

Trauma and Fractures – Selected Excerpts

Stem Cell and Other Biologic Treatment of Fractures

Nonunion Fracture Procedures US, 2005–2016								
Year	InPatient Tibia, Fibula, Humerus and Radius Fractures	Number of Patients over 45 Years of Age	"Difficult Healers"	Full Blown Nonunion Fractures	Growth	% Using Bone Graft Material	Bone Graft Procedures: Non and Mal-Unions	Growth
2005	230,896	117,398	64,547	29,046		67.2%	62,833	
2006	237,813	120,879	66,483	29,917	3.0%	67.6%	66,154	3.5%
2007	244,547	124,506	68,478	30,815	3.0%	67.2%	66,766	2.5%
2008	252,296	128,240	70,532	31,739	3.0%	67.2%	68,769	3.8%
2009	259,864	132,087	72,648	32,692	3.0%	67.2%	70,832	3.8%
2010	268,310	136,880	77,773	34,998	7.1%	67.2%	75,829	7.1%
2011	277,030	143,394	80,301	36,136	3.3%	67.2%	78,293	3.3%
2012	286,033	148,054	82,910	37,310	3.3%	67.2%	80,838	3.3%
2013	295,329	155,366	88,559	39,851	6.8%	67.3%	86,433	6.8%
2014	305,371	160,648	91,370	41,206	3.4%	67.4%	89,464	3.5%
2015	315,753	166,110	94,883	42,807	3.4%	67.4%	92,505	3.4%
2016	326,486	171,758	99,628	44,829	5.2%	67.6%	97,627	5.5%

Stem cells participate in the last three phases of bone healing. In adult humans, stem cells reside in various tissues of the body (bone marrow, blood, adipose or fat tissue, the enamel of teeth, hair follicles) and play an essential role in the body’s ability to replace dead cells and to repair injury. Stem cells are stimulated by inflammatory signals. When a fracture occurs, the mesenchymal stem cells naturally assemble at the site of the injury and begin to release growth factors, anti-inflammatory compounds and cytokines. Stem cells can aid in revascularization. They can recruit new cells and growth factors.

Various studies have demonstrated the ability of mesenchymal stem cells to improve and accelerate the fracture healing process.

Bone Graft Materials in Fresh Fracture Repair

Bone harvested from the patient is the most commonly used material to fill voids during fracture repair. Out of a total 109,000 fresh fracture procedures in the U.S. in 2006, approximately half used autograft material. Autograft is the favored material for surgeons because it combines the three essential elements for healing: an

Fresh Fracture Bone Graft Market, Revenue, US, 2005–2016						
Year	Allograft	DBM	Synthetic	MSCs	Growth Factors	Total (\$ in mm)
2005	\$1.4	\$1.2	\$1.9	\$1.3	\$1.9	\$6.4
2006	\$1.7	\$1.2	\$1.2	\$1.3	\$2.1	\$6.5
2007	\$1.9	\$1.9	\$1.9	\$1.5	\$2.3	\$6.5
2008	\$1.2	\$1.2	\$1.5	\$1.4	\$2.2	\$7.4
2009	\$1.2	\$1.4	\$1.3	\$1.4	\$2.5	\$6.4
2010	\$1.3	\$1.2	\$1.9	\$2.3	\$1.5	\$6.7
2011	\$1.4	\$1.9	\$1.8	\$1.2	\$1.6	\$6.8
2012	\$1.4	\$1.6	\$1.9	\$1.1	\$1.9	\$6.9
2013	\$1.5	\$1.4	\$1.7	\$1.6	\$1.2	\$6.4
2014	\$1.6	\$1.2	\$1.5	\$1.6	\$1.6	\$6.5
2015	\$1.6	\$1.9	\$1.6	\$1.5	\$1.1	\$6.9
2016	\$1.7	\$1.9	\$1.1	\$1.7	\$1.6	\$6.9

osteoconductive scaffold in the form of the patient’s own bone, osteoinductive proteins in the form of growth factors that are naturally found in the patient’s harvested bone, and osteogenetic progenitor cells which are also found in the patient’s own bone. Allogenic mesenchymal stem cells were used, we estimate, in about 2,190 fracture cases in 2006, and their use will likely increase to about 2,738 cases in 2007. This figure represents 2.4% of the potential fracture market in the United States.

By 2016, however, we estimate that mesenchymal stem cells will be used in approximately 31,000 patients annually or about 20% of the available market. The market for these products will grow slowly between 2006 and 2012 as allogenic and, later, cultured MSCs work their way through the market. MSCs represent the only material other than autograft that provides the three essential elements of healing: structure, osteoinduction and osteogenesis.

To order the complete *Stem Cell Analysis and Market Forecast 2006-2016*, [click here](#).