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[54] **METHODS OF BONE REPAIR USING COLLAGEN**

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[58] **Field of Search** ..... 424/95, 443, 423; 514/2, 21, 801; 530/356; 128/92 C, 92 G; 435/68

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,621,145	12/1952	Sano	167/84
3,318,774	5/1967	Dingwall	167/74
3,443,261	5/1969	Battista	3/1
3,458,397	7/1969	Myers et al.	424/95
3,820,167	6/1974	Sivash	3/1
3,918,100	11/1975	Shaw	3/1.9
3,919,723	11/1975	Heimke	3/1.9
3,949,073	4/1976	Daniels	514/801
4,066,083	6/1978	Ries	128/325
4,140,537	2/1979	Luck	106/155
4,186,486	2/1980	Gordon	433/201
4,294,241	10/1981	Miyata	128/156
4,294,753	10/1981	Urist	260/112 R
4,314,380	2/1982	Miyata	3/1.9
4,394,370	7/1983	Jefferies	424/15
4,434,094	2/1964	Seyedia	260/112 R
4,440,750	4/1984	Glowacki	424/95

FOREIGN PATENT DOCUMENTS

0012443	12/1979	European Pat. Off. .
0012959	12/1979	European Pat. Off. .
0071242	7/1982	European Pat. Off. .

OTHER PUBLICATIONS

Cucin, R. L. et al., *NY State Jour. Med.*, 11/1979, 1856–1857, "Experimental Bony Defects".

Hayashi, K., *Arch Orhop Traumat Surg* (1982) 99: 265–269, "Repair of Experimental Bone Defect with a Collagen Block Containing Synthesized Apatite".

Jaffee, A. et al., Archs Oral Biol, (1978) 12:415–419, "Biological Anchoring of Acrylic Tooth Implants in the Dog Using Enriched Collagen Solutions".

Krekeler, G. et al., *Int J. Oral Surg.* (1981) 10: Suppll 151–155, "The Healing of Autologous Spongiosa and Heterologous Materials in the Periodontal Bone Pocket".

Joos, U. et al., *Biomaterials*, (1980) 1:23–26, "Influence of Collagenfleece on Bone Regeneration".

Jaffe, A. *Archs Oral Biol*, (1982), 27:99–1001, "One--Year Follow Up for the Use of Collagen for Biological Anchoring of Acrylic Dental Roots in the Dog".

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[57] **ABSTRACT**

A method of repairing bone defects by use of suspensions containing purified atelopeptide, reconstituted, fibrillar skin collagen or bone collagen powder or mixtures thereof is disclosed. The suspensions provide matrices for conductive growth of bone into the defect. The skin collagen may also be lyophilized and used in the form of mats.

10 Claims, No Drawings