTR<sup>72, 73</sup>. Inoltre anche nei pazienti con fattori limitanti, quali età avanzata e insufficiente igiene orale, il trattamento dei difetti della forcazione di II grado con Straumann® Emdogain è stato riscontrato superiore rispetto alla GTR<sup>71</sup>.

#### 3.1 Studi clinici con difetti di forcazione

71. Hoffmann T, et al. A randomized clinical multicentre trial comparing enamel matrix derivative and membrane treatment of buccal class II furcation involvement in mandibular molars. Part III: patient factors and treatment outcome.  
*J Clin Periodontol.* 2006;33(8):575–583.
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*J Periodontol.* 2004;75:1150–1160.
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*J Periodontol.* 2004;75:1188–1195.
74. Donos N, et al. Clinical evaluation of an enamel matrix derivative in the treatment of mandibular degree II furcation involvement: a 36-month case series.  
*Int J Periodontics Restorative Dent.* 2003;23(5): 507–512.
75. Donos N, et al. Wound healing of degree III furcation involvements following guided tissue regeneration and/or Emdogain. A histologic study.  
*J Clin Periodontol.* 2003;30:1061–1068.

## 4 STRAUMANN® EMDOGAIN NEI DIFETTI DI RECESSIONE

Il trattamento delle superfici radicolari esposte sta diventando una questione terapeutica sempre più importante. Una delle forze propulsive di questo sviluppo è il costante incremento delle esigenze estetiche dei pazienti.

Per il paziente e il clinico la stabilità a lungo termine della copertura del difetto è un criterio discriminante del successo. Straumann® Emdogain è stato usato con successo per migliorare i parametri clinici della tecnica del lembo ad avanzamento coronale (CAF)<sup>87</sup>. Sulle superfici radicolari esposte formalmente e trattate con il CAF, l'aggiunta di Straumann® Emdogain determina un miglioramento significativo dei parametri clinici, fra cui copertura della radice<sup>77, 80, 83, 84, 85</sup>, qualità e quantità del tessuto (per es. tessuto cheratinizzato<sup>76, 77, 80, 83, 84, 85, 91</sup>) e stabilità a lungo termine<sup>81</sup> dopo procedure di copertura delle recessioni.

La combinazione del CAF con Straumann® Emdogain mostra una copertura radicolare completa nell'89,5% dei casi, rispetto al 79% ottenuto combinando il CAF con un innesto di tessuto connettivo (CTG)<sup>87</sup>. La tecnica combinata con Straumann® Emdogain presenta meno complicanze ed è meno dolorosa per il paziente<sup>87, 85</sup> poiché evita una seconda ferita iatrogena. È stato possibile ottenere l'evidenza istologica della rigenerazione parodontale, inclusi nuovo cemento, nuova formazione di osso e di fibre connettivali anche per la terapia combinata di CAF e Straumann® Emdogain<sup>92, 88</sup>.

### 4.1 Studi clinici e casistica con difetti di recession

76. Shin SH, et al. A comparative study of root coverage using a cellular dermal matrix with and without enamel matrix derivative. *J Periodontol.* 2007;78:411–421.
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78. Sato S, et al. Treatment of Miller class III recessions with enamel matrix derivative (Emdogain) in combination with subepithelial connective tissue grafting. *Int J Periodontics Restorative Dent.* 2006;26(1):71–77.
79. Moses O, et al. Comparative study of two root coverage procedures: a 24-month follow-up multi-center study. *J Periodontol.* 2006;77(2):195–202.
80. Castellanos A, et al. Enamel matrix derivative and coronal flaps to cover marginal tissue recessions. *J Periodontol.* 2006;77(1):7–14.
81. Spahr A, et al. Coverage of Miller class I and II recession defects using enamel matrix proteins versus coronally advanced flap technique: a 2-year report. *J Periodontol.* 2005;76(11):1871–1880.
82. Berlucchi I, et al. The influence of anatomical features on the outcome of gingival recessions treated with coronally advanced flap and enamel matrix derivative: a 1-year prospective study. *J Periodontol.* 2005;76(6):899–907.
83. Del Pizzo M, et al. Coronally advanced flap with or without enamel matrix derivative for root coverage: a 2-year study. *J Clin Periodontol.* 2005;32:1181–1187.

84. Cueva MA, et al. A comparative study of coronally advanced flaps with and without the addition of enamel matrix derivative in the treatment of marinal tissue recession.  
*J Periodontol.* 2004;75:949–956.
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*J Periodontol.* 2004;75:600–607.
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*Int J Periodontics Restorative Dent.* 2003;23:607–613.
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*J Periodontol.* 2003;74:1110–1125.
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*J Periodontol.* 2003;74:1126–1135.
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*Int J Periodontics Restorative Dent.* 2002;22(6):583–593.
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*J Periodontol.* 2002;73:1534–1543.
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*J Clin Periodontol.* 2002;29:35–41.
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*Int J Periodontics Restorative Dent.* 2000;20:269–275.
93. Heijl L. Periodontal regeneration with enamel matrix derivative in one human experimental defect. A case report.  
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## 5 STRAUMANN® EMDOGAIN CON MATERIALE PER INNESTO OSSEO

Nel trattamento di difetti intraossei estesi, viene occasionalmente preso in considerazione il sostegno meccanico dei tessuti molli. Alcuni clinici hanno riferito di usare Straumann® Emdogain in combinazione con vari surrogati di innesti ossei che offrono un sostegno strutturale ai tessuti molli nei difetti estesi<sup>94-120</sup>. Straumann® Emdogain PLUS combina le proprietà rigenerative di Straumann® Emdogain con il sostegno strutturale del materiale osteoconduttivo Straumann® BoneCeramic.

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