Medical Coverage Policy

Effective Date.....**10/15/2021**
Next Review Date.....**10/15/2022**
Coverage Policy Number **0276**

Manipulation Under Anesthesia

Table of Contents

Related Coverage Resources

Chiropractic Care

INSTRUCTIONS FOR USE
The following Coverage Policy applies to health benefit plans administered by Cigna Companies. Certain Cigna Companies and/or lines of business only provide utilization review services to clients and do not make coverage determinations. References to standard benefit plan language and coverage determinations do not apply to those clients. Coverage Policies are intended to provide guidance in interpreting certain standard benefit plans administered by Cigna Companies. Please note, the terms of a customer's particular benefit plan document [Group Service Agreement, Evidence of Coverage, Certificate of Coverage, Summary Plan Description (SPD) or similar plan document] may differ significantly from the standard benefit plans upon which these Coverage Policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a Coverage Policy. In the event of a conflict, a customer's benefit plan document always supersedes the information in the Coverage Policies. In the absence of a controlling federal or state coverage mandate, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of 1) the terms of the applicable benefit plan document in effect on the date of service; 2) any applicable laws/regulations; 3) any relevant collateral source materials including Coverage Policies and; 4) the specific facts of the particular situation. Each coverage request should be reviewed on its own merits. Medical directors are expected to exercise clinical judgment and have discretion in making individual coverage determinations. Coverage Policies relate exclusively to the administration of health benefit plans. Coverage Policies are not recommendations for treatment and should never be used as treatment guidelines. In certain markets, delegated vendor guidelines may be used to support medical necessity and other coverage determinations.

Overview

This Coverage Policy addresses manipulation under anesthesia (MUA).

Coverage Policy

A single treatment of manipulation under anesthesia* (MUA) is considered as medically necessary for ANY of the following indications:

- adhesive capsulitis (i.e., frozen shoulder) when there is failure of conservative medical management, including medications with or without articular injections, home exercise programs and physical therapy/standard chiropractic treatment (Common Procedural Terminology [CPT] code 23700)
- post-traumatic or postoperative arthrofibrosis of the knee (e.g., total knee replacement, anterior cruciate ligament repair) (CPT code 27570) when there is failure of conservative medical management, including exercise and physical therapy/standard chiropractic treatment
- reduction of a displaced fracture (e.g., vertebral, long bones) (e.g., CPT code 22505, 25675)
- reduction of acute/traumatic dislocation (e.g., vertebral, perched cervical facet) (e.g., CPT code 22505)

- chronic contracture of upper or lower extremity joint (e.g., fixed contracture from a neuromuscular condition) when there is failure of conservative medical management including range of motion exercise programs and physical therapy/standard chiropractic treatment

***MUA provided for these indications consists of a SINGLE treatment session. Repeat treatment sessions involving a previously treated bone or joint are subject to medical necessity review. Furthermore, serial treatment sessions (i.e., treatments of the same bone/joint provided subsequently over a period of time) are not in accordance with generally accepted standards of medical practice and are therefore not medically necessary.**

MUA for any other indication, including the treatment of acute or chronic pain conditions, involving one or more of the following joints, is considered experimental, investigational or unproven:

- ankle (CPT code 27860)
- cervical, thoracic or lumbar spine (e.g., CPT code 22505)
- elbow (CPT code 24300)
- finger (e.g., CPT code 26340, 26675)
- hip (CPT code 27275)
- pelvis, sacroiliac (CPT code 27198)
- temporomandibular (CPT code 21073)
- thumb (CPT code 26340)
- toe (CPT code 28635, 28665)
- wrist (CPT code 25259)

General Background

Manipulation under anesthesia (MUA) is aimed at reducing pain and improving range of motion and is a treatment modality that consists of manipulation and stretching procedures performed while an individual receives anesthesia (e.g., conscious sedation, general anesthesia). A chiropractor, osteopathic physician or medical physician may perform this type of manipulation with an anesthesiologist in attendance.

MUA is considered a safe and effective form of treatment for some joint conditions, such as arthrofibrosis of the knee and adhesive capsulitis. It is also utilized for treatment of fractures (e.g., vertebral, long bones) and dislocations. Although there is limited evidence in the peer-reviewed medical literature supporting safety and efficacy for the treatment of pain conditions, MUA has been recommended as a treatment modality for acute and chronic pain conditions, particularly of the spinal region, when standard chiropractic care and other conservative measures have proved unsuccessful.

An individual's protective reflex mechanism is absent under anesthesia and proponents contend it is less difficult to separate and move the joint when the reflex is absent. During MUA, the chiropractor or physician performs a combination of short manipulations, passive stretches and maneuvers to break up fibrous and scar tissue around the spine and surrounding joint areas. This manipulation typically includes a high velocity thrust (i.e., a technique that adjusts the joints rapidly), which may be followed by a popping or snapping sound.

In a less frequently used technique, manipulation under anesthesia (MUA) may be accompanied by fluoroscopically-guided intra-articular injections with corticosteroid agents to reduce inflammation. This procedure is referred to as manipulation under joint anesthesia/analgesia (MUJA). Manipulation under epidural anesthesia (MUEA) employs an epidural, segmental anesthetic, often with simultaneous epidural steroid injections, followed by spinal manipulation therapy. Some therapies may combine manipulation with cortisone injections into paraspinal tissues and proliferant injections. Other forms of manipulation under anesthesia include spinal manipulation under anesthesia (SMUA) performed with or without manipulation of other joints and total body joint manipulation.

MUA is considered safe and effective and is a well-established method of treatment for conditions such as adhesive capsulitis of the shoulder, arthrofibrosis of the knee, and some fractures, dislocations and contractures.

When performed for these specific conditions, MUA generally requires a single session of treatment, most often performed unilaterally, involving a single joint. Data supporting the need for, and clinical efficacy of multiple, repeat MUA treatment sessions for these specific conditions, is lacking in the peer-reviewed published medical literature.

Adhesive Capsulitis/Frozen Shoulder
Adhesive capsulitis, also referred to as frozen shoulder, is used to describe a painful restriction (both passive and active) of shoulder motion in an individual whose radiographs are typically normal. It may also be referred to as pericapsulitis and occurs in approximately 2-5% of the general population. Some authors contend the condition results from synovial inflammation with subsequent reactive capsular fibrosis. Early stages are treated with steroid injections and home therapy. For refractory cases, more aggressive treatment involves manipulation of the shoulder joint under anesthesia or an arthroscopic capsular release (Griffen, 2003). Manipulating the joint under anesthesia breaks up the adhesions surrounding the joint and stretches the fibrotic tissue thereby increasing joint motion and reducing pain. Evidence in the peer-reviewed published scientific literature, including textbook sources, supports MUA may be considered for refractory cases of adhesive capsulitis of the shoulder (Kim, et al., 2020; Srikesavan, et al., 2021, Brealey, et al., 2020, Alsubheen, et al., 2019, Rolle, 2017; Miller, et al., 2021; Vastamaki, Vastamaki, 2013; Maund, et al., 2012; Kivimaki, et al., 2007; Wang, et al., 2007; Sheridan and Hannafin, 2006; Dias, et al., 2005; Farrell, et al., 2005; Hamdan and Essa, 2003; Nirschl and Willet, 2002). MUA is generally recommended for individuals who do not respond to or who demonstrate little improvement after conservative treatment.

Postoperative/Post-traumatic Arthrofibrosis of the Knee
Arthrofibrosis of the knee is a condition that may occur following trauma, surgery or joint replacement and results from inflammation and proliferation of scar tissue. Physiologically, traumatic injury to the knee leads to the formation of internal scar tissue with shrinking and tightening of the joints knee capsule. Tendons outside the joint may also shrink and tighten, leading to a further decrease of joint mobility. Treatment of arthrofibrosis of the knee begins with physical therapy to improve motion, for refractory cases manipulation of the joint under anesthesia may be performed. However in some cases manipulation of the joint inadvertently results in femoral or tibial fracture, depending on the severity of adhesion formation and weak joints. As a result, some surgeons perform an arthroscopic internal resection of scar tissue prior to manipulating the joint in order to reduce the manipulation force and prevent fractures. MUA is indicated, with or without arthroscopy for arthrofibrosis of the knee, when there is < 90° range of motion following surgery or trauma despite physical therapy (Magit, et al. 2007). Published evidence in the medical literature supports MUA as a well-established safe and effective treatment for arthrofibrosis of the knee (Randsborg, et al., 2020; Gu, et al., 2018 ; Issa, et al., 2014a; Issa, et al., 2014b; Pivec, et al., 2013; Ghani, et al., 2012; Ipach, et al., 2011; Fitzsimmons, et al., 2010; Mohammed, et al., 2009; Keating, et al., 2007; Magit, et al., 2007; Namba and Inacio, 2007; D'Amato and Bach, 2003; Esler, et al. 1999).

Postoperative/Post-traumatic Arthrofibrosis of the Elbow
Arthrofibrosis of the elbow often occurs following injury (e.g., operative, fracture). The elbow becomes stiff as a result of soft-tissue contracture of the ligaments, muscles and/or tendons. Early management generally involves bracing and splints (Araghi, et al, 2010). Manipulation under anesthesia may be recommended when there is failure to progress improve and progress following the use of bracing. Operative release may be considered a treatment option depending on the cause of the contracture, the presence of pain or other symptoms, and decrease in functional level.

Published evidence in the peer reviewed scientific literature supporting the safety and effectiveness of using manipulation under anesthesia of the elbow is limited to retrospective case series, involve small sample populations and lack control groups (Rotman, et al, 2019; Spitler, et al., 2018; Araghi, et al, 2012, Duke, et al., 1991, Davilia, Johnston-Jones, 2006; Tan, et al., 2006; Chao, et al, 2002; Gaur, et al, 2003). Few studies lend support to clinical effectiveness for the treatment of joint stiffness/fibrosis when other conservative measures, such as bracing and splinting, have failed to improve range of motion. In addition, evidence-based clinical practice guidelines supporting MUA for arthrofobrosis of the elbow are not available. There is insufficient evidence in the peer-reviewed published literature and lack of consensus among professional societies to support the effectiveness of MUA as treatment for arthrofibrosis of the elbow.

Fracture and/or Dislocation
MUA is also considered a well-established and successful treatment for some types of fractures (e.g., vertebral, long bones) and acute/traumatic dislocations (e.g., perched cervical facet). It is typically performed with surgical repair and other medically necessary procedures such as arthroscopy. When performed in this context, MUA is considered incidental to the base procedure.

Chronic Contracture of Upper or Lower Extremity Joint
A joint contracture is a limitation in the passive range of motion of a joint. Joint contractures prevent normal movement of the associated body part and can result from a variety of causes such as spasticity or prolonged immobilization. Intra-articular adhesions and peri-articular adhesions, as well as capsular, ligament and muscle shortening and tightness may develop. As a result, activities of daily living and other skills may be adversely affected due to the decreased mobility. In many cases, contractures can be successfully treated nonoperatively with aggressive physical therapy or splinting with restoration of functional range of motion. When conservative treatment fails more aggressive treatment may necessary and includes anesthetic block, maximal stretching, and in some cases, serial casting (Garden, 2002). For joint contracture deformities, extra-articular and intra-articular soft tissue releases are considered standard treatment (Paley, 2003). Surgical treatments include tenotomy, tendon lengthening and joint capsule release. Manipulation under anesthesia, involving maximal passive stretching may be considered standard treatment and is often performed in combination with serial casting and/or surgical release when less aggressive treatments have failed.

Pain Management
Although not well-supported in the peer-reviewed published scientific literature, manipulation under anesthesia has been proposed as a treatment for spine-related pain conditions, including but not limited to, acute or chronic cervical pain, cervicobrachial, cervicocranial, lumbar, pelvis, or lower extremity syndromes with somatic dysfunctions that have not responded to conservative management. Manipulation under anesthesia for pain management often involves the spine and/or other major body joints in addition to the spine. Individuals typically undergo a 4 to 8 week trial of conservative manipulation management (e.g., chiropractic care) prior to more aggressive approaches, such as MUA. Authors contend failure of a trial of conservative therapy is thought to be the primary basis for more aggressive MUA approaches (Kohlbeck, et al., 2002).

When utilized for pain management, MUA treatment typically consists of consecutive daily treatment sessions, (generally one to five sessions, with three being the average), followed by additional outpatient chiropractic sessions and may or may not be accompanied by steroid injections. During the procedure, manipulation of various joints, including the spine, may be performed as part of the overall therapy plan. Cremata and associates (2005) identified three distinct stages to MUA: sedation of the patient, specific chiropractic adjustments, and passive stretching and traction procedures of the spine, sacroiliac and pelvis. The literature suggests maneuvers are predetermined for each individual patient but often involves all regions of the spine (i.e., cervical, thoracic, lumbar) as well as distal extremities and that the need for serial manipulations is determined by the degree of biomechanical function following the initial procedure. However, there is insufficient evidence in the peer-reviewed published scientific literature to support safety and efficacy of MUA for the management of acute or chronic pain conditions, when performed as single or multiple treatment sessions.

Spine: Theoretically, spinal manipulation as a method of treatment for subluxation stretches the joint capsules and resets the spinal cord and nerve position, allowing the nervous system to function optimally. Evidence in the published, peer-reviewed scientific literature has failed to demonstrate the safety and efficacy of MUA when used for the treatment of pain associated with the spine (SMUA) and some sources indicate the treatment may be hazardous and is obsolete (Kohatsu, 2007; Lindsey, et al., 2003). In addition, anesthesia itself carries a small but clinically significant risk. Overall, the evidence evaluating SMUA consists mainly of case reports, case series, few controlled clinical trials and literature reviews (Peterson, et al., 2014; Taber, et al., 2013; Cremata, et al., 2005; Kohlbeck, et al., 2005; Palmieri and Smoyak, 2002; Kohlbeck and Haldeman, 2002; West, et al., 1999). Some of the study results support improvement in pain and function following SMUA when compared to traditional manipulation (Kohlbeck, et al., 2005; Palmieri and Smoyak, 2002); however these studies are limited by lack of randomization, small sample populations and measurement of short-term outcomes. Follow-up assessments were generally conducted from three months to one year post-MUA treatment, some of which consisted of self-reported outcomes and questionnaires. Patient selection criteria are poorly defined and treatment protocols vary making comparisons difficult. Much of the evidence evaluating SMUA is low quality and reliable conclusions

cannot be drawn regarding efficacy and improvement of health outcomes. Further well-designed clinical trials are needed to support the safety and effectiveness of the procedure for the management of acute or chronic pain conditions related to the spine.

Other Joints: Evidence in the medical literature evaluating the use of MUA for management of pain conditions involving one or more (i.e., multiple joints, whole body MUA) of other major joints such as the hip, ankle, toe, elbow, and wrist, is lacking. Due to insufficient evidence conclusions cannot be made regarding the clinical utility or safety and efficacy of MUA involving other single or multiple joints for pain management.

Other Conditions
There is insufficient evidence in the peer-reviewed published scientific literature to support safety and efficacy of manipulation under anesthesia of any joint such as the hip, ankle, toe, elbow, and wrist for the treatment of any other condition.

Professional Societies/Organizations
According to the American College of Occupational and Environmental Medicine (ACOEM) practice guidelines regarding physical methods of treatment for low back disorders (Hegmann, 2007; update: Hegmann, et al., 2008), due to insufficient evidence manipulation under anesthesia (MUA) and medication-assisted spinal manipulation (MASM) for acute, subacute or chronic low back pain is not recommended.

Use outside the US
No relevant information.

Medicare Coverage Determinations

	Contractor	Policy Name/Number	Revision Effective Date
NCD	National	National Coverage Determination (NCD) for Manipulation (150.1)	Longstanding national coverage determination. The effective date of this version has not been posted.
LCD		No Local Coverage Determination found	

Note: Please review the current Medicare Policy for the most up-to-date information.

Coding/Billing Information

Note: 1) This list of codes may not be all-inclusive.
2) Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement.

Coverage is limited to a SINGLE treatment session of an isolated joint condition.

SHOULDER

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
23655	Closed treatment of shoulder dislocation, with manipulation; requiring anesthesia
23700	Manipulation under anesthesia, shoulder joint, including application of fixation apparatus (dislocation excluded)

SPINE

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
22505	Manipulation of spine requiring anesthesia, any region

PELVIS

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
27198	Closed treatment of posterior pelvic ring fracture(s), dislocation(s), diastasis or subluxation of the ilium, sacroiliac joint, and/or sacrum, with or without anterior pelvic ring fracture(s) and/or dislocation(s) of the pubic symphysis and/or superior/inferior rami, unilateral or bilateral; with manipulation, requiring more than local anesthesia (ie, general anesthesia, moderate sedation, spinal/epidural)

ARM

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
24300	Manipulation, elbow, under anesthesia
24605	Treatment of closed elbow dislocation; requiring anesthesia
25675	Closed treatment of distal radioulnar dislocation with manipulation

WRIST

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
25259	Manipulation, wrist, under anesthesia
25690	Closed treatment of lunate dislocation, with manipulation
26641	Closed treatment of carpometacarpal dislocation, thumb, with manipulation
26675	Closed treatment of carpometacarpal dislocation, other than thumb, with manipulation, each joint; requiring anesthesia

HAND /FINGERS

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
26340	Manipulation, finger joint, under anesthesia, each joint
26705	Closed treatment of metacarpophalangeal dislocation, single, with manipulation; requiring anesthesia
26775	Closed treatment of interphalangeal joint dislocation, single, with manipulation; requiring anesthesia

CPT®* Codes	Description
26989†	Unlisted procedure, hands or fingers
28665	Closed treatment of interphalangeal joint dislocation; requiring anesthesia

†**Note: Covered when medically necessary when used to report MUA of a finger or thumb requiring anesthesia.**

HIP

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
27252	Closed treatment of hip dislocation, traumatic; requiring anesthesia
27275	Manipulation, hip joint, requiring general anesthesia

LEG

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
27831	Closed treatment of proximal tibiofibular joint dislocation; requiring anesthesia

KNEE

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
27552	Closed treatment of knee dislocation; requiring anesthesia
27562	Closed treatment of patellar dislocation; requiring anesthesia
27570	Manipulation of knee joint under general anesthesia (includes application of traction or other fixation devices)

ANKLE

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
27860	Manipulation of ankle under general anesthesia (includes application of traction or other fixation apparatus)
28545	Closed treatment of tarsal bone dislocation, other than talotarsal; requiring anesthesia

FOOT/TOES

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
28635	Closed treatment of metatarsophalangeal joint dislocation; requiring anesthesia
28899	Unlisted procedure, foot or toes

Experimental, investigational or unproven when used to report manipulation under anesthesia of a single joint or multiple body joints for any other condition, including the management of acute or chronic pain conditions:

CPT®* Codes	Description
21073	Manipulation of temporomandibular joint(s) (TMJ), therapeutic, requiring an anesthesia service (ie, general or monitored anesthesia care)
22505	Manipulation of spine requiring anesthesia, any region
23655	Closed treatment of shoulder dislocation, with manipulation; requiring anesthesia
23700	Manipulation under anesthesia, shoulder joint, including application of fixation apparatus (dislocation excluded)
24300	Manipulation, elbow, under anesthesia
25259	Manipulation, wrist, under anesthesia
25675	Closed treatment of distal radioulnar dislocation with manipulation
25690	Closed treatment of lunate dislocation, with manipulation
26340	Manipulation, finger joint, under anesthesia, each joint
26641	Closed treatment of carpometacarpal dislocation, thumb, with manipulation
26675	Closed treatment of carpometacarpal dislocation, other than thumb, with manipulation, each joint, requiring anesthesia
26705	Closed treatment of metacarpophalangeal dislocation, single, with manipulation; requiring anesthesia
26775	Closed treatment of interphalangeal joint dislocation, single, with manipulation; requiring anesthesia
26989	Unlisted procedure, hands or fingers
27198	Closed treatment of posterior pelvic ring fracture(s), dislocation(s), diastasis or subluxation of the ilium, sacroiliac joint, and/or sacrum, with or without anterior pelvic ring fracture(s) and/or dislocation(s) of the pubic symphysis and/or superior/inferior rami, unilateral or bilateral; with manipulation, requiring more than local anesthesia (ie, general anesthesia, moderate sedation, spinal/epidural)
27275	Manipulation, hip joint, requiring general anesthesia
27570	Manipulation of knee joint under general anesthesia (includes application of traction or other fixation devices)
27860	Manipulation of ankle under general anesthesia (includes application of traction or other fixation apparatus)
28635	Closed treatment of metatarsophalangeal joint dislocation; requiring anesthesia
28665	Closed treatment of interphalangeal joint dislocation; requiring anesthesia
28899	Unlisted procedure, foot or toes

References

1. Alsubheen SA, Nazari G, Bobos P, MacDermid JC, Overend TJ, Faber K. Effectiveness of Nonsurgical Interventions for Managing Adhesive Capsulitis in Patients With Diabetes: A Systematic Review. Arch Phys Med Rehabil. 2019 Feb;100(2):350-365.

2. American Association of Manipulation Under Anesthesia Providers. Guidelines for the practice and performance of manipulation under anesthesia. Feb 3, 2014. Chiropr Man Therap. 2014; 22: 7.

3. Antuna SA, Morrey BF, Adams RA, O'Driscoll SW. Ulnohumeral arthroplasty for primary degenerative arthritis of the elbow: long-term outcome and complications. J Bone Joint Surg Am. 2002Dec: 84-A(12):2168-73.

4. Araghi A, Celli A, Adams R, Morrey B. The outcome of examination (manipulation) under anesthesia on the stiff elbow after surgical contracture release. Shoulder Elbow Surg. 2010 Mar;19(2):202-8.

5. Assendelft WJJ, Morton SC, Yu EI, Suttorp MJ, Shekelle PG. Spinal manipulative therapy for low-back pain. The Cochrane Database of Systematic Reviews 2005 Issue 4. In: The Cochrane Library, Issue 4, 2005.

6. Brealey S, Northgraves M, Kottam L, Keding A, Corbacho B, Goodchild L, et al. Surgical treatments compared with early structured physiotherapy in secondary care for adults with primary frozen shoulder: the UK FROST three-arm RCT. Health Technol Assess. 2020 Dec;24(71):1-162.

7. Chao EK, Chen AC, Lee MS, Ueng SW. Surgical approaches for nonneurogenic elbow heterotopic ossification with ulnar neuropathy. J Trauma. 2002 Nov;53(5):928-33.

8. Charalambous CP, Morrey BF. Posttraumatic elbow stiffness. J Bone Joint Surg Am. 2012 Aug 1;94(15):1428-37.

9. Centers for Medicare and Medicaid Services (CMS). National Coverage Determinations (NCDs). https://www.cms.gov/medicare-coverage-database/indexes/ncd-alphabetical-index.aspx

10. Cremata E, Collins S, Clauson W, Solinger AB, Roberts ES. Manipulation under anesthesia: a report of four cases. J Manipulative Physiol Ther. 2005 Sep;28(7):526-33.

11. D'Amato MJ, Bach BR. Loss of motion. In: DeLee: DeLee and Drez's Orthopaedic Sports Medicine, 2nd edition. Copyright © 2003, Saunders. Section J. Anterior cruciate ligament injuries.

12. Esler CN, Lock K, Harper WM, Gregg PJ. Manipulation of total knee replacements. Is the flexion gained retained? J Bone Joint Surg Br. 1999 Jan;81(1):27-9.

13. Farrell CM, Sperling JW, Cofield RH. Manipulation for frozen shoulder: long-term results. J Shoulder Elbow Surg. 2005 Sep-Oct;14(5):480-4.

14. Fitzsimmons SE, Vazquez EA, Bronson MJ. How to treat the stiff total knee arthroplasty?: a systematic review. Clin Orthop Relat Res. 2010 Apr;468(4):1096-106.

15. Foster ME, Gray RJ, Davies SJ, Macfarlane TV. Therapeutic manipulation of the temporomandibular joint. Br J Oral Maxillofac Surg. 2000 Dec;38(6):641-644.

16. Garden F. Contractures. In: Frontera: Essentials of Physical Medicine and Rehabilitation, 1st ed. Ch 103. Copyright © 2002 Hanley and Belfus.

17. Gaur A, Sinclair M, Caruso E, Peretti G, Zaleske D. Heterotopic ossification around the elbow following burns in children: results after excision. J Bone Joint Surg Am. 2003 Aug;85-A(8):1538-43.

18. Ghani H, Maffulli N, Khanduja V. Management of stiffness following total knee arthroplasty: A systematic review. Knee. 2012 Apr 23.

19. Griffen LY. Frozen shoulder. In: DeLee: DeLee and Drez's Orthopaedic Sports Medicine, 2nd ed. Ch 13 The female athlete. Copyright © 2003 Saunders.

20. Gu A, Michalak AJ, Cohen JS, Almeida ND, McLawhorn AS, Sculco PK. Efficacy of Manipulation Under Anesthesia for Stiffness Following Total Knee Arthroplasty: A Systematic Review. J Arthroplasty. 2018 May;33(5):1598-1605.

21. Hamdan TA, Al-Essa KA. Manipulation under anaesthesia for the treatment of frozen shoulder. Int Orthop. 2003;27(2):107-9. Epub 2002 Sep 13.

22. Hegmann KT, editor. Low back disorders. In: Glass LS, editor(s). Occupational medicine practice guidelines: evaluation and management of common health problems and functional recovery in workers. 2nd ed. American College of Occupational and Environmental Medicine (ACOEM); 2007. p. 366.

23. Hegmann KT, editor. Feinberg SD, Genovese E, Korevaar WC, Mueller KL, associate editors. Low back disorders. In: Glass LS, editor(s). Occupational medicine practice guidelines: evaluation and management of common health problems and functional recovery in workers. Update to Ch 6 of Occupational Medical Practice Guidelines 2007. Copyright 2008, 2004, 1997 by the American College of Occupational and Environmental Medicine.

24. Ipach I, Mittag F, Lahrmann J, Kunze B, Kluba T. Arthrofibrosis after TKA - Influence factors on the absolute flexion and gain in flexion after manipulation under anaesthesia. BMC Musculoskelet Disord. 2011 Aug 12;12:184.

25. Issa K, Banerjee S, Kester MA, Khanuja HS, Delanois RE, Mont MA. The effect of timing of manipulation under anesthesia to improve range of motion and functional outcomes following total knee arthroplasty. J Bone Joint Surg Am. 2014a Aug 20;96(16):1349-57.

26. Issa K, Kapadia BH, Kester M, Khanuja HS, Delanois RE, Mont MA. Clinical, objective, and functional outcomes of manipulation under anesthesia to treat knee stiffness following total knee arthroplasty. J Arthroplasty. 2014b Mar;29(3):548-52.

27. Jacobs LG, Smith MG, Khan SA, Smith K, Joshi M. Manipulation or intra-articular steroids in the management of adhesive capsulitis of the shoulder? A prospective randomized trial. J Shoulder Elbow Surg. 2009 May-Jun;18(3):348-53.

28. Keating EM, Ritter MA, Harty LD, Haas G, Meding JB, Faris PM, Berend ME. Manipulation after total knee arthroplasty. J Bone Joint Surg Am. 2007 Feb;89(2):282-6.

29. Kim DH, Song KS, Min BW, Bae KC, Lim YJ, Cho CH. Early Clinical Outcomes of Manipulation under Anesthesia for Refractory Adhesive Capsulitis: Comparison with Arthroscopic Capsular Release. Clin Orthop Surg. 2020 Jun;12(2):217-223.

30. Kivimäki J, Pohjolainen T, Malmivaara A, Kannisto M, Guillaume J, Seitsalo S, Nissinen M. Manipulation under anesthesia with home exercises versus home exercises alone in the treatment of frozen shoulder: a randomized, controlled trial with 125 patients. J Shoulder Elbow Surg. 2007 Nov-Dec;16(6):722-6..

31. Kohatsu W. Low back pain. In: Rakel: Integrative Medicine, 2nd ed. Ch 63. Copyright © 2007 Saunders.

32. Kohlbeck FJ, Haldeman S, Hurwitz EL, Dagenais S. Supplemental care with medication-assisted manipulation versus spinal manipulation therapy alone for patients with chronic low back pain. J Manipulative Physiol Ther. 2005 May;28(4):245-52.

33. Kohlbeck FJ, Haldeman S. Medication-assisted spinal manipulation. Technical report. Spine J. 2002 Jul-Aug;2(4):288-302.

34. Kornuijt A, Das D, Sijbesma T, de Vries L, van der Weegen W. Manipulation under anesthesia following total knee arthroplasty: a comprehensive review of literature. Musculoskelet Surg. 2018 Dec;102(3):223-230.

35. Lindsey RW, Pneumaticos SG, Gugala Z. Thoracolumbar spine fractures. Management techniques for spinal injuries. In: Browner: Skeletal Trauma: Basic Science, Management, and Reconstruction, 3rd ed., Copyright © 2003. Ch 27.

36. Looney CG, Raynor B, Lowe R. Adhesive capsulitis of the hip: a review. J Am Acad Orthop Surg. 2013 Dec;21(12):749-55.

37. Luukkainen R, Sipola E, Varjo P. Successful treatment of frozen hip with manipulation and pressure dilatation. Open Rheumatol J. 2008;2:31-2.

38. Magit D, Wolff A, Sutton K, Medvecky MJ. Arthrofibrosis of the knee. J Am Acad Orthop Surg. 2007 Nov;15(11):682-94.

39. Martin GM, Harris I. Complications of total knee arthroplasty. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. Last updated: March 18, 2020. (Accessed on August 31, 2021).

40. Maund E, Craig D, Suekarran S, Neilson A, Wright K, Brealey S, et al. Management of frozen shoulder: a systematic review and cost-effectiveness analysis. Health Technol Assess. 2012;16(11):1-264.

41. Miller RH, Azar FM, Throckmorton TW. Shoulder and Elbow Injuries. In: Campbell's Operative Orthopaedics, Chapter 46, 2374-2425. Copyright © 2021 Elsevier.

42. Mohammed R, Syed S, Ahmed N. Manipulation under anesthesia for stiffness following knee arthroplasty. Ann R Coll Surg Engl. 2009 Apr;91(3):220-3.

43. Morningstar MW1, Strauchman MN. Manipulation under anesthesia for patients with failed back surgery: retrospective report of 3 cases with 1-year follow-up. J Chiropr Med. 2012 Mar;11(1):30-5.

44. Namba RS, Inacio M. Early and late manipulation improve flexion after total knee arthroplasty. J Arthroplasty. 2007 Sep;22(6 Suppl 2):58-61.

45. Nirschl RP, Willett SG. Adhesive capsulitis. In; Frontera: Essentials of Physical Medicine and Rehabilitation, 1st ed. Ch 12. Copyright © 2002.

46. Paley D. Principles of deformity correction. In: Browner: Skeletal Trauma: Basic Science, Management, and Reconstruction, 3rd ed. Ch 62. Copyright © 2003 Saunders.

47. Palmieri NF, Smoyak S. Chronic low back pain: a study of the effects of manipulation under anesthesia. J Manipulative Physiol Ther. 2002 Oct;25(8):E8-E17.

48. Peterson CK, Humphreys BK, Vollenweider R, Kressig M, Nussbaumer R. Outcomes for chronic neck and low back pain patients after manipulation under anesthesia: a prospective cohort study. J Manipulative Physiol Ther. 2014 Jul-Aug;37(6):377-82.

49. Pivec R, Issa K, Kester M, Harwin SF, Mont MA. Long-term outcomes of MUA for stiffness in primary TKA. Knee Surg. 2013 Dec;26(6):405-10.

50. Randsborg PH, Tajet J, Negård H, Røtterud JH. Manipulation under Anesthesia for Stiffness of the Knee Joint after Total Knee Replacement. Arthroplast Today. 2020 Jun 28;6(3):470-474.

51. Rotman D, Factor S, Schermann H, Kadar A, Atlan F, Pritsch T, Rosenblatt Y. Manipulation under anesthesia for the postsurgical stiff elbow: a case series and review of literature. Eur J Orthop Surg Traumatol. 2019 Jul 6.

52. Rolle A. Frozen Shoulder. In: Ferri's Clinical Advisor 2017. 487. E3. Copyright © 2017 by Elsevier.

53. Sheridan MA, Hannafin JA. Upper extremity: emphasis on frozen shoulder. Orthop Clin North Am. 2006 Oct;37(4):531-9.

54. Srikesavan C, Toye F, Brealey S, Goodchild L, Northgraves M, Charalambous CP, et al. Experiences and perceptions of trial participants and healthcare professionals in the UK Frozen Shoulder Trial (UK FROST): a nested qualitative study. BMJ Open. 2021 Jun 11;11(6):e040829.

55. Spitler CA, Doty DH, Johnson MD, et al. Manipulation under anesthesia as a treatment of posttraumatic elbow stiffness. J Orthop Trauma. 2018;32(8):e304-e308

56. Taber DJ, James GD, Jacon A. Manipulation under anesthesia for lumbopelvic pain: a retrospective review of 18 cases. J Chiropr Med. 2014 Mar;13(1):28-34.

57. Tan V, Daluiski A, Simic P, Hotchkiss RN . Outcome of open release for post-traumatic elbow stiffness. J Trauma 2006 Sep:6(13);673-8.

58. Wang JP, Huang TF, Hung SC, Ma HL, Wu JG, Chen TH. Comparison of idiopathic, post-trauma and post-surgery frozen shoulder after manipulation under anesthesia. Int Orthop. 2007 Jun;31(3):333-7. Epub 2006 Aug 23.

59. West DT, Mathews RS, Miller MR, Kent GM. Effective management of spinal pain in one hundred seventy-seven patients evaluated for manipulation under anesthesia. J Manipulative Physiol Ther.1999 Jun;22(5):299-308.

60. Witvrouw E, Bellemans J, Victor J. Manipulation under anaesthesia versus low stretch device in poor range of motion after TKA. Knee Surg Sports Traumatol Arthrosc. 2012 Aug 3.