



# CLINICAL GUIDELINES

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## CMM-611: Sacroiliac Joint Fusion or Stabilization Guidelines

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eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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Clinical guidelines for medical necessity review of Comprehensive Musculoskeletal Management Services.

**CMM-611: Sacroiliac Joint Fusion or Stabilization**

|                                                                               |          |
|-------------------------------------------------------------------------------|----------|
| <b>CMM-611.1: General Guidelines</b>                                          | <b>3</b> |
| <b>CMM-611.2: Minimally Invasive Sacroiliac Joint Fusion or Stabilization</b> | <b>3</b> |
| <b>CMM-611.3: Open Sacroiliac Joint Fusion</b>                                | <b>5</b> |
| <b>CMM-611.4: Non-Indications</b>                                             | <b>5</b> |
| <b>CMM-611.5: Procedure (CPT®) Codes</b>                                      | <b>6</b> |
| <b>CMM-611.6: References</b>                                                  | <b>6</b> |

## **CMM-611.1: General Guidelines**

- The determination of medical necessity for the performance of sacroiliac joint fusion or stabilization is always made on a case-by-case basis.
- For prior authorization requirements, see **CMM-600.1: Prior Authorization Requirements**.

## **CMM-611.2: Minimally Invasive Sacroiliac Joint Fusion or Stabilization**

Minimally invasive sacroiliac joint (SIJ) fusion using titanium triangular implants (SI BONE [iFuse Implant™ or iFuse-3D Implant™]) for the treatment of lumbopelvic pain originating from the SIJ is considered **medically necessary** when **ALL** of the following are met:

- Performed by an orthopedic surgeon or neurosurgeon with specific training and expertise in percutaneous sacroiliac joint fusion surgical techniques and regularly use image-guidance for placement of implants
- Presence of non-radiating lumbopelvic pain caudal to L5, buttock, hip, and/or groin pain without radiation into the leg(s) that impairs physical activities
- SIJ pain interfering with activities of daily living
- Patient localizes posterior pain to the posterior superior iliac spine (Fortin's point)
- Localized tenderness to palpation over the sacral sulcus and posterior SIJ
- Elicitation of typical pain on three (3) or more provocative physical examination maneuvers/tests that stress the SIJ:
  - ◆ Thigh thrust test
  - ◆ Compression test
  - ◆ Gaenslen's maneuver
  - ◆ Distraction test
  - ◆ FABER/Patrick's sign
  - ◆ Posterior provocation test
- Absence of localized tenderness to palpation of similar severity to palpation of the sacral sulcus and posterior SIJ over the greater trochanter, lumbar spine, and coccyx
- Diagnostic confirmation of the SIJ as a pain generator through  $\geq 75\%$  reduction in pain for the expected duration of effect of the anesthetic agent used upon two separate contrast-enhanced fluoroscopically or CT-guided intra-articular SIJ blocks using a local anesthetic performed

- SIJ pain without minimal clinically important difference (MCID) from a minimum of a consecutive six (6) months of conservative, non-surgical treatment including **ALL** of the following unless contraindicated:
  - ◆ Non-steroidal anti-inflammatory drugs (NSAIDs)
  - ◆ Prescription medication optimization
  - ◆ Activity modification
  - ◆ Physician supervised/prescribed active physical therapy (including home exercise program) targeting lumbopelvic (core) area
  - ◆ Chiropractic care
- Absence of generalized pain behavior (e.g. somatoform disorder) or generalized pain disorders (e.g. fibromyalgia)
- Documentation of nicotine-free status with **EITHER** of the following:
  - ◆ Patient is a never-smoker
  - ◆ Patient has refrained from smoking, use of smokeless tobacco, and/or nicotine replacement therapy for at least 6 weeks prior to planned surgery as evidenced by blood cotinine lab results of  $\leq 10$  ng/mL
- Absence of unmanaged significant mental and/or behavioral health disorders (e.g. major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Absence of alternative diagnoses that are a more likely cause of the patient's ongoing pain or disability
- Recent (within 6 months) diagnostic imaging studies that include **ALL** of the following:
  - ◆ Plain X-rays and/or cross sectional imaging (CT or MRI) that excludes the presence of destructive lesions (e.g. tumor, infection), acute fracture or inflammatory arthropathy that would not be properly addressed by SIJ fusion
  - ◆ Plain X-rays of the pelvis including the ipsilateral hip to evaluate potential concomitant hip pathology
  - ◆ Cross-sectional imaging (e.g. CT or MRI) of the lumbar spine to evaluate potential concomitant neural compression or other degenerative conditions

### **CMM-611.3: Open Sacroiliac Joint Fusion**

Open sacroiliac joint (SIJ) fusion is considered **medically necessary** when **ALL** of the following are met:

- Recent (within 6 months) plain X-rays and/or cross-sectional imaging (CT or MRI) demonstrate localized SIJ pathology
- Documentation of nicotine-free status with **EITHER** of the following:
  - ◆ Patient is a never-smoker
  - ◆ Patient has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least 6 weeks prior to planned surgery as evidenced by blood cotinine lab results of  $\leq 10$  ng/mL
- **ANY** of the following:
  - ◆ Post-traumatic injury of the SIJ (e.g. following pelvic ring fracture)
  - ◆ As an adjunctive treatment for SIJ infection
  - ◆ Management of sacral tumor (e.g. partial sacrectomy)
  - ◆ When performed as part of a multisegmental long fusion constructs for the correction of spinal deformity (e.g. idiopathic scoliosis, neuromuscular scoliosis)
  - ◆ Failed prior percutaneous SIJ fusion

### **CMM-611.4: Non-Indications**

#### **Experimental, Investigational, or Unproven (EIU)**

- Minimally invasive or percutaneous SIJ fusion or stabilization using titanium triangular implants is considered **experimental, investigational, or unproven (EIU)**, including, but not limited to **ANY** of the following:
  - ◆ Any case that does not fulfill **ALL** of the above criteria
  - ◆ Less than six months of SIJ pain and/or functional impairment
  - ◆ Failure to pursue conservative treatment of the SIJ unless contraindications are clearly documented
  - ◆ Systemic arthropathy (e.g. ankylosing spondylitis, psoriatic arthritis, rheumatoid arthritis)
  - ◆ Generalized pain behavior (e.g. somatoform disorder) or generalized pain disorder (e.g. fibromyalgia)
  - ◆ Presence of infection, tumor, or fracture
  - ◆ Acute traumatic instability of the SIJ
  - ◆ Presence of neural compression as seen on an MRI or CT that correlates with the patient's symptoms or other more likely source for the patient's pain
  - ◆ Any condition that would prevent insertion of the implants
  - ◆ Bilateral procedures on the same date of service
- The use of minimally invasive fusion products/implants **other than** SI BONE (iFuse Implant™ or iFuse-3D Implant™) System is considered **experimental, investigational, or unproven (EIU)**.

- Open sacroiliac joint (SIJ) fusion is considered **experimental, investigational, or unproven (EIU)**, for **ANY** of the following indications:
- ◆ Mechanical low back pain
  - ◆ Sacroiliac joint syndrome
  - ◆ Degenerative sacroiliac joint
  - ◆ Radicular pain syndromes

### **CMM-611.5: Procedure (CPT®) Codes**

This guideline relates to the CPT® code set below. Codes are displayed for informational purposes only. Any given code's inclusion on this list does not necessarily indicate prior authorization is required.

| CPT®                                                                                                                                                                                                                                                                                                | Code Description/Definitions                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>27279</b>                                                                                                                                                                                                                                                                                        | Arthrodesis, sacroiliac joint, percutaneous or minimally invasive (indirect visualization), with image guidance, includes obtaining bone graft when performed, and placement of transfixing device |
| <b>27280</b>                                                                                                                                                                                                                                                                                        | Arthrodesis, sacroiliac joint, open, includes obtaining bone graft, including instrumentation, when performed                                                                                      |
| <b>0775T</b>                                                                                                                                                                                                                                                                                        | Arthrodesis, sacroiliac joint, percutaneous, with image guidance, includes placement of intra-articular implant(s) (eg, bone allograft[s], synthetic device[s])                                    |
| This list may not be all inclusive and is not intended to be used for coding/billing purposes. The final determination of reimbursement for services is the decision of the health plan and is based on the individual's policy or benefit entitlement structure as well as claims processing rules |                                                                                                                                                                                                    |

### **CMM-611.6: References**

1. Al-Khayer A, Hegarty J, Hahn D, Grevitt MP. Percutaneous sacroiliac joint arthrodesis: a novel technique. *J Spinal Disord Tech*. 2008; 21(5): 359-363.
2. Ackerman S, Cummings J, Polly D, Knight T, Schneider K, Holt T. Comparison of the costs of nonoperative care to minimally invasive surgery for sacroiliac joint disruption and degenerative sacroiliitis in a United States Medicare population: potential economic implications of a new minimally-invasive technology. *Clin Outcomes Res*. 2013; 2013(5): 575-587.
3. Ashman B, Norvell D, Hermsmeyer J. Chronic sacroiliac joint pain: fusion versus denervation as treatment options. *Evid-Based Spine-Care J*. 2010; 1(03): 35-44.
4. Belanger TA, Dall BE. Sacroiliac arthrodesis using a posterior midline fascial splitting approach and pedicle screw instrumentation: a new technique. *J Spinal Disord*. 2001; 14(2): 118-124.
5. Bernard TN, Kirkaldy-Willis WH. Recognizing specific characteristics of nonspecific low back pain. *Clin Orthop*. 1987; (217): 266-80.
6. Boradhurst NA, Bond MJ. Pain provocation tests for the assessment of sacroiliac joint dysfunction. *J Spinal Disord*. 1998; 11(4): 341-345.
7. Bornemann R, Roesler PP, Straus A, et al. 2-year clinical results of patients with sacroiliac joint syndrome treated by arthrodesis using a triangular implant system. *Technol Health Care Off J Eur Soc Eng Med*. Nov2016.
8. Buchowski JM, Kebaish KM, Sinkov V, Cohen DB, Sieber AN, Kostuik JP. Functional and radiographic outcome of sacroiliac arthrodesis for the disorders of the sacroiliac joint. *Spine J*. 2005. 5(5): 520-528.
9. Capobianco R, Cher D. Safety and effectiveness of minimally invasive sacroiliac joint fusion in women with persistent post-partum posterior pelvic girdle pain: 12-month outcomes from a prospective, multi-center trial. *SpingerPlus*. 2015; 4(1): 570.
10. Cher DJ, Frasco MA, Arnold RJ, Polly DW. Cost-effectiveness of minimally invasive sacroiliac joint fusion. *Clin Outcomes Res CEOR*. 2016; 8: 1-14.
11. Cher DJ, Polly D, Berven S. Sacroiliac joint pain: burden of disease. *Med Devices Evid Res*. 2014; 7: 73-81.
12. Cher DJ, Reckling WC. Quality of life in preoperative patients with sacroiliac dysfunction is at least as depressed as in other lumbar spinal conditions. *Med Devices Evid Res*. 2015; 8: 395-403.
13. Cher DJ, Reckling WC, Capobianco RA. Implant survivorship analysis after minimally invasive sacroiliac fusion using the iFuse Implant System. *Med Devices Evid Res*. 2015; 8: 485-492.

14. Cohen SP, Strassels SA, Kurihara C, et al. Outcome Predictors for Sacroiliac Joint (Lateral Branch) Radiofrequency Denervation. *Reg Anesth Pain Med*. 2009; 34(3): 206-214.
15. Cohen SP, Hurley RW, Buckenmaier CC, Kurihara C, Morlando B, Dragovich A. Randomized placebo-controlled study evaluating lateral branch radiofrequency denervation for sacroiliac pain. *Anesthesiology*. 2008; 109(2): 279-288.
16. Cummings J Jr, Capobianco RA. Minimally invasive sacroiliac joint fusion: one-year outcomes in 18 patients. *Ann Surg Innov Res*. 2013; 7(1): 12.
17. Dengler J, Duhon B, Whang P, et al. Predictors of Outcome in Conservative and Minimally Invasive Surgical Management of Pain Originating from the Sacroiliac Joint: A Pooled Analysis. *Spine*. March 2017.
18. Dengler J, Kools D, Pflugmacher R, et al. 1-Year Results of a Randomized Controlled Trial of Conservative Management vs. Minimally Invasive Surgical Treatment for Sacroiliac Joint Pain. *Pain Physician*. 2017; 20: 537-550.
19. Dengler J, Sturesson B, Kools D, et al. Referred leg pain originating from the sacroiliac joint: 6-month outcomes from the prospective randomized controlled iMIA trial. *Acta Neurochir (Wien)*. Nov 2016; 158(11): 2219-2224.
20. DePalma MJ, Ketchum JM, Saullo TR. Etiology of chronic low back pain in patients having undergone lumbar fusion. *Pain Med*. 2011. 12(5): 732-739.
21. Duhon B, Bitan F, Lockstadt H, Kovalsky D, Cher D, Hillen T. Triangular Titanium Implants for Minimally Invasive Sacroiliac Joint Fusion: 2-Year Follow-Up from a Prospective Multicenter Trial. *Int J Spine Surg*. 2016; 10: Article 13.
22. Duhon BS, Cher DJ, Wine KD, Kovalsky DA, Lockstadt H, on behalf of the SIFI Study Group. Triangular Titanium Implants for Minimally Invasive Sacroiliac Joint Fusion: A Prospective Study. *Glob Spine J*. 2016; 6(3): 257-269.
23. Duhon BS, Cher D, Wine K, Lockstadt H, Kovalsky D, Soo C-L. Safety and 6-month effectiveness of minimally invasive sacroiliac joint fusion: a prospective study. *Med Devices Evid Res*. 2013; 6: 219-229.
24. Endres S, Ludwig E. Outcome of distraction interference arthrodesis of the sacroiliac joint for sacroiliac arthritis. *Indian J Orthop*. 2013; 47(5): 437-442.
25. Eno JJ, Boone C, Bellino M, Bishop J. The Prevalence of Sacroiliac Joint Degeneration in Asymptomatic Adults. *J Bone Joint Surg AM*. 2015; 97(11): 932-936.
26. Fortin JD, Aprill CN, Ponthieux B, Pier J. Sacroiliac joint pain referral maps upon applying a new injection/arthrography technique. Part II: Clinical evaluation. *Spine*. 1994; 19: 1483-9.
27. Fortin JD, Dwyer AP, West S, Pier J. Joint: pain referral maps upon applying a new injection/arthrography technique. Part I. Asymptomatic volunteers. *Spine*. 1994; 19: 1475-82.
28. Gaetani P, Miotti D, Risso A, et al. Percutaneous arthrodesis of sacroiliac joint: a pilot study. *J Neurosurg Sci*. 2013; 57(4): 297-301.
29. Graham Smith A, Capobianco R, Cher D, et al. Open versus minimally invasive sacroiliac fusion: a multi-center comparison of perioperative measures and clinical outcomes. *Ann Surg Innov Res*. 2013; 7(1): 14.
30. Heiney J, Capobianco R, Cher D. Systemic review of minimally invasive sacroiliac joint fusion using a lateral transarticular approach. *Int J Spine Surg*. 2015; 9: Article 40.
31. Kancherla VK, McGowan SM, Audley BN, Sokunbi G, Puccio ST. Patient Reported Outcomes from Sacroiliac Joint Fusion. *Asian Spine J*. 2017; 11(1): 120-126.
32. Katz V, Schofferman J, Reynolds J. The sacroiliac joint: a potential cause of pain after lumbar fusion to the sacrum. *J Spinal Disord Tech*. 2003; 16(1): 96-99.
33. Khurana A, Guha AR, Mohanty K, Ahuja S. Percutaneous fusion of the sacroiliac joint with hollow modular anchorage screws: clinical and radiological outcome. *JBJS Br*. 2009; 91(5): 627-631.
34. Kim JT, Rudolf LM, Glaser JA. Outcome of percutaneous sacroiliac joint fixation with porous plasma-coated triangular titanium implants: an independent review. *Open Orthop J*. 2013; 7: 51-56.
35. Kube RA, Muir JM. Sacroiliac Joint Fusion: One Year Clinical and Radiographic Results Following Minimally Invasive Sacroiliac Joint Fusion Surgery. *Open Orthop J*. 2016; 10(1).
36. International Society for the Advancement of Spine Surgery (ISASS) *Policy Statement – Minimally Invasive Sacroiliac Joint Fusion*. July 2016.
37. Irwin RW, Watson T, Miick RP, Ambrosius WT. Age, Body Mass Index, and Gender Differences in Sacroiliac Joint Pathology. *Am J Phys Med Rehabil*. 2007; 86(1): 37-44.
38. Ledonio CGT, Polly DW, Swiontkowski MF. Minimally invasive versus open sacroiliac joint fusion: are they similarly safe and effective? *Clin Orthop*. 2014; 472(6): 1831-1838.
39. Ledonio C, Polly D, Swiontkowski MF, Cummings J. Comparative effectiveness of open versus minimally invasive sacroiliac joint fusion. *Med Devices Evid Res*. 2014; 7(7): 187-193.
40. Liliang PC, Lu K, Weng HC, Liang CL, Tsai YD, Chen HJ. The therapeutic efficacy of sacroiliac joint blocks with triamcinolone acetate in the treatment of sacroiliac joint dysfunction without spondyloarthropathy. *Spine*. 2009; 34(9): 896-900.
41. Liliang PC, Lu K, Liliang CL, Tsai YD, Wank KW, Chen HJ. Sacroiliac joint pain after lumbar and lumbosacral fusion: findings using dual sacroiliac joint blocks. *Pain Medicine* 2011; 12(4): 565-570.
42. Lindsey DP, Kiapour A, Yerby SA, Goel VK. Sacroiliac Joint Fusion Minimally Affects Adjacent Lumbar Segment Motion: A Finite Element Study. *Int J Spine Surg*. 2015; 9: 64.

43. Lindsey D, Perez-Orribo L, Rodriquez-Martinez N, et al. Evaluation of a minimally invasive procedure for sacroiliac joint fusion – an in vitro biomechanical analysis of initial and cycled properties. *Med Devices Evid Res*. 2014; (7): 131-137.
44. Lingutla KK, Pollock R, Ahuja S. Sacroiliac joint fusion for low back pain: a systematic review and meta-analysis. *Eur Spine J*. March 2016: 1-8.
45. Lorio M, Kube R, Araghi A. International Society for the Advancement of Spine Surgery Policy 2020 Update—Minimally Invasive Surgical Sacroiliac Joint Fusion (for Chronic Sacroiliac Joint Pain): Coverage Indications, Limitations, and Medical Necessity. *Int J Spine Surg*. 2020:7156. doi:10.14444/7156.
46. Lorio M, Polly D, Ninkovic I, et al. Utilization of Minimally Invasive Surgical Approach for Sacroiliac Joint Fusion in Surgeon Population of ISASS and SMISS Membership. *Open J Orthop* 2014 Jan; 8(1): 1-6.
47. Lorio M, Rashbaum R. ISASS Policy Statement – Minimally Invasive Sacroiliac Joint Fusion. *Int J Spine Surg*. 2014; 8: Article 25.
48. Lorio MP. ISASS policy statement – minimally invasive sacroiliac joint fusion (July 2016). 2016.
49. Maingne JY, Aivaliklis A, Pfefer F. Results of sacroiliac joint double block and value of sacroiliac pain provocation tests in 54 patients with low back pain. *Spine*. 1996; 21(16): 1889-1892.
50. Mason, LW, Chopra I, Mohanty K. The percutaneous stabilization of the sacroiliac joint with hollow modular anchorage screws: a prospective outcome study. *Eur Spine J*. 2013; 22(10); 2325-2331.
51. McGuire RA, Chen Z, Donahoe K. Dual fibular allograft technique for sacroiliac joint arthrodesis. *Evid Based Spine Care J*. 2012; 3(3): 21-8.
52. Miller, LE, Block JE. Minimally invasive arthrodesis for chronic sacroiliac joint dysfunction using the SImmetry SI Joint Fusion system. *Med Devices Evid Res*. 2014; 7; 125-130.
53. Miller L, Reckling WC, Block JE. Analysis of postmarket complaints database for the iFuse SI joint Fusion System: a minimally invasive treatment for degenerative sacroiliitis and sacroiliac disruption. *Med Devices Evid Res*. 2013; 6: 77-84.
54. NASS Coverage Policy Recommendations. Percutaneous Sacroiliac Joint Fusion. 2015.
55. National Institute for Health and Care Excellence. *Minimally invasive sacroiliac joint fusion surgery for chronic sacroiliac pain [IPG578]*. 2017; <https://www.nice.org.uk/guidance/ipg578>.
56. Ohtori S, Sainoh T, Takaso M, et al. Clinical Incidence of Sacroiliac Joint Arthritis and Pain after Sacropelvic Fixation for Spinal Deformity. *Yonsei Med J*. 2012; 53(2): 416.
57. Ou-Yang DC, York PJ, Kleck CJ, Patel VV. Current Concepts Review: Diagnosis and Management of Sacroiliac Joint Dysfunction. *J Bone Joint Surg Am*. 2017; 99: 2027-36.
58. Patel N. Twelve-Month Follow-Up of a Randomized Trial Assessing Cooled Radiofrequency Denervation as a Treatment for Sacroiliac Region Pain. *Pain Pract Off J World Inst Pain*. January 2015.
59. Patel N, Gross A, Brown L, Gekht G. A randomized, placebo-controlled study to assess the efficacy of lateral branch neurotomy for chronic sacroiliac joint pain. *Pain Med Malden Mass*. 2012; 13(3): 383-398.
60. Polly D, Cher D, Whang PG, Frank C, Sembrano J. for the INSITE Study Group. Does Level of Response to SI Joint Block Predict Response to SI Joint Fusion? *Int J Spine Surg*. 2016; 10: Article 4.
61. Polly DW, Cher DJ, Wine KD, et al. Randomized Controlled Trial of Minimally Invasive Sacroiliac Joint Fusion Using Triangular Titanium Implants vs Nonsurgical management for Sacroiliac Joint Dysfunction: 12-Month Outcomes. *Neurosurgery*. 2015; 77(5): 674-691.
62. Polly DW, Swofford J, Whang PG et al. Two-Year Outcomes from a Randomized Controlled Trial of Minimally Invasive Sacroiliac Joint Fusion vs Non-Surgical Management for Sacroiliac Joint Dysfunction. *Int J Spine Surg*. 2016; 10: Article 28.
63. Rappaport LH, Luna IY, Joshua G. Minimally Invasive Sacroiliac Joint Fusion Using a Novel Hydroxyapatite-Coated Screw: Preliminary 1-Year Clinical and Radiographic Results of a 2-Year Prospective Study. *World Neurosurg*. 2017; 101: 493-497.
64. Rashbaum RF, Ohnmeiss DD, Lindley EM, Kitchel SH, Patel VV. Sacroiliac Joint Pain and Its Treatment. *Clin Spine Surg*. 2016; 29(2): 42-48.
65. Rudolf L. MIS Fusion of the SI Joint: Does Prior Lumbar Spinal Fusion Affect Patient Outcomes? *Open Orthop J*. 2013; 7: 163-168.
66. Rudolf L. Sacroiliac joint arthrodesis – MIS technique with titanium implants: report of the first 50 patients and outcomes. *Open Orthop J*. 2012; 6(1):495-502.
67. Rudolf L, Capobianco R. Five-year clinical and radiographic outcomes after minimally invasive sacroiliac fusion using triangular implants. *Open Orthop J*. 2014; 8: 375-383.
68. Sachs D. Minimally Invasive versus Open Sacroiliac Joint Fusion: A Comparison of Process Measures and Description of Technique. *IntJ Spine Surg*. Vancouver, BC Canada; 2013: 187.
69. Sachs D, Capobianco R. Minimally invasive sacroiliac joint fusion: one-year outcomes in 40 patients. *Adv Orthop*. 2013.
70. Sachs D., Capobianco R. One year successful outcomes for novel sacroiliac joint arthrodesis system. *Ann Surg Innov Res*. 2012; 6(13); 1-4.
71. Sachs D, Capobianco R, Cher D, et al. One-year outcomes after minimally invasive sacroiliac joint fusion with a series of triangular implants: a multicenter, patient-level analysis. *Med Devices Evid Res*. 2014. 7: 299-304.

72. Sachs D, Kovalsky D, Redmond A, et al. Durable intermediate to long-term outcomes after minimally invasive transiliac sacroiliac joint fusion using triangular titanium implants. *Med Devices Evid Res*. 2016; 9: 213-222.
73. Schneider B, Rosati R, Zheng P, McCormick Z. Challenges in Diagnosing Sacroiliac Joint Pain: A Narrative Review. *PMR*. 2019;11(S1):S40-S45. doi:10.1002/pmrj.12175.
74. Schoell K, Buser Z, Jakoi A, et al. Postoperative complications in patients undergoing minimally invasive sacroiliac fusion. *Spine J*. 2016 Nov; 16(11): 1324-1332. PMID 27349627.
75. Schofferman J, Reynolds J, Herzog R, Covington E, Dreyfuss P, O'Neill C. Failed back surgery: etiology and diagnostic evaluation. *Spine J*. 2003; 3(5): 400-403.
76. Schroader JE, Cunningham ME, Ross T, Boachie-Adjei O. Early Results of Sacro-Iliac Joint Fixation Following Long Fusion in the Sacrum in Adult Spine Deformity. *Hosp Spec Surg J*. 2013; 10(1): 30-35.
77. Schwarzer AC, Aprill CN, Bogduk N. The sacroiliac joint in chronic low back pain. *Spine*. 1995; 20(1): 31-37.
78. Sembrano JN, Polly DW. How often is low back pain not coming from the back? *Spine*. 2009; 34(1): E27-E32.
79. Smith AG, Capobianco R, Cher D, et al. Open versus minimally invasive sacroiliac joint fusion: a multi-center comparison. *Ann Surg Innov Res*. 2013; 7: 14.
80. Soriano-Baron H, Lindsey DP, Rodriguez-Martinez N, et al. The Effect of Implant Placement on Sacroiliac Joint Range of Motion: Posterior vs Trans-articular. *Spine*. 2015; 40(9): E525-E530.
81. Spain K, Holt T. Surgical revision after sacroiliac joint fixation or fusion. *Int J Spine Surg*. Apr 2017; 11:5. PMID 28377863.
82. Spiker WR, Lawrence BD, Raich AI, Skelly AC, Brodke DS. Surgical versus injection treatment for injection-confirmed chronic sacroiliac pain. *Evid-Based Spine-Care J*. 2012; 3(4): 41-53.
83. Stuge B, Laerum E, Kirkesola G, Volestad N. The efficacy of a treatment program focusing on specific stabilizing exercises for pelvic girdle pain after pregnancy: a randomized controlled trial. *Spine*. 2004; 29(4): 351-359.
84. Stureson B, Kools D, Pflugmacher R, Gasbarrini A, Prestamburgo D, Dengler J. Six-Month Outcomes from a Randomized Controlled Trial of Minimally Invasive SI Joint Fusion with Triangular Titanium Implants vs. Conservative Management. *Eur Spine J*. 2017; 26(3): 708-719.
85. Szadek KM, Hoogland PV, Zuurmond WW, de Lange JJ, Perez RS. Nociceptive nerve fibers in the sacroiliac joint in humans. *Reg Anesth Pain Med*. 2008; 33(1): 36-43.
86. Szadek KM, van der Wurff P, van Tulder MW, Zuurmond WW, Perez RSGM. Diagnostic validity of criteria for sacroiliac joint pain: a systematic review. *J Pain*. 2009; 10(4): 354-368.
87. Vanaclocha V, Herrera JM, Siz-Sapena N, Rivera-Paz M, Verdu-Lopez F. Minimally Invasive Sacroiliac Joint Fusion, Radiofrequency Denervation, and Conservative Management for Sacroiliac Joint Pain: 6-Year Comparative Case Series. *Neurosurgery*. April 2017.
88. Vanaclocha VV, Verdu-Lopez F, Sanchez-Pardo M, et al. Minimally Invasive Sacroiliac Joint Arthrodesis: Experience in a Prospective Series with 24 Patients. *J Spine*. 2014; 3(5).
89. Waisbrod H, Krainick JU, Gerbershagen HU. Sacroiliac joint arthrodesis for chronic lower back pain. *Arch Orthop Trauma Surg Arch*. 1987; 106(4): 238-240.
90. Whang PG, Cher D, Polly D, et al. Sacroiliac Joint Fusion Using Triangular Titanium Implants vs Non-Surgical Management: Six-Month Outcomes from a Prospective Randomized Controlled Trial. *Int J Spine Surg*. 2015; 9: Article 6.
91. Whang PG, Darr E, Meyer SC et al. Long-term prospective clinical and radiographic outcomes after minimally invasive lateral transiliac sacroiliac joint fusion using triangular titanium implants. *Med Devices Auckl. Research*. 2019; 12:411-422. doi:10.2147/mder.s219862.
92. Wise CL, Dall BE. Minimally invasive sacroiliac arthrodesis: outcomes of a new technique. *J Spinal Disord Tech*. 2008; 21(8): 579-584.
93. Yang A, McCormick Z, et al. Radiofrequency ablation for the posterior sacroiliac joint complex pain: a narrative review. *PMR*. 2019; 11: S105-S113.
94. Yason S, Sembrano J, et al. Sacroiliac Joint fusion: Approaches and recent outcomes. *PMR*. 2019: S114-S117.
95. Yoshihara H. Sacroiliac joint pain after lumbar/lumbosacral fusion: current knowledge. *Eur Spine J*. 2012; 21(9): 1788-1796.
96. Zaidi HA, Montoure AJ, Dickman CA. Surgical and clinical efficacy of sacroiliac joint fusion: a systematic review of the literature. *J Neurosurg Spine*. April 2015; 23(1): 59-66.
97. Zheng P, Schneider B, et al. Image-guided sacroiliac joint injections: an evidence-based review of best practices and clinical outcomes. *PMR*. 2019; 11:S 98-S104.