US009511119B2

(12) **United States Patent**
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(10) **Patent No.: US 9,511,119 B2**
(45) **Date of Patent: Dec. 6, 2016**

(54) **PREPARATIONS CONTAINING HEPATOCYTE GROWTH FACTOR AND HYALURONIC ACID AND METHODS OF MAKING AND USING SAME**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/211,929**

(22) Filed: **Mar. 14, 2014**

(65) **Prior Publication Data**

US 2014/0274899 A1 Sep. 18, 2014

Related U.S. Application Data

(60) Provisional application No. 61/790,075, filed on Mar. 15, 2013.

(51) **Int. Cl.**

A61K 38/18	(2006.01)
A61K 47/36	(2006.01)
A61F 2/00	(2006.01)
A61F 13/00	(2006.01)
A61L 27/20	(2006.01)
A61K 8/64	(2006.01)
A61K 8/73	(2006.01)
A61Q 19/08	(2006.01)

(52) **U.S. Cl.**

CPC ***A61K 38/1833*** (2013.01); ***A61K 8/64*** (2013.01); ***A61K 8/735*** (2013.01); ***A61L 27/20*** (2013.01); ***A61Q 19/08*** (2013.01); *A61K 2800/91* (2013.01); *A61L 2300/414* (2013.01); *A61L 2400/06* (2013.01); *A61L 2430/02* (2013.01); *A61L 2430/06* (2013.01); *A61L 2430/10* (2013.01); *A61L 2430/24* (2013.01); *A61L 2430/34* (2013.01); *A61L 2430/38* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,544,516	A	10/1985	Hughes et al.	
5,399,351	A	3/1995	Leshchiner et al.	
5,486,359	A	1/1996	Caplan et al.	
5,612,028	A	3/1997	Sackier et al.	
6,152,142	A	11/2000	Tseng	
6,162,908	A *	12/2000	Itano et al.	536/23.2
6,326,019	B1	12/2001	Tseng	
6,355,239	B1	3/2002	Bruder et al.	
7,824,711	B2	11/2010	Kizer	
8,093,365	B2 *	1/2012	Wisniewski	A61K 47/4823 530/350
8,420,601	B2 *	4/2013	Wisniewski	A61K 47/4823 514/17.1
2004/0161419	A1	8/2004	Strom et al.	
2004/0181240	A1	9/2004	Tseng et al.	
2007/0071740	A1 *	3/2007	Tseng	A61K 35/48 424/94.1
2007/0093905	A1 *	4/2007	O'Neil et al.	623/17.16
2007/0218039	A1	9/2007	Devi et al.	
2007/0231401	A1	10/2007	Tseng et al.	
2008/0102135	A1	5/2008	Ollivier	
2010/0168869	A1 *	7/2010	Long et al.	623/23.72
2011/0038921	A1 *	2/2011	Wen et al.	424/445
2012/0100185	A1 *	4/2012	Wen et al.	424/400

OTHER PUBLICATIONS

Ruvinov, Emil et al., The effects of controlled HGF delivery from an affinity-binding alginate biomaterial on angiogenesis and blood perfusion in a hindlimb ishemia model. Biomaterial 31 (2010) pp. 4573-4582.

Boo, Lily et al., A Preliminary Study of Human Amniotic Membrane as a Potential Chondrocyte Carrier. Malaysian Orthopaedic Journal 2009, vol. 3 No. 2.

Vishwakarma, G.K., Amniotic Arthroplasty for Tuberculosis of the Hip, The Journal of Bone and Joint Surgery. vol. 68 B. No. 1, Jan. 1986.

Moriya, Takuro et al., Evaluation of reparative cartilage after autologous chondrocyte implantation for osteochondritis dissecans: histology, biochemistry and MR imaging. Journal of Orthopaedic SC, 2007.

Zhou, Shuanhu et al., Demineralized bone promotes chondrocyte or osteoblast differentiation of human marrow stromal cells cultured in collagen sponges, National Institute of Health Author of Manuscript. Cell Tissue Bank, 2005.

Hildner, F. et al., State of the Art and future perspectives of articular cartilage regeneration: a focus on adipose-derived stem cells and platelet-derived products. Journal of Tissue Engineering and Regenerative Medicine, 2011.

Krishnamurithy, G. et al., Human amniotic membrane as a chondrocyte carrier vehicle/substrate: In vitro study. Journal of Biomedical Materials Research A. vol. 99A, Issue 3, 2011.

Jin, Cheng Zhe et al., Human Amniotic Membrane as a Delivery Matrix for Articular Cartilage Repair. Tissue Engineering, vol. 13, No. 7, 2007.

Lindenmair, Andrea et al., Osteogenic differentiation of intact human membrane. Biomaterials 31 (2010) 8659-8665.

Diaz-Prado, Silvia et al., Potential use of human amniotic membrane as a scaffold in human articular cartilage repair. Cell Tissue Bank (2010) 11: 183-195.

(Continued)

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(57) **ABSTRACT**

Preparations containing hepatocyte growth factor (HGF) and hyaluronic acid (HA) and methods of making and using same. The HGF and HA preparations can be prepared together in solution as an injectable fluid without gelatinization, or impregnated within a porous hydrophilic matrix material with, or without, cross-linking of the HA with the matrix material. The preparations can be used as a dermal filler or to generate and promote healing of cartilage, vertebral discs, connective tissues such as tendons and ligaments and bone in vivo.

13 Claims, No Drawings