Graulich BL, Fehr SD, Howell NM, et al. The use, safety and efficacy of corticosteroid injections in pediatric orthopedics and sports medicine: A systematic review. *Orthopedic Reviews*. 2026;18. doi:10.52965/001c.175232

General

The use, safety and efficacy of corticosteroid injections in pediatric orthopedics and sports medicine: A systematic review

Bethany L. Graulich, M.D.[1][a], Shayne D. Fehr, M.D.[2], Nathan M. Howell, M.D.[3], Jacob C. Jones, M.D.[4], Ruikang (Kong Kong) Liu, M.D.[5], Thomas P. Swaffield, M.D.[6], Lauren H. Yaeger, MLIS[7], William L. Hollabaugh, M.D.[8]

[1] Department of Pediatrics, Washington University School of Medicine, [2] Department of Orthopaedic Surgery, Medical College of Wisconsin, [3] Department of Orthopedics, University of Colorado, [4] Department of Orthopedics and Pediatrics, Scottish Rite for Children, [5] Department of Sports Medicine, Stanford University Medical Partners, [6] Sports Medicine and Performance Center, Children's Hospital of Philadelphia, [7] Bernard Becker Medical Library, Washington University School of Medicine, [8] Department of Orthopaedic Surgery, Washington University School of Medicine

Keywords: corticosteroid injection, pediatrics, sports medicine, skeletally immature patients

https://doi.org/10.52965/001c.175232

Orthopedic Reviews

Vol. 18, 2026

Introduction

Corticosteroid injections (CSI) are frequently used in orthopedic surgery and sports medicine (OSM) in adults. Evidence for their use in pediatric OSM is limited and extrapolated.

Objective

To review the use, safety, and efficacy of CSI in OSM in pediatric patients.

Methods

This systematic review followed PRISMA guidelines. Inclusion criteria comprised English language, human-subject research published from 2005-2025 of patients ⩽18 years-old who underwent a CSI for an OSM indication in level I-IV studies. Systematic reviews and meta-analyses were excluded.

Results

3986 abstracts and 117 full-text studies were screened. Eleven studies (3 prospective cohort studies, 3 retrospective cohort studies, 5 retrospective case series) met inclusion criteria. Using NOS and NIH/NHLBIQA, studies were rated good (4), fair (1) and poor (6). Females comprised 62.4% of the study population. 7/11 studies included only adolescents. CSI were administered for the following indications: anterior cutaneous nerve entrapment (3), acetabular labral tears (1), axial back pain (1), Baastrup's disease (1), carpal tunnel syndrome (1), coccydynia (1), congenital muscular torticollis (1), symptomatic bipartite patella (1), and talocalcaneal coalition (1). Nine studies reported adverse outcome data, with no adverse outcomes reported. Efficacy data were heterogenous, ranging from no response to complete symptom resolution. Follow-up ranged from 6 weeks to 31.8 years.

Conclusion

CSI are used in pediatric OSM despite limited evidence. Existing studies suggest variable benefit with no adverse events, though studies are heterogenous and not representative of the indications treated in clinical practice. Future research is needed to define the indications, safety, and efficacy for CSI in the pediatric population.

a **Corresponding author:** Bethany L Graulich, MD, Washington University School of Medicine, Washington University in St. Louis, 660 S Euclid Ave, St. Louis, MO 63110, 314-853-1539, Bethany.graulich98@gmail.com

INTRODUCTION

Corticosteroid injections (CSI) are widely utilized for orthopedic and sports medicine (OSM) indications. Their ability to suppress inflammation and modulate the immune response has made them valuable in the treatment of a wide range of musculoskeletal conditions.[1] CSI can reduce pain, improve function, and delay or prevent the need for surgical intervention, although degree and duration of pain relief is variable.[2-4] CSI may be performed with or without image guidance, including ultrasound (US) and fluoroscopy. The use of US when performing CSI for OSM indications has demonstrated greater accuracy, efficacy and cost-effectiveness compared to landmark-guided injections.[5-7] There is little consensus regarding the most effective type of corticosteroid for OSM indications, although triamcinolone acetonide, triamcinolone hexanoate and methylprednisolone have been shown to be the most common preparations utilized.[8,9]

Research on CSI for OSM indications has primarily focused on adults, while pediatric research has largely centered on rheumatologic indications. Consequently, evidence of the indications for CSI in pediatric patients with OSM conditions is extremely limited and is often extrapolated. Studies on the safety of CSI in pediatric patients with juvenile idiopathic arthritis (JIA) have shown that they are a safe and effective first-line treatment. Reported side effects are generally mild and include subcutaneous atrophy, skin hypopigmentation, periarticular calcifications, post-injection flare, and adrenal suppression due to systemic absorption.[9,10] These side effects are similar to those reported in adults, in whom additional short- and long-term adverse events—such as osteonecrosis, insufficiency fractures, and progression of osteoarthritis—have been described.[11] Although repeated intra-articular (IA) CSI in adults with osteoarthritis may be associated with accelerated cartilage loss, there is conflicting evidence regarding clinically significant structural progression or the need for joint replacement.[12,13]

Skeletally immature patients present unique considerations, as it remains unknown whether IA CSI administered near open growth plates affect growth and whether their developing tendons and joints are more susceptible to injection-related complications. Furthermore, long-term complications are of increased concern than in the adult population, as these individuals receive CSI at a younger age and have more time to develop potential CSI-related long-term effects. However, pediatric rheumatologic studies have shown that repeated CSIs may not cause joint damage, cartilage damage, or aseptic necrosis. These studies have demonstrated fewer cases of leg-length discrepancy in pediatric patients with JIA who received IA CSIs compared with those who did not.[14-18] Nonetheless, the potential long-term effects of CSI in pediatric patients remain a concern.

Given the ongoing use of CSI for OSM in pediatrics, it is important to determine if CSI are safe and effective in this population, especially with the potential risk for long-term side effects and the lack of research evaluating CSI in this population. In this context, the primary aim of this systematic review is to describe the indications, safety, and efficacy of CSI for OSM conditions in pediatric patients.

METHODS

This systematic review was performed in accordance with the methodologic approach outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) in Exercise, Rehabilitation, Sport Medicine and Sports Science (PERSiST) statement.[19] The study protocol was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO) database (ID CRD420251035479) prior to the commencement of literature searching and screening.

SEARCH STRATEGY

A medical librarian (LY) with expertise in biomedical science research comprehensively searched the literature for records including the concepts of "corticosteroid injection," "pediatric," "skeletally immature," "sports medicine," "orthopedic," "safety," "efficacy." The librarian performed the searches on March 14, 2025, developing strategies that used a combination of keywords and controlled vocabulary across Embase.com (1947–), Ovid MEDLINE (1946–), Scopus (1823–), the Cochrane Central Register of Controlled Trials (CENTRAL), SportDiscus (1930–), ClinicalTrials.gov (1997–), and grey literature sources (trial registries and conference abstracts). The fully reproducible search strategies for each database can be found in the Appendix.

STUDY SELECTION

Article screening was performed using Covidence (Veritas Health Innovation, Melbourne, Australia) systematic review management software. Pairs of two reviewers (SF, NH, RL, TS, JJ, WH) independently screened an equal share of titles and abstracts against the study inclusion criteria. In the event of a disagreement, consensus was reached through a third reviewer separate from the initial reviewer dyad. After title and abstract screening, full texts were assessed for eligibility by pairs of independent reviewers (SF, NH, RL, TS, JJ, WH), with assignments distributed evenly. In the event of a disagreement, consensus was reached through a third reviewer separate from the initial reviewer dyad.

Studies were included if the following conditions were met: (1) pediatric patients (age ⩽18 years), (2) studies evaluating an intervention involving CSI administered in the following locations [IA, intra-cystic, intra-bursal, tendon, tendon sheath, paratenon, ligament, bone, fat pad, nerve, muscle, plantar fascia, finger pulley, intra-lesional (for OSM indication), spinal (for OSM indications - interlaminar epidural, transforaminal epidural, caudal epidural, IA facet joint, medial branch block, sacroiliac joint, selective nerve root, dorsal root ganglion)], (3) CSI administered for an OSM indication, (4) Level 1-4 studies, excluding systematic reviews. Studies were excluded if they met any of the following criteria: (1) non-English language, (2) non-human

subject's research, (3) non-OSM literature, (4) population included adult patients (>18 years), (5) injection was not a corticosteroid, (6) corticosteroid administration route was oral, intravenous, intramuscular, subcutaneous, dermal/topical, intranasal, ophthalmic, otic, or rectal, (7) case reports, systematic reviews with or without a meta-analysis.

DATA COLLECTION AND SYNTHESIS

Data were independently extracted by two reviewers using a pre-defined, customized form within Covidence. Any discrepancies in extracted data were resolved by a third reviewer, if needed. The extracted data included: study characteristics (author names, year of publication, geographic location, study design, sample size, and follow-up time); injection details [indication, location, medication type and dose, frequency, anatomic site, time from injury to injection, injection preparation (i.e., sterile, non-sterile), relevant prior imaging and use of image guidance (i.e., ultrasound, fluoroscopy)]; injection efficacy (outcome assessment tools); sport, sex, age [pre-adolescent cohort (less than 11 years old), adolescent cohort (11-18 years-old)], co-morbidities, race, ethnicity, time to return to sport, complications or adverse events attributed to the injection and duration of study follow-up. If data were not reported in the text, it was extracted from tables if present.

Due to high methodological and clinical outcome heterogeneity across the included studies, meta-analysis was not performed. Individual study demographics, CSI indications, adverse outcomes/complications, and CSI efficacy data (i.e., outcome measures) were analyzed qualitatively and reported using a narrative synthesis, including quantitative data where applicable.

METHODOLOGICAL QUALITY

The methodological quality of the included studies was assessed using the Newcastle-Ottawa Quality Assessment Tool (NOS) for non-randomized studies and National Institutes of Health, National Heart, Lung, and Blood Institute Quality Assessment Tool (NIH/NHLBIQAT) for case series.[20,21]

RESULTS

STUDY SELECTION

The PRISMA flow diagram is shown in Figure 1. The comprehensive search identified 5,711 records, 1,725 duplicates were removed, resulting in 3,986 unique citations included in the project library. A total of 117 full texts were assessed for eligibility. Forty-two studies were excluded due to including adult participants, 27 for the wrong indication, 19 for an incorrect study timeframe, 14 for the wrong study design, 1 for the wrong injectate, 1 for the wrong patient population, 1 for the wrong procedure location, and 1 for the wrong route of administration. A total of 11 full text studies met inclusion criteria.[22-32]



Figure 1. PRISMA Flow Diagram describing screening process for study selection.[33]

GENERAL CHARACTERISTICS

The general characteristics of the 11 included studies are presented in Table 1. Females comprised 62.4% (184/295) of the study population, and 63.6% (7/11) studies included only adolescent participants. Injection sites varied and included the cervical region, spine/axial skeleton, pelvis, abdominal wall, wrist, hip, knee, and foot/ankle, with 18% (2/11) of studies involving intra-articular injections. Among the eight studies reporting injectate composition, all used a combination of a local anesthetic and glucocorticoid, most commonly lidocaine or ropivacaine and triamcinolone or methylprednisolone, respectively. Image guidance was reported in 36.4% (4/11) of studies, most frequently using ultrasound. One study reported using US and fluoroscopy for image guidance, although US was the primary imaging modality used during the final seven years of the study period.

ASSESSMENT OF METHODOLOGICAL QUALITY

The methodological quality of the included studies is summarized in Table 2. Using the criteria described for the NOS for non-randomized studies and NIH/NHLBIQAT for case series, four (36.4%) studies were rated good,[26-28,32] one (9.1%) study was rated fair,[23] and six (54.5%) studies were rated poor.[22,24,25,29-31]

INDICATIONS FOR CSI

Study indications are summarized in Table 3. In the 11 included studies, CSI were administered for the following OSM indications: anterior cutaneous nerve entrapment (ACNES) (3), acetabular labral tears (1), axial back pain (1), Baastrup's disease (1), carpal tunnel syndrome (1), coccydynia (1), congenital muscular torticollis (1), symptomatic bipartite patella (1), and talocalcaneal coalition (1).

Table 1. Main characteristics of included studies.

Study Title	Study Design	Population	Sample Size	CSI Intervention	Injection Location	Anatomic Region
Zhao et al.	Retrospective Chart Review	Abnormal SCM found by neck US, with clinical manifestations and the diagnosis of CMT	2599 kids (191/2599 received PT and CSI vs 2368/2599 received PT w/o CSI)	glucocorticoid (total =< 20 mg)	Sternocleidomastoid	Neck/ Cervical
Peterson et al.	Retrospective case series	Adolescents with axial back pain	2	9 mL 0.25% bupivacaine, 40mg of methylprednisolone acetate. 0.5 - 1mL injected at each of the 5 trigger points along the lumbar paraspinals.	Bilateral Lumbar Paraspinal Muscles	Spine/ Axial Skeleton
Ali et al.	Retrospective case series	Pediatric patients undergoing interventional modalities for the treatment of back pain associated with Baastrup's disease	2	1st patient: 6ml of 0.2% ropivicaine and 60mg depo-medrol. 2nd patient: 1ml of 0.2% ropivicaine with 40mg Kenalog.	1st patient: T11-L1 medial branch blocks. 2nd patient: L2-L3 interspinous process ligament	Spine/ Axial Skeleton
Finsen et al.	Prospective cohort study	Diagnosis of Chronic coccydynia in adolescent 11-17 yo	358 total patients. 43 adolescents. 32 underwent treatment. 27 had injections.	Mixture of lidocaine and corticosteroid	Most painful level of the coccyx, usually the sacrococcygeal or Co1-Co2 level	Pelvis
Akhnikh et al.	Retrospective case series	Pediatric patients with abdominal pain ultimately diagnosed with ACNES	3	10 ml 0.5% levobupivacaine and triamcinolone 40 mg	Rectus sheath at the point of maximum tenderness	Abdominal Wall
Kifer et al.	Prospective cohort study	<18 y/o diagnosed 01/2014 - 06/2016 with ACNES by pediatric GI using physical exam and a positive Carnett's sign, referred to the anesthesiologist for confirmation of the diagnosis and treatment.	38	40mg 1% lidocaine and 4mg dexamethasone	Subfascial into the rectus abdominis muscle at the site of the most severe pain (trigger point infiltration)	Abdominal Wall
Siawash et al.	Retrospective cohort study	Adolescents 10-18 years, registered with the pediatric diagnosis code 3303, evaluated 2011-2012 and ongoing abdominal complaints with normal diagnostic tests performed by pediatrician.	12/95 patients with chronic abdominal pain had ACNES (12 patients in injection cohort)	4 mL 1% lidocaine, 40 mg methylprednisolone	Underneath the superficial sheath of the rectus muscle	Abdominal Wall
Batdorf et al.	Retrospective cohort study	1. Clinical symptoms of CTS. 2. Diagnosis of CTS by a physician. 3. Treatment at our institution. 4. Documented follow-up	20 patients, 31 wrists	Not Reported	Carpal Tunnel	Wrist

Study Title	Study Design	Population	Sample Size	CSI Intervention	Injection Location	Anatomic Region
Murtha et al.	Prospective cohort study	Adolescents presenting to clinic with groin-based hip pain, had a positive anterior impingement test on clinical examination	36 hips (10 in the injection cohort)	40mg triamcinolone and local anesthetic	Intra-articular hip	Hip
Nakase et al.	Retrospective cohort study	Symptomatic type III bipartite patella confirmed by XR, US, and CT, with conventional conservative therapy (i.e., restriction of activities, immobilization, NSAIDs, PT) being ineffective for more than 2 months.	14 patients (15 knees)	3 mL of 1% lidocaine for local anesthesia, 2 mL of 1% lidocaine and 5 mg of triamcinolone acetonide	Between the patella and free fragment, and fenestration of the vastus lateralis tendon and lateral retinaculum with 10 fenestrations after the injection.	Knee
Zide et al.	Retrospective case series	Patients between the ages of 0-18 years with a radiographically confirmed diagnosis of the talocalcaneal coalition	83 patients (125 feet) in the study. 25 patients (34 feet) received a subtalar injection.	1 mL of 0.5% ropivacaine, 20mg triamcinolone, 20 mg methylprednisolone, or 40 mg methylprednisolone	Lateral Subtalar Joint	Ankle/ Foot

ACNES: Anterior cutaneous nerve entrapment syndrome
CTS: Carpal tunnel syndrome
SCM: Sternocleidomastoid muscle
CMT: Congenital muscular torticollis

Table 2. Methodological quality assessment of included studies.

Study	Quality Assessment	Grade
Zhao et al.	NOS	Poor
Peterson et al.	NIH	Poor
Ali et al.	NIH	Fair
Finsen et al.	NOS	Poor
Akhnikh et al.	NIH	Poor
Kifer et al.	NOS	Good
Siawash et al.	NOS	Poor
Batdorf et al.	NIH	Poor
Murtha et al.	NOS	Good
Nakase et al.	NIH	Good
Zide et al.	NIH	Good

NOS: Newcastle-Ottawa Quality Assessment for non-randomized studies
NIH: NIH/NHLBI Quality Assessment Tool for case series

Table 3. Indications for CSIs in the included studies.

Indication	Anatomic Region	# of Relevant Studies
Congenital muscular torticollis	Neck/ Cervical	1
Chronic back pain	Spine/ Axial Skeleton	1
Baastrup's disease	Spine/ Axial Skeleton	1
Coccydynia	Pelvis	1
Anterior cutaneous nerve entrapment syndrome	Abdominal Wall	3
Carpal Tunnel Syndrome	Wrist	1
Hip labral tears / FAI	Hip	1
Symptomatic bipartite patella	Knee	1
Tarsal coalition	Ankle/foot	1

FAI: Femoral acetabular impingement

SAFETY OUTCOMES OF CSI

Safety outcomes are summarized in Table 4. Nine studies reported adverse outcome data, with no adverse outcomes reported over their follow-up period. Study follow-up for all 11 studies ranged from 6 weeks to 31.8 years. Of the studies that reported adverse outcome data, the follow-up period ranged from 4 months to 64.4 months.

EFFICACY OF CSI

Treatment outcomes following CSI, according to each study's defined outcome measures, are summarized in Table 5. Outcome measures varied across studies and included resolution of pain or symptoms, return to play, and patient-reported outcome measures such as the modified Harris hip score (mHHS), Nonarthritic Hip Score (NAHS), the Victorian Institute of Sport Assessment-Patellar Tendinopathy (VISA) score, Numeric Pain Rating Scale (NPRS), and the Verbal Rating Scale (VRS).[27,34] Definitions of recovery also differed between studies and included symptom resolution or achievement of clinically meaningful improvements in validated outcome scores.

Table 4. Safety outcomes after CSIs for the included studies.

Study Title	Adverse Events	Follow-up
Zhao et al.	None reported	12 months
Peterson et al.	None reported	9-11 months
Ali et al.	None reported	1 year
Finsen et al.	None Reported	12 months
Akhnikh et al.	None reported	1 year
Kifer et al.	None Reported	12 months (median: 1.7 years; range: 1 to 2.7 years)
Siawash et al.	Not reported	6 weeks
Batdorf et al.	Not reported	17.6 years (range 2.8 - 31.8)
Murtha et al.	None Reported	35.7 +/- 18.3 months (range: 11.7-64.4 months)
Nakase et al.	None reported	>4 months
Zide et al.	None reported	878 days

NECESSITY OF REPEAT CSI

The rates of patients who underwent a repeat CSI are summarized in Table 6. Three studies reported that patients had recurrence of symptoms following initial resolution or improvement. Six of the eleven (54.5%) studies reported the need for repeat CSI due to symptom recurrence or persistence.

DISCUSSION

This systematic review assessed the indications, safety, and efficacy of CSI for OSM conditions in pediatric patients. Eleven studies were identified that met inclusion criteria in this systematic review.

The indications for CSI in pediatric OSM reported in the included studies - ACNES, acetabular labral tears, axial back pain, Baastrup's disease, carpal tunnel syndrome, coccydynia, congenital muscular torticollis, symptomatic bipartite patella, and talocalcaneal coalition - demonstrate its broad utility in this population, though they do not cap-

Table 5. Recovery after CSI in the included studies.

Study	Measured Outcome	Injection Sample Size	Full Recovery	Partial Recovery	No Recovery	Worsened	Progressed to Surgery
Zhao et al.	Difference in neck rotation between healthy and affected side within 5 degrees, resolved contracture	191	60.2% (115/191)	N.R.	N.R.	N.R.	39.8% (76/191)
Peterson et al.	NPRS	2	Immediately after: 50% (1/2) Months later: 0%	Immediately after: 50% (1/2) Months later: 100% (2/2)	0	0	0%
Ali et al.	Pain relief & return to play	2	100%	0%	0%	0%	0%
Finsen et al.		27					44% (12/27)
	Pain resolution in the school classroom for those who only underwent injection		30% (3/10)	40% (1/10 much better, 3/10 somewhat better)	30% (3/10)	0%	
	Pain resolution in school physical exercise for those who only underwent injection		40% (4/10)	30% (2/10 much better, 1/10 somewhat better)	30% (3/10)	10% (1/10)	
	Pain resolution in general sports for those who only underwent injection		55% (6/11)	18% (1/11 much better, 1/11 somewhat better)	27% (3/11)	0%	
Akhnikh et al.	Resolution of pain	3	100%	0%	0%	0%	0%
Kifer et al.	Resolution of symptoms	38	63% (24/38) w/ 1 injection 16% (6/38) w/ 2 injections 8% (3/38) w/ >=3 injections	N.R.	N.R.	N.R.	13% (5/38)
Siawash et al.	VRS of satisfaction & pain intentsity	12 (9 received lidocaine & methylprednisolone injection)	22% (2/9)	N.R.	N.R.	N.R.	78% (7/9)
Batdorf et al.	Resolution of symptoms	Injections in 11/31 wrists	46% (5/11)	46% (5/11)	9% (1/11)	0%	32% (10/31)
Murtha et al.	Minimal clinically significant difference in the mHHS & NAHS	17 hips (recovery measured in the 10 hips that did not	80% (8/10)	20% (2/10)	N.R.	N.R.	41% (7/17) of injected

Study	Measured Outcome	Injection Sample Size	Full Recovery	Partial Recovery	No Recovery	Worsened	Progressed to Surgery
		progress to surgery)					hips
Nakase et al.	VISA Score	14 patients (15 knees)	60% (9/15)	26.7% (4/15)	6.7% (1/15)	6.7% (1/15)	2 patients, 3 knees (20%)
Zide et al.	Pain relief	25 patients (34 feet)	18% (6/34)	77% [53% (18/34) with moderate pain relief, 24% (8/34) with minimal pain relief]	6% (2/34)	N.R.	35% (12/34)

N.R.: Not reported
NPRS: Numeric pain rating scale
VRS: Verbal rating scale
mHHS: Modified Harris hip score
NAHS: Nonarthritic hip score
VISA: Victorian Institute of Sport Assessment

Table 6. Need for repeat injections after CSI in the included studies.

Study	# Who Needed Repeat Injections	# of CSIs Needed	Time between Injections
Zhao et al.	N.R.	N.R.	2-3 months
Peterson et al.	100% (2/2)	2	1-3 months
Ali et al.	50% (1/2)	4	1-2 years
Finsen et al.	22.2% (6/27)	2 (4 patients) 3 (2 patients)	N.R.
Akhnikh et al.	0% (0/3)	0	-
Kifer et al.	31.6% (12/38)	2 (6 patients) >=3 (6 patients)	at least 1 month
Siawash et al.	N.R.	1-3	2 weeks
Batdorf et al.	N.R.	N.R.	-
Murtha et al.	N.R.	N.R.	-
Nakase et al.	60% (9/15)	2 (6 knees) 4 (3 knees)	2-4 weeks apart
Zide et al.	26.5% (9/34)	2 (8 feet) 3 (1 foot)	1-52 months

N.R.: Not reported

ture the broad spectrum of indications treated with a CSI in pediatric OSM clinical practice. Numerous real-world pediatric OSM indications were not identified in this systematic review. This may be due to a lack of prior studies on this topic and due to our strict study inclusion criteria, which excluded all studies involving patients over 18 years of age.

Adverse outcome data was reported for 9/11 studies, with no adverse outcomes reported. Of the studies that reported adverse outcome data, the follow-up period ranged from 4 months to 64.4 months. The short follow-up time frame of most studies may not allow for development of the potential long-term side effects pertinent to the pediatric population. Beyond the commonly reported risks of CSI in the adult OSM population, skeletal immaturity and ongoing development of pediatric patients may make them uniquely susceptible to short- and long-term risks, including growth plate disruption, compromised tendon health, altered joint integrity, and potential effects on normal musculoskeletal growth. Thus, rigorous patient selection and the establishment of evidence-based treatment protocols are critical for this vulnerable population.

Evaluation of adverse outcomes was also limited by the heterogeneity of injection type. Most studies utilized soft tissue injections and only two studies utilized intra-articular injections. The included studies used various combinations of corticosteroids and anesthetics, each having varied biologic effects, which may also differ by the anatomic structure exposed. Local anesthetics have been shown to increase chondrocyte cell death, apoptosis, and necrosis with ropivacaine being the least chondrotoxic and bupivacaine being the most chondrotoxic. These chondrotoxic effects worsened when anesthetic was combined with betamethasone.[35] Bupivacaine has been shown to increase necrosis of fibroblasts and tenocytes, while ropivacaine and triamcinolone did not demonstrate this effect.[36] There has been mixed evidence regarding the biologic effects of corticosteroids on cartilage with some studies showing increase in cartilage loss following intra-articular CSI and others showing no significant difference in cartilage volume change.[12,37] There is a paucity of research investigating the biologic effects of CSI in the pediatric population, although studies have not shown evidence of toxic effects on cartilage based on magnetic resonance imaging.[16] This large variation in biologic effect based on injectate and involved anatomic structures suggests a wide range of possible secondary effects, although the clinical significance of these is chiefly unknown in pediatric patients.

Efficacy data were reported using a variety of outcome measures (e.g. symptom resolution, pain rating scale, or mHHS/NAHS). The heterogeneity of these measures precluded quantitative meta-analysis; therefore, these results were described qualitatively. Reported efficacy ranged from no response to resolution of symptoms. Progression to surgery after CSI ranged from 0% to 78%, and repeat CSI due to symptom recurrence or persistence was reported in 54.5% of studies. Like findings in adult orthopedics and pediatric rheumatologic literature, CSI may be effective for various OSM conditions in pediatric patients when used as part of a comprehensive treatment approach. Because image-guided, particularly US-guided, CSI has demonstrated greater accuracy and efficacy than landmark-guided injections, future pediatric studies should prioritize the use and reporting of image guidance. Consistent reporting of validated, condition-specific outcome measures will be essential to determine and compare treatment efficacy in this population. However, further research is needed to define the efficacy of CSI across the full spectrum of pediatric OSM indications.

This systematic review was limited by the small number of included studies and heterogeneity of the data reported. The methodological quality of the included studies was rated good for four studies, fair for one study and poor for six studies. This indicates that the included studies have study design limitations, a high risk of bias, and variable

methodologies, which reduces the strength of their findings and highlights the need for higher-quality research. Moreover, a meta-analysis was not performed because the reported efficacy data were heterogeneous, which further limits the strength of this study's conclusions.

CONCLUSION

CSI are used in pediatric OSM despite limited high-quality evidence guiding their use. Existing studies suggest potential clinical benefit with no reported adverse events; however, the literature is heterogeneous and does not fully reflect the range of indications encountered in practice. Important questions remain regarding the short- and long-term efficacy of CSI in reducing pain, improving function, and facilitating return to play, as well as how CSI compares with or complements treatments such as physical therapy or surgery. Further high-quality studies across a broader range of pediatric OSM indications, with standardized outcome measures and longer follow-up, are needed to better define the safety, appropriate indications, and overall efficacy of CSI in this population.

AUTHOR CONTRIBUTIONS

All authors contributed to data curation, investigation, methodology, writing – original draft, and writing – review & editing. All authors reviewed and approved the final manuscript.

AUTHOR DISCLOSURE

This systematic review does not contain a discussion of an unapproved or investigative use of a commercial product/device. The authors declare no conflicts of interest and do not have any financial disclosures. No funding was received.

Submitted: September 01, 2026 EST. Accepted: November 07, 2026 EST. Published: November 22, 2026 EST.

REFERENCES

1. Richard MJ, Driban JB, McAlindon TE. Pharmaceutical treatment of osteoarthritis. *Osteoarthritis Cartilage*. 2023;31(4):458-466. doi:10.1016/j.joca.2022.11.005

2. Ashworth NL, Bland JDP, Chapman KM, et al. Local corticosteroid injection versus placebo for carpal tunnel syndrome. *Cochrane Database Syst Rev*. 2023;2(2):CD015148. doi:10.1002/14651858.CD015148. PMID:36722795

3. Hirsch G, Kitas G, Klocke R. Intra-articular corticosteroid injection in osteoarthritis of the knee and hip: factors predicting pain relief—a systematic review. *Semin Arthritis Rheum*. 2013;42(5):451-473. doi:10.1016/j.semarthrit.2012.08.005

4. Carney J, Ungerleider S, Tanenbaum J, et al. The efficacy of intra-articular corticosteroid injections for elbow arthritis: a retrospective cohort study. *Int Orthop*. 2025;49:1127-1132. doi:10.1007/s00264-025-06449-9

5. Deng X, Li Y, Li D. Ultrasound-guided versus blind arthrocentesis in knee osteoarthritis: A systematic review and meta-analysis. *Medicine (Baltimore)*. 2025;104(5):e41389. doi:10.1097/MD.0000000000041389. PMID:39889185

6. Johannsen F, Olesen JL, Øhlenschläger TF, et al. Effect of ultrasonography-guided corticosteroid injection vs placebo added to exercise therapy for achilles tendinopathy. *JAMA Netw Open*. 2022;5(7):e2219661. doi:10.1001/jamanetworkopen.2022.19661. PMID:35816306

7. Finnoff JT, Hall MM, Adams E, et al. American Medical Society for Sports Medicine position statement: interventional musculoskeletal ultrasound in sports medicine. *Clin J Sport Med*. 2015;25(1):6-22. doi:10.1097/JSM.0000000000000175

8. Benzon HT, Provenzano DA, Nagpal A, et al. Use and safety of corticosteroid injections in joints and musculoskeletal soft tissue: guidelines from the American Society of Regional Anesthesia and Pain Medicine, the American Academy of Pain Medicine, the American Society of Interventional Pain Physicians, and the International Pain and Spine Intervention Society. *Reg Anesth Pain Med*. 2026;51(7):746-773. doi:10.1136/rapm-2024-105656

9. Li S, Zhang W, Lin Y. Application of intra-articular corticosteroid injection in juvenile idiopathic arthritis. *Front Pediatr*. 2022;10:822009. doi:10.3389/fped.2022.822009. PMID:35425732

10. Gotte AC. Intra-articular corticosteroids in the treatment of juvenile idiopathic arthritis: Safety, efficacy, and features affecting outcome. A comprehensive review of the literature. *Open Access Rheumatol*. 2009;1:37-49. doi:10.2147/OARRR.S5103. PMID:27789980

11. Kamel SI, Rosas HG, Gorbachova T. Local and systemic side effects of corticosteroid injections for musculoskeletal indications. *AJR Am J Roentgenol*. 2024;222(3):e2330458. doi:10.2214/AJR.23.30458

12. McAlindon TE, LaValley MP, Harvey WF, et al. Effect of intra-articular triamcinolone vs saline on knee cartilage volume and pain in patients with knee osteoarthritis: a randomized clinical trial. *JAMA*. 2017;317(19):1967-1975. doi:10.1001/jama.2017.5283. PMID:28510679

13. Latourte A, Rat AC, Omorou A, et al. Do glucocorticoid injections increase the risk of knee osteoarthritis progression over 5 years? *Arthritis Rheumatol*. 2022;74(8):1343-1351. doi:10.1002/art.42118

14. Hashkes PJ, Laxer RM. Medical treatment of juvenile idiopathic arthritis. *JAMA*. 2005;294(13):1671-1684. doi:10.1001/jama.294.13.1671

15. Sherry DD, Stein LD, Reed AM, et al. Prevention of leg length discrepancy in young children with pauciarticular juvenile rheumatoid arthritis by treatment with intraarticular steroids. *Arthritis Rheum*. 1999;42(11):2330-2334. doi:10.1002/1529-0131(199911)42:11<2330::AID-ANR11>3.0.CO;2-B

16. Huppertz HI, Tschammler A, Horwitz AE, et al. Intraarticular corticosteroids for chronic arthritis in children: efficacy and effects on cartilage and growth. *J Pediatr*. 1995;127(2):317-321. doi:10.1016/S0022-3476(95)70320-9

17. Neidel J, Boehnke M, Kuster RM. The efficacy and safety of intraarticular corticosteroid therapy for coxitis in juvenile rheumatoid arthritis. *Arthritis Rheum*. 2002;46(6):1620-1628. doi:10.1002/art.10313

18. Hagelberg S, Magnusson B, Jenner G, et al. Do frequent corticosteroid injections in the knee cause cartilage damage in juvenile chronic arthritis? long-term follow-up with MRI. *J Rheumatol*. 2000;27(suppl 58):95.

19. Ardern CL, Büttner F, Andrade R, et al. Implementing the 27 PRISMA 2020 Statement items for systematic reviews in the sport and exercise medicine, musculoskeletal rehabilitation and sports science fields: the PERSiST (implementing Prisma in Exercise, Rehabilitation, Sport medicine and SporTs science) guidance. *Br J Sports Med*. 2022;56(4):175-195. doi:10.1136/bjsports-2021-103987. PMID:34625401

20. Wells GA, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses. Ottawa Hospital Research Institute. Accessed November 16, 2025. http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp

21. National Heart, Lung, and Blood Institute. Quality assessment tool for case series studies. National Institutes of Health. 2013. Accessed November 16, 2025. https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools

22. Akhnikh S, De Korte N, De Winter P. Anterior cutaneous nerve entrapment syndrome (ACNES): the forgotten diagnosis. *Eur J Pediatr*. 2014;173:445-449. doi:10.1007/s00431-013-2140-2

23. Ali AA, Jacobs BM, Gandhi A, et al. Baastrup's disease in pediatric gymnasts. *Children (Basel)*. 2022;9(7):1018. doi:10.3390/children9071018. PMID:35884004

24. Batdorf NJ, Cantwell SR, Moran SL. Idiopathic carpal tunnel syndrome in children and adolescents. *J Hand Surg Am*. 2015;40(4):773-777. doi:10.1016/j.jhsa.2015.01.026

25. Finsen V, Kalstad A, Knobloch RG. The effect of injection therapy and operation of coccydynia on the schooling and physical activity of adolescent patients. *Orthop Rev (Pavia)*. 2020;12(3):8619. doi:10.4081/or.2020.8619. PMID:33312487

26. Kifer T, Mišak Z, Jadrešin O, et al. Anterior cutaneous nerve entrapment syndrome in children: a prospective observational study. *Clin J Pain*. 2018;34(7):670-673. doi:10.1097/AJP.0000000000000573

27. Murtha AS, Bomar JD, Johnson KP, et al. Acetabular labral tears in the adolescent athlete: results of a graduated management protocol from therapy to arthroscopy. *J Pediatr Orthop B*. 2021;30(6):549-555. doi:10.1097/BPB.0000000000000793

28. Nakase J, Oshima T, Takata Y, et al. Ultrasound-guided injection and the pie crust technique for the treatment of symptomatic bipartite patella. *J Med Ultrason (2001)*. 2019;46(4):497-502. doi:10.1007/s10396-019-00960-4

29. Peterson E, Finkel J. Trigger point injections for axial back pain in adolescents. *BMJ Case Rep*. 2021;14(6):e242727. doi:10.1136/bcr-2021-242727. PMID:34167984

30. Siawash M, de Jager-Kievit JW, Ten WT, et al. Prevalence of anterior cutaneous nerve entrapment syndrome in a pediatric population with chronic abdominal pain. *J Pediatr Gastroenterol Nutr*. 2016;62(3):399-402. doi:10.1097/MPG.0000000000000966

31. Zhao Z, Deng H, Li Y, et al. Experience with the management of 2599 cases of congenital muscular torticollis and a multicenter epidemiological investigation in 17 hospitals in China. *BMC Musculoskelet Disord*. 2023;24(1):901. doi:10.1186/s12891-023-06983-w. PMID:37980469

32. Zide JR, Shivers C, Adair C, et al. The efficacy of intra-articular subtalar steroid injection for symptomatic talocalcaneal coalitions: a 30-year single institution experience. *J Pediatr Orthop*. 2022;42(5):e453-e458. doi:10.1097/BPO.0000000000002132

33. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71. PMID:33782057

34. Hernandez-Sanchez S, Hidalgo MD, Gomez A. Responsiveness of the VISA-P scale for patellar tendinopathy in athletes. *Br J Sports Med*. 2014;48(6):453-457. doi:10.1136/bjsports-2012-091163

35. Jayaram P, Kennedy DJ, Yeh P, et al. Chondrotoxic effects of local anesthetics on human knee articular cartilage: a systematic review. *PM R*. 2019;11(4):379-400. doi:10.1002/pmrj.12007

36. Zhang AZ, Ficklscherer A, Gülecyüz MF, et al. Cell toxicity in fibroblasts, tenocytes, and human mesenchymal stem cells-a comparison of necrosis and apoptosis-inducing ability in ropivacaine, bupivacaine, and triamcinolone. *Arthroscopy*. 2017;33(4):840-848. doi:10.1016/j.arthro.2016.10.026

37. Pelletier JP, Raynauld JP, Abram F, et al. Intra-articular corticosteroid knee injection induces a reduction in meniscal thickness with no treatment effect on cartilage volume: a case-control study. *Sci Rep*. 2020;10(1):13789. doi:10.1038/s41598-020-70064-4. PMID:32796866

APPENDIX

Full Search Strategies:

Embase

Date Searched: 3/14/2025

Applied Database Supplied Limits: [2005-2025]/py AND [humans]/lim AND [english]/lim

Number of Results: 2,281

Full Search Strategy:

('skeletal immaturity'/exp OR 'pediatric orthopedics'/exp OR 'pediatrics'/exp OR 'child'/exp OR 'preschool child'/exp OR 'adolescent'/exp OR ((Skeletal* OR bone) NEAR/3 (immature* OR 'under develop*' OR underdevelop* OR growth OR 'still grow*' OR age* OR discordance* OR defficienc* OR delay OR 'developmental anomal*' OR 'developmental arrest' OR 'developmental impairment*' OR 'developmental lag' OR 'maturation deficit*')):ti,ab,kw OR ('chronological growth discrepanc*" OR 'growth plate immaturity' OR 'incomplete skeletal evolution' OR 'retarded bone maturation'):ti,ab,kw OR (child* OR toddler* OR adolescent* OR teen* OR youth* OR adolescence OR girl* OR boy* OR juvenile* OR pediatric* OR paediatric* OR pediatry OR schoolboy OR schoolboys OR schoolchild OR schoolchildren OR schoolgirl OR schoolgirls):ti,ab,kw) **AND** ('corticosteroid'/exp OR 'betamethasone dipropionate'/exp OR 'clobetasol propionate'/exp OR 'dexamethasone sodium phosphate'/exp OR 'fluocinolone acetonide'/exp OR 'glucocorticoid'/exp OR 'hydrocortisone acetate'/exp OR 'methylprednisolone acetate'/exp OR 'prednisolone acetate'/exp OR 'triamcinolone acetonide'/exp OR ('Betamethasone Dipropionate' OR alphatrex OR becloson OR beloderm OR bepronate OR beprosone OR betacrem OR betamesol OR betazone OR cleniderm OR cortiderm OR cremirit OR cycloson OR dicortin OR diprocel OR diproderm OR diprolene OR diprophos OR diprosis OR diprosone OR diprotop OR flogoderm OR helpoderm OR maxisona OR maxivate OR mesonta OR metonate OR oviskin OR proson OR sernivo OR skizon OR soluderme OR 'taro-sone' OR topilene OR topisone OR 'Clobetasol Propionate' OR betasol OR betavate OR butavate OR clarelux OR clobaderm OR clobasol OR clobasone OR clobavate OR clobecare OR clobederm OR clobegalen OR clobenate OR clobesol OR clobeson OR clobet OR clobetan OR clobetaxon OR clobetazol OR clobevate OR clobex OR clobisdin OR clodan OR clonovate OR closanasol OR closol OR clovate OR cormax OR cortimax OR crinale OR crobate OR decloban OR delor OR dermasone OR dermatovate OR dermo OR dermol OR dermosol OR dermotyl OR dermoval OR dermovat OR dermovate OR dermoxinale OR dhabesol OR eczoria OR embeline OR etrivex OR forderm OR glevate OR impeklo OR impoyz OR 'karison crème' OR 'karison crinale' OR 'karison salbe' OR kloderma OR klonat OR lobate OR lobesol OR lobevat OR lotasbat OR medodermone OR novate OR pentasol OR primolux OR rivelin OR rizlasol OR rubocord OR rubocort OR stivate OR tasoprol OR temovate OR tenovate OR topifort OR tovet OR univate OR xenovate OR yihfu OR yugofin OR Corticosteroid* OR 'adrenal cortex hormone*' OR 'adrenal cortical hormone*' OR 'adrenal cortical steroid*' OR 'adrenal steroid*' OR 'adreno cortical steroid*' OR 'adreno corticosteroid' OR adrenocortical OR adrenocorticosteroid OR 'cortical steroid' OR 'cortico steroid' OR corticoid OR dermocorticosteroid OR 'Dexamethasone Sodium Phosphate' OR aacidexam OR colvasone OR dexadreson OR dexafree OR dexair OR 'dexamethasone 21 disodiumphosphate' OR 'dexamethasone 21 phosphate' OR 'dexamethasone disodium phosphate' OR 'dexamethasone phosphate' OR dexavet OR diodex OR etacortilen OR 'hexadrol phosphate' OR 'maxidex ointment' OR 'neodecadron ophthalmic' OR ophthasona OR semdexa OR soldesam OR 'solu decadron' OR soludecadrol OR soludecadron OR spersadex OR sterodex OR totocortin OR turbinaire OR wymesone OR 'Fluocinolone Acetonide' OR adermina OR alfabios OR 'alvadermo fuerte' OR aplosyn OR capex OR cervicum OR cinolon OR clofeet OR cortilona OR cremisona OR cynozet OR dermalar OR dermoflam OR dermoran OR dermotic OR esacinone OR flozet OR fluciderm OR flucinar OR flulone OR fluocet OR fluocid OR 'fluocinolon acetonid' OR 'fluocinonide acetonide' OR fluoderm OR fluolar OR fluonid OR fluonide OR fluotrex OR fluovitef OR fluquinol OR flurosyn OR flusonlen OR fluzon OR fusalar OR gelargin OR gelidina OR iluvien OR inoderm OR jellin OR lluvien OR localyn OR luci OR medidur OR 'nasal synalar' OR neosynalar OR otazem OR otoflamm OR otoken OR psoranide OR radiocin OR retisert OR sinaflana OR supralan OR synalar OR synandone OR synemol OR synotic OR syntopic OR trisyn OR yutiq OR Glucocorticoid* OR Glucocorticoidsteroid* OR Glucocorticosteroid* OR Glucocortoid* OR Glycocorticoid* OR Hydrocortisone Acetate OR 'anusol hc' OR 'anusol-hc' OR 'aphilan dermangeaisons' OR apocort OR barseb OR berlison OR biocort OR calacort OR caldecort OR 'clear aid' OR colifoam OR cortaid OR cortamed OR 'cortef acetate' OR 'cortic cream' OR 'cortic-ds' OR cortifoam OR 'cortisol acetate' OR dermacort OR dhacort OR dilucort OR dricort OR ekzemsalbe OR enkacort OR 'fenistil hydrocortison' OR ficortil OR glycortison OR 'hemsol-hc' OR hipoge OR 'hycor acetate' OR 'hycor eye ointment' OR hyderm OR hydrocortal OR 'hydrocortison berco' OR 'hydrocortison dispersa' OR 'hydrocortison streuli' OR hydrocortistab OR 'hydrocortone acetate' OR hydrocutan OR hydrosone OR lanacort OR litraderm OR 'micort-hc' OR mylocort OR pabracort OR pannocort OR 'servicort topical' OR sigmacort OR 'siquent hycor' OR steroderm OR stopitch OR wellcortin OR wycort OR 'Methylprednisolone Acetate' OR 'depmedalone 40' OR 'depmedalone 80' OR 'depo medrate' OR 'depo medrol' OR 'depo medrone' OR 'depo-medrate' OR 'depo-medrol' OR 'depo-medrone' OR 'depo-moderin' OR 'depo-nisolone' OR depomedrol OR depomedron OR depomedrone OR 'depot medrate' OR 'epizolone-depot' OR 'medrol acetate' OR 'medrol enpak' OR mepred OR 'urbason retard' OR 'veriderm medrol' OR 'Prednisolone Acetate' OR deppredalone OR econopred OR 'flo pred' OR 'flo-pred' OR 'isopto cetapred' OR 'key pred' OR 'meticortelone acetate' OR 'ocupred' OR omnipred OR optilon OR 'poly pred' OR 'pred forte' OR 'pred mild' OR predforte OR predmet OR 'predniophtal' OR prednigalen OR savacort OR ultracortensol OR ultracortinol OR 'triamcinolone acetonide' OR aftab OR af-

tach OR ahbina OR albicort OR 'allegra nasal' OR allernase OR allernaze OR aquatain OR aristocort OR aristoderm OR aristogel OR azmacort OR centocort OR cinolar OR 'delphi crème' OR 'denkacort forte' OR facort OR flutex OR flutone OR fougera OR ftorocort OR gemicort OR generlog OR kemzid OR 'kena log' OR kenac OR 'kenacort a' OR kenalog OR kenalone OR kenlog OR 'kortikoid ratiopharm' OR manolone OR maqaid OR metoral OR nasacort OR nasatrim OR 'nasocor aq' OR nincort OR oracort OR oralog OR oralone OR oramedy OR orrepaste OR panalog OR pokkortolon OR 'polcortolon n' OR respicort OR rhinisan OR shincort OR solodelf OR taioftal OR 'telfast spray nasal' OR tibicorten OR tibiocorten OR tramacin OR 'tri anemul' OR 'tri-nasal' OR triacet OR triacort OR triaderm OR triam OR 'triam-denk' OR triamalone OR 'triamcinolide acetonide' OR 'triamcinolon acetonide' OR triamcinolonacetonid OR triamcinolonacetonide OR 'triamcinolone acetamide' OR 'triamcinolone acetonamide' OR 'triamcinolone acetonid' OR 'triamcinolone benetonide' OR triamcinolone OR triamhexal OR triamvirgi OR trianex OR trianide OR triatex OR tricort OR tricortone OR tricot OR triderm OR tridez OR triesence OR trigon OR trikort OR trinolone OR trivaris OR trymex OR vetalog OR vistrec OR volonimat OR wp0508st OR xipere OR zilretta OR zuprata):ti,ab,kw) **AND** ('injection'/exp OR 'intraarticular drug administration'/exp OR (injection* OR shot OR intraarticular OR 'Intra-articular' OR IACIs):ti,ab,kw) NOT ('chapter'/it OR 'conference abstract'/it OR 'conference paper'/it OR 'conference review'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it OR 'review'/it OR 'short survey'/it OR abstract:ti OR editorial:ti OR letter:ti OR editor:ti OR review:ti)

Ovid Medline

Date Searched: 3/14/2025

Applied Database Supplied Limits: limit to (english language and humans and yr="2005 - 2025")

Number of Results: 1,668

Full Search Strategy:

((Exp Child/ OR exp Pediatrics/ OR exp Child, Preschool/ OR exp Adolescent/ OR ((Skeletal* OR bone) ADJ3 (immature* OR under develop* OR underdevelop* OR growth OR still grow* OR age* OR discordance* OR defficienc* OR delay OR developmental anomal* OR developmental arrest OR developmental impairment* OR developmental lag OR maturation deficit*)).ti,ab,kf. OR (chronological growth discrepanc* OR growth plate immaturity OR incomplete skeletal evolution OR retarded bone maturation).ti,ab,kf. OR (child* OR toddler* OR adolescent* OR teen* OR youth* OR adolescence OR girl* OR boy* OR juvenile* OR pediatric* OR paediatric* OR pediatry OR schoolboy OR schoolboys OR schoolchild OR schoolchildren OR schoolgirl OR schoolgirls).ti,ab,kf.) AND (exp Adrenal Cortex Hormones/ OR exp Betamethasone/ OR exp Clobetasol/ OR exp Dexamethasone/ OR exp Fluocinolone Acetonide/ OR exp Glucocorticoids/ OR exp Hydrocortisone/ OR exp Methylprednisolone Acetate/ OR exp Prednisolone/ OR exp Triamcinolone Acetonide/ OR (Betamethasone Dipropionate OR alphatrex OR becloson OR beloderm OR bepronate OR beprosone OR betacrem OR betamesol OR betazone OR cleniderm OR cortiderm OR cremirit OR cycloson OR dicortin OR diprocel OR diproderm OR diprolene OR diprophos OR diprosis OR diprosone OR diprotop OR flogoderm OR helpoderm OR maxisona OR maxivate OR mesonta OR metonate OR oviskin OR proson OR sernivo OR skizon OR soluderme OR taro-sone OR topilene OR topisone OR Clobetasol Propionate OR betasol OR betavate OR butavate OR clarelux OR clobaderm OR clobasol OR clobasone OR clobavate OR clobecare OR clobederm OR clobegalen OR clobenate OR clobesol OR clobeson OR clobet OR clobetan OR clobetaxon OR clobetazol OR clobevate OR clobex OR clobisdin OR clodan OR clonovate OR closanasol OR closol OR clovate OR cormax OR cortimax OR crinale OR crobate OR decloban OR delor OR dermasone OR dermatovate OR dermo OR dermol OR dermosol OR dermotyl OR dermoval OR dermovat OR dermovate OR dermoxinale OR dhabesol OR eczoria OR embeline OR etrivex OR forderm OR glevate OR impeklo OR impoyz OR karison creme OR karison crinale OR karison salbe OR kloderma OR klonat OR lobate OR lobesol OR lobevat OR lotasbat OR medodermone OR novate OR pentasol OR primolux OR rivelin OR rizlasol OR rubocord OR rubocort OR stivate OR tasoprol OR temovate OR tenovate OR topifort OR tovet OR univate OR xenovate OR yihfu OR yugofin OR Corticosteroid* OR adrenal cortex hormone* OR adrenal cortical hormone* OR adrenal cortical steroid* OR adrenal steroid* OR adreno cortical steroid* OR adreno corticosteroid OR adrenocortical OR adrenocorticosteroid OR cortical steroid OR cortico steroid OR corticoid OR dermocorticosteroid OR Dexamethasone Sodium Phosphate OR aacidexam OR colvasone OR dexadreson OR dexafree OR dexair OR dexamethasone 21 disodiumphosphate OR dexamethasone 21 phosphate OR dexamethasone disodium phosphate OR dexamethasone phosphate OR dexavet OR diodex OR etacortilen OR hexadrol phosphate OR maxidex ointment OR neodecadron ophthalmic OR ophthasona OR semdexa OR soldesam OR solu decadron OR soludecadrol OR soludecadron OR spersadex OR sterodex OR totocortin OR turbinaire OR wymesone OR Fluocinolone Acetonide OR adermina OR alfabios OR alvadermo fuerte OR aplosyn OR capex OR cervicum OR cinolon OR clofeet OR cortilona OR cremisona OR cynozet OR dermalar OR dermoflam OR dermoran OR dermotic OR esacinone OR flozet OR fluciderm OR flucinar OR flulone OR fluocet OR fluocid OR fluocinolon acetonid OR fluocinonide acetonide OR fluoderm OR fluolar OR fluonid OR fluonide OR fluotrex OR fluovitef OR fluquinol OR flurosyn OR flusonlen OR fluzon OR fusalar OR gelargin OR gelidina OR iluvien OR inoderm OR jellin OR lluvien OR localyn OR luci OR medidur OR nasal synalar OR neosynalar OR otazem OR otoflamm OR otoken OR psoranide OR radiocin OR retisert OR sinaflana OR supralan OR synalar OR synandone OR synemol OR synotic OR syntopic OR trisyn OR yutiq OR Glucocorticoid* OR Glucocorticoidsteroid* OR Glucocorticosteroid* OR Glucocortoid* OR Glycocorticoid* OR Hydrocortisone Acetate OR anusol hc OR anusol-hc OR aphilan dermangeaisons OR apocort OR barseb OR berlison OR biocort OR calacort OR caldecort OR clear aid OR colifoam OR cortaid OR cortamed OR cortef acetate OR cortic cream OR cortic-ds OR cortifoam OR cortisol acetate OR dermacort OR dhacort OR dilucort OR dricort OR ekzem-

salbe OR enkacort OR fenistil hydrocortison OR ficortil OR glycortison OR hemsol-hc OR hipoge OR hy-cor acetate OR hycor eye ointment OR hyderm OR hydrocortal OR hydrocortison berco OR hydrocortison dispersa OR hydrocortison streuli OR hydrocortistab OR hydrocortone acetate OR hydrocutan OR hydrosone OR lanacort OR litraderm OR micort-hc OR mylocort OR pabracort OR pannocort OR servicort topical OR sigmacort OR siquent hycor OR sterodern OR stopitch OR wellcortin OR wycort OR Methylprednisolone Acetate OR depmedalone 40 OR depmedalone 80 OR depo medrate OR depo medrol OR depo medrone OR depo-medrate OR depo-medrol OR depo-medrone OR depo-moderin OR depo-nisolone OR depomedrol OR depomedron OR depomedrone OR depot medrate OR epizolone-depot OR medrol acetate OR medrol enpak OR mepred OR urbason retard OR veriderm medrol OR Prednisolone Acetate OR deppredalone OR econopred OR flo pred OR flo-pred OR isopto cetapred OR key pred OR meticortelone acetate OR ocu-pred OR omnipred OR optilon OR poly pred OR pred forte OR pred mild OR predforte OR predmet OR predni-ophtal OR prednigalen OR savacort OR ultracortensol OR ultracortinol OR triamcinolone acetonide OR aftab OR aftach OR ahbina OR albicort OR allegra nasal OR allernase OR allernaze OR aquatain OR aristocort OR aristoderm OR aristogel OR azmacort OR centocort OR cinolar OR delphi creme OR denkacort forte OR facort OR flutex OR flutone OR fougera OR ftorocort OR gemicort OR generlog OR kemzid OR kena log OR kenac OR kenacort a OR kenalog OR kenalone OR kenlog OR kortikoid ratiopharm OR manolone OR maqaid OR metoral OR nasacort OR nasatrim OR nasocor aq OR nincort OR oracort OR oralog OR oralone OR oramedy OR orrepaste OR panalog OR pokkortolon OR polcortolon n OR respicort OR rhinisan OR shincort OR solodelf OR taioftal OR telfast spray nasal OR tibicorten OR tibiocorten OR tramacin OR tri anemul OR tri-nasal OR triacet OR triacort OR triaderm OR triam OR triam-denk OR triamalone OR triamcinolide acetonide OR triamcinolon acetonide OR triamcinolonacetonid OR triamcinolonacetonide OR triamcinolone acetamide OR triamcinolone acetonamide OR triamcinolone acetonid OR triamcinolone benetonide OR triamcinolone OR triamhexal OR triamvirgi OR trianex OR trianide OR triatex OR tricort OR tricortone OR tricot OR triderm OR tridez OR triesence OR trigon OR trikort OR trinolone OR trivaris OR trymex OR vetalog OR vistrec OR volonimat OR wp0508st OR xipere OR zilretta OR zuprata).ti,ab,kf.) AND (exp Injections/ OR exp Injections, Intra-Articular/ OR (injection* OR shot OR intraarticular OR Intra-articular OR IACIs).ti,ab,kf.)) NOT (clinical conference.pt. OR comment.pt. OR consensus development conference.pt. OR editorial.pt. OR letter.pt. OR meta analysis.pt. OR review.pt. OR systematic review.pt. OR abstract.ti. OR editorial.ti. OR letter.ti. OR editor.ti. OR review.ti.)

Scopus

Date Searched: 3/14/2025

Applied Database Supplied Limits: PUBYEAR > 2004 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE , “English”)) AND (LIMIT-TO (EXACTKEYWORD , “Human”))

Number of Results: 730

Full Search Strategy:

(((TITLE-ABS-KEY (injection* OR shot OR intraarticular OR “Intra-articular” OR iacis))) AND (((TITLE-ABS-KEY ((skeletal* OR bone) W/3 (immature* OR “under develop*” OR underdevelop* OR growth OR “still grow*” OR age* OR discordance* OR defficienc* OR delay OR “developmental anomal*” OR “developmental arrest” OR “developmental impairment*” OR “developmental lag” OR “maturation deficit*”))) OR (TITLE-ABS-KEY (“chronological growth discrepanc*” OR “growth plate immaturity” OR “incomplete skeletal evolution” OR “retarded bone maturation”)) OR (TITLE-ABS-KEY (child* OR toddler* OR adolescent* OR teen* OR youth* OR adolescence OR girl* OR boy* OR juvenile* OR pediatric* OR paediatric* OR pediatry OR schoolboy OR schoolboys OR schoolchild OR schoolchildren OR schoolgirl OR schoolgirls)))) AND ((TITLE-ABS-KEY (“Betamethasone Dipropionate” OR alphatrex OR becloson OR beloderm OR bepronate OR beprosone OR betacrem OR betamesol OR betazone OR cleniderm OR cortiderm OR cremirit OR cycloson OR dicortin OR diprocel OR diproderm OR diprolene OR diprophos OR diprosis OR diprosone OR diprotop OR flogoderm OR helpoderm OR maxisona OR maxivate OR mesonta OR metonate OR oviskin OR proson OR sernivo OR skizon OR soluderme OR “taro-sone” OR topilene OR topisone OR “Clobetasol Propionate” OR betasol OR betavate OR butavate OR clarelux OR clobaderm OR clobasol OR clobasone OR clobavate OR clobecare OR clobederm OR clobegalen OR clobenate OR clobesol OR clobeson OR clobet OR clobetan OR clobetaxon OR clobetazol OR clobevate OR clobex OR clobisdin OR clodan OR clonovate OR closanasol OR closol OR clovate OR cormax OR cortimax OR crinale OR crobate OR decloban OR delor OR dermasone OR dermatovate OR dermo OR dermol OR dermosol OR dermotyl OR dermoval OR dermovat OR dermovate OR dermoxinale OR dhabesol OR eczoria OR embeline OR etrivex OR forderm OR glevate OR impeklo OR impoyz OR “karison creme” OR “karison crinale” OR “karison salbe” OR kloderma OR klonat OR lobate OR lobesol OR lobevat OR lotasbat OR medodermone OR novate OR pentasol OR primolux OR rivelin OR rizlasol OR rubocord OR rubocort OR stivate OR tasoprol OR temovate OR tenovate OR topifort OR tovet OR univate OR xenovate OR yihfu OR yugofin OR corticosteroid* OR “adrenal cortex hormone*” OR “adrenal cortical hormone*” OR “adrenal cortical steroid*” OR “adrenal steroid*” OR “adreno cortical steroid*” OR “adreno corticosteroid” OR adrenocortical OR adrenocorticosteroid OR “cortical steroid” OR “cortico steroid” OR corticoid OR dermocorticosteroid OR “Dexamethasone Sodium Phosphate” OR aacidexam OR colvasone OR dexadreson OR dexafree OR dexair OR “dexamethasone 21 disodiumphosphate” OR “dexamethasone 21 phosphate” OR “dexamethasone disodium phosphate” OR “dexamethasone phosphate” OR dexavet OR diodex OR etacortilen OR “hexadrol phosphate” OR “maxidex ointment” OR “neodecadron ophthalmic” OR ophthasona OR semdexa OR soldesam OR “solu decadron” OR soludecadrol OR soludecadron OR spersadex OR sterodex OR totocortin OR turbinaire OR wymesone OR “Fluocinolone Acetonide” OR adermina OR alfabios OR “alvadermo fuerte” OR aplosyn

OR capex OR cervicum OR cinolon OR clofeet OR cortilona OR cremisona OR cynozet OR dermalar OR dermoflam OR dermoran OR dermotic OR esacinone OR flozet OR fluciderm OR flucinar OR flulone OR fluocet OR fluocid OR "fluocinolon acetonid" OR "fluocinonide acetonide" OR fluoderm OR fluolar OR fluonid OR fluonide OR fluotrex OR fluovitef OR fluquinol OR flurosyn OR flusonlen OR fluzon OR fusalar OR gelargin OR gelidina OR iluvien OR inoderm OR jellin OR lluvien OR localyn OR luci OR medidur OR "nasal synalar" OR neosynalar OR otazem OR otoflamm OR otoken OR psoranide OR radiocin OR retisert OR sinaflana OR supralan OR synalar OR synandone OR synemol OR synotic OR syntopic OR trisyn OR yutiq OR glucocorticoid* OR glucocorticoidsteroid* OR glucocorticosteroid* OR glucocortoid* OR glycocorticoid* OR hydrocortisone AND acetate OR "anusol hc" OR "anusol-hc" OR "aphilan dermangeaisons" OR apocort OR barseb OR berlison OR biocort OR calacort OR caldecort OR "clear aid" OR colifoam OR cortaid OR cortamed OR "cortef acetate" OR "cortic cream" OR "cortic-ds" OR cortifoam OR "cortisol acetate" OR dermacort OR dhacort OR dilucort OR dricort OR ekzemsalbe OR enkacort OR "fenistil hydrocortison" OR ficortil OR glycortison OR "hemsol-hc" OR hipoge OR "hy-cor acetate" OR "hycor eye ointment" OR hyderm OR hydrocortal OR "hydrocortison berco" OR "hydrocortison dispersa" OR "hydrocortison streuli" OR hydrocortistab OR "hydrocortone acetate" OR hydrocutan OR hydrosone OR lanacort OR litraderm OR "micort-hc" OR mylocort OR pabracort OR pannocort OR "servicort topical" OR sigmacort OR "siquent hycor" OR steroderm OR stopitch OR wellcortin OR wycort OR "Methylprednisolone Acetate" OR "depmedalone 40" OR "depmedalone 80" OR "depo medrate" OR "depo medrol" OR "depo medrone" OR "depo-medrate" OR "depo-medrol" OR "depo-medrone" OR "depo-moderin" OR "depo-nisolone" OR depomedrol OR depomedron OR depomedrone OR "depot medrate" OR "epizolone-depot" OR "medrol acetate" OR "medrol enpak" OR mepred OR "urbason retard" OR "veriderm medrol" OR "Prednisolone Acetate" OR deppredalone OR econopred OR "flo pred" OR "flo-pred" OR "isopto cetapred" OR "key pred" OR "meticortelone acetate" OR "ocu-pred" OR omnipred OR optilon OR "poly pred" OR "pred forte" OR "pred mild" OR predforte OR predmet OR "predni-ophtal" OR prednigalen OR savacort OR ultracortensol OR ultracortinol OR "triamcinolone acetonide" OR aftab OR aftach OR ahbina OR albicort OR "allegra nasal" OR allernase OR allernaze OR aquatain OR aristocort OR aristoderm OR aristogel OR azmacort OR centocort OR cinolar OR "delphi creme" OR "denkacort forte" OR facort OR flutex OR flutone OR fougera OR ftorocort OR gemicort OR generlog OR kemzid OR "kena log" OR kenac OR "kenacort a" OR kenalog OR kenalone OR kenlog OR "kortikoid ratiopharm" OR manolone OR maqaid OR metoral OR nasacort OR nasatrim OR "nasocor aq" OR nincort OR oracort OR oralog OR oralone OR oramedy OR orrepaste OR panalog OR pokkortolon OR "polcortolon n" OR respicort OR rhinisan OR shincort OR solodelf OR taioftal OR "telfast spray nasal" OR tibicorten OR tibiocorten OR tramacin OR "tri anemul" OR "tri-nasal" OR triacet OR triacort OR triaderm OR triam OR "triam-denk" OR triamalone OR "triamcinolide acetonide" OR "triamcinolon acetonide" OR triamcinolonacetonid OR triamcinolonacetonide OR "triamcinolone acetamide" OR "triamcinolone acetonamide" OR "triamcinolone acetonid" OR "triamcinolone benetonide" OR triamcinolone OR triamhexal OR triamvirgi OR trianex OR trianide OR triatex OR tricort OR tricortone OR tricot OR triderm OR tridez OR triesence OR trigon OR trikort OR trinolone OR trivaris OR trymex OR vetalog OR vistrec OR volonimat OR wp0508st OR xipere OR zilretta OR zuprata)))) AND NOT ((TITLE (abstract OR editorial OR letter OR editor OR review))) AND PUBYEAR > 2004 AND PUBYEAR < 2026 AND (EXCLUDE (DOCTYPE , "re") OR EXCLUDE (DOCTYPE , "le") OR EXCLUDE (DOCTYPE , "cp") OR EXCLUDE (DOCTYPE , "no") OR EXCLUDE (DOCTYPE , "sh") OR EXCLUDE (DOCTYPE , "ed")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Human"))

The Cochrane Library

Date Searched: 3/14/2025

Applied Database Supplied Limits: with Publication Year from 2005 to 2025, in Trials

Number of Results

CENTRAL: 930

Full Search Strategy:

([mh "Child"] OR [mh "Pediatrics"] OR [mh "Child, Preschool"] OR [mh "Adolescent"] OR ((Skeletal* OR bone) NEAR/3 (immature* OR "under develop*" OR underdevelop* OR growth OR "still grow*" OR age* OR discordance* OR defficienc* OR delay OR "developmental anomal*" OR "developmental arrest" OR "developmental impairment*" OR "developmental lag" OR "maturation deficit*")):ti,ab,kw OR ("chronological growth discrepanc*" OR "growth plate immaturity" OR "incomplete skeletal evolution" OR "retarded bone maturation"):ti,ab,kw OR (child* OR toddler* OR adolescent* OR teen* OR youth* OR adolescence OR girl* OR boy* OR juvenile* OR pediatric* OR paediatric* OR pediatry OR schoolboy OR schoolboys OR schoolchild OR schoolchildren OR schoolgirl OR schoolgirls):ti,ab,kw) AND ([mh "Adrenal Cortex Hormones"] OR [mh "Betamethasone"] OR [mh "Clobetasol"] OR [mh "Dexamethasone"] OR [mh "Fluocinolone Acetonide"] OR [mh "Glucocorticoids"] OR [mh "Hydrocortisone"] OR [mh "Methylprednisolone Acetate"] OR [mh "Prednisolone"] OR [mh "Triamcinolone Acetonide"] OR ("Betamethasone Dipropionate" OR alphatrex OR becloson OR beloderm OR bepronate OR beprosone OR betacrem OR betamesol OR betazone OR cleniderm OR cortiderm OR cremirit OR cycloson OR dicortin OR diprocel OR diproderm OR diprolene OR diprophos OR diprosis OR diprosone OR diprotop OR flogoderm OR helpoderm OR maxisona OR maxivate OR mesonta OR metonate OR oviskin OR proson OR sernivo OR skizon OR soluderme OR "taro sone" OR topilene OR topisone OR "Clobetasol Propionate" OR betasol OR betavate OR butavate OR clarelux OR clobaderm OR clobasol OR clobasone OR clobavate OR clobecare OR clobederm OR clobegalen OR clobenate OR clobesol OR clobeson OR clobet OR clobetan OR clobetaxon OR clobetazol OR clobevate OR clobex OR clobisdin OR clodan OR

clonovate OR closanasol OR closol OR clovate OR cormax OR cortimax OR crinale OR crobate OR decloban OR delor OR dermasone OR dermatovate OR dermo OR dermol OR dermosol OR dermotyl OR dermoval OR dermovat OR dermovate OR dermoxinale OR dhabesol OR eczoria OR embeline OR etrivex OR forderm OR glevate OR impeklo OR impoyz OR "karison creme" OR "karison crinale" OR "karison salbe" OR kloderma OR klonat OR lobate OR lobesol OR lobevat OR lotasbat OR medodermone OR novate OR pentasol OR primolux OR rivelin OR rizlasol OR rubocord OR rubocort OR stivate OR tasoprol OR temovate OR tenovate OR topifort OR tovet OR univate OR xenovate OR yihfu OR yugofin OR Corticosteroid* OR "adrenal cortex hormone*" OR "adrenal cortical hormone*" OR "adrenal cortical steroid*" OR "adrenal steroid*" OR "adreno cortical steroid*" OR "adreno corticosteroid" OR adrenocortical OR adrenocorticosteroid OR "cortical steroid" OR "cortico steroid" OR corticoid OR dermocorticosteroid OR "Dexamethasone Sodium Phosphate" OR aacidexam OR colvasone OR dexadreson OR dexafree OR dexair OR "dexamethasone 21 disodiumphosphate" OR "dexamethasone 21 phosphate" OR "dexamethasone disodium phosphate" OR "dexamethasone phosphate" OR dexavet OR diodex OR etacortilen OR "hexadrol phosphate" OR "maxidex ointment" OR "neodecadron ophthalmic" OR ophthasona OR semdexa OR soldesam OR "solu decadron" OR soludecadrol OR soludecadron OR spersadex OR sterodex OR totocortin OR turbinaire OR wymesone OR "Fluocinolone Acetonide" OR adermina OR alfabios OR "alvadermo fuerte" OR aplosyn OR capex OR cervicum OR cinolon OR clofeet OR cortilona OR cremisona OR cynozet OR dermalar OR dermoflam OR dermoran OR dermotic OR esacinone OR flozet OR fluciderm OR flucinar OR flulone OR fluocet OR fluocid OR "fluocinolon acetonid" OR "fluocinonide acetonide" OR fluoderm OR fluolar OR fluonid OR fluonide OR fluotrex OR fluovitef OR fluquinol OR flurosyn OR flusonlen OR fluzon OR fusalar OR gelargin OR gelidina OR iluvien OR inoderm OR jellin OR lluvien OR localyn OR luci OR medidur OR "nasal synalar" OR neosynalar OR otazem OR otoflamm OR otoken OR psoranide OR radiocin OR retisert OR sinaflana OR supralan OR synalar OR synandone OR synemol OR synotic OR syntopic OR trisyn OR yutiq OR Glucocorticoid* OR Glucocorticoidsteroid* OR Glucocorticosteroid* OR Glucocortoid* OR Glycocorticoid* OR Hydrocortisone Acetate OR "anusol hc" OR "anusol hc" OR "aphilan dermangeaisons" OR apocort OR barseb OR berlison OR biocort OR calacort OR caldecort OR "clear aid" OR colifoam OR cortaid OR cortamed OR "cortef acetate" OR "cortic cream" OR "cortic ds" OR cortifoam OR "cortisol acetate" OR dermacort OR dhacort OR dilucort OR dricort OR ekzemsalbe OR enkacort OR "fenistil hydrocortison" OR ficortil OR glycortison OR "hemsol hc" OR hipoge OR "hy cor acetate" OR "hycor eye ointment" OR hyderm OR hydrocortal OR "hydrocortison berco" OR "hydrocortison dispersa" OR "hydrocortison streuli" OR hydrocortistab OR "hydrocortone acetate" OR hydrocutan OR hydrosone OR lanacort OR litraderm OR "micort hc" OR mylocort OR pabracort OR pannocort OR "servicort topical" OR sigmacort OR "siquent hycor" OR steroderm OR stopitch OR wellcortin OR wycort OR "Methylprednisolone Acetate" OR "depmedalone 40" OR "depmedalone 80" OR "depo medrate" OR "depo medrol" OR "depo medrone" OR "depo medrate" OR "depo medrol" OR "depo medrone" OR "depo moderin" OR "depo nisolone" OR depomedrol OR depomedron OR depomedrone OR "depot medrate" OR "epizolone depot" OR "medrol acetate" OR "medrol enpak" OR mepred OR "urbason retard" OR "veriderm medrol" OR "Prednisolone Acetate" OR deppredalone OR econopred OR "flo pred" OR "flo pred" OR "isopto cetapred" OR "key pred" OR "meticortelone acetate" OR "ocu pred" OR omnipred OR optilon OR "poly pred" OR "pred forte" OR "pred mild" OR predforte OR predmet OR "predni ophtal" OR prednigalen OR savacort OR ultracortensol OR ultracortinol OR "triamcinolone acetonide" OR aftab OR aftach OR ahbina OR albicort OR "allegra nasal" OR allernase OR allernaze OR aquatain OR aristocort OR aristoderm OR aristogel OR azmacort OR centocort OR cinolar OR "delphi creme" OR "denkacort forte" OR facort OR flutex OR flutone OR fougera OR ftorocort OR gemicort OR generlog OR kemzid OR "kena log" OR kenac OR "kenacort a" OR kenalog OR kenalone OR kenlog OR "kortikoid ratiopharm" OR manolone OR maqaid OR metoral OR nasacort OR nasatrim OR "nasocor aq" OR nincort OR oracort OR oralog OR oralone OR oramedy OR orrepaste OR panalog OR pokkortolon OR "polcortolon n" OR respicort OR rhinisan OR shincort OR solodelf OR taioftal OR "telfast spray nasal" OR tibicorten OR tibiocorten OR tramacin OR "tri anemul" OR "tri nasal" OR triacet OR triacort OR triaderm OR triam OR "triam denk" OR triamalone OR "triamcinolide acetonide" OR "triamcinolon acetonide" OR triamcinolonacetonid OR triamcinolonacetonide OR "triamcinolone acetamide" OR "triamcinolone acetonamide" OR "triamcinolone acetonid" OR "triamcinolone benetonide" OR triamcinolone OR triamhexal OR triamvirgi OR trianex OR trianide OR triatex OR tricort OR tricortone OR tricot OR triderm OR tridez OR triesence OR trigon OR trikort OR trinolone OR trivaris OR trymex OR vetalog OR vistrec OR volonimat OR wp0508st OR xipere OR zilretta OR zuprata):ti,ab,kw) AND ([mh "Injections"] OR [mh "Injections, Intra-Articular"] OR (injection* OR shot OR intraarticular OR "Intra articular" OR IACIs):ti,ab,kw)

SportDiscus

Date Searched: 3/13/2025

Applied Database Supplied Limits: **Limiters** - Publication Date: 20050101-20241231

Number of Results: 20

Full Search Strategy:

1. TI ((Skeletal* OR bone) N3 (immature* OR "under develop*" OR underdevelop* OR growth OR "still grow*" OR age* OR discordance* OR defficienc* OR delay OR "developmental anomal*" OR "developmental arrest" OR "developmental impairment*" OR "developmental lag" OR "maturation deficit*")) OR AB ((Skeletal* OR bone) N3 (immature* OR "under develop*" OR underdevelop* OR growth OR "still grow*" OR age* OR discordance* OR defficienc* OR delay OR "developmental anomal*" OR "developmental arrest" OR "developmental impairment*" OR

"developmental lag" OR "maturation deficit*")) OR TI ("chronological growth discrepanc*" OR "growth plate immaturity" OR "incomplete skeletal evolution" OR "retarded bone maturation") OR AB ("chronological growth discrepanc*" OR "growth plate immaturity" OR "incomplete skeletal evolution" OR "retarded bone maturation") OR TI (child* OR toddler* OR adolescent* OR teen* OR youth* OR adolescence OR girl* OR boy* OR juvenile* OR pediatric* OR paediatric* OR pediatry OR schoolboy OR schoolboys OR schoolchild OR schoolchildren OR schoolgirl OR schoolgirls) OR AB (child* OR toddler* OR adolescent* OR teen* OR youth* OR adolescence OR girl* OR boy* OR juvenile* OR pediatric* OR paediatric* OR pediatry OR schoolboy OR schoolboys OR schoolchild OR schoolchildren OR schoolgirl OR schoolgirls)

AND

2. TI ("Betamethasone Dipropionate" OR alphatrex OR becloson OR beloderm OR bepronate OR beprosone OR betacrem OR betamesol OR betazone OR cleniderm OR cortiderm OR cremirit OR cycloson OR dicortin OR diprocel OR diproderm OR diprolene OR diprophos OR diprosis OR diprosone OR diprotop OR flogoderm OR helpoderm OR maxisona OR maxivate OR mesonta OR metonate OR oviskin OR proson OR sernivo OR skizon OR soluderme OR "taro-sone" OR topilene OR topisone OR "Clobetasol Propionate" OR betasol OR betavate OR butavate OR clarelux OR clobaderm OR clobasol OR clobasone OR clobavate OR clobecare OR clobederm OR clobegalen OR clobenate OR clobesol OR clobeson OR clobet OR clobetan OR clobetaxon OR clobetazol OR clobevate OR clobex OR clobisdin OR clodan OR clonovate OR closanasol OR closol OR clovate OR cormax OR cortimax OR crinale OR crobate OR decloban OR delor OR dermasone OR dermatovate OR dermo OR dermol OR dermosol OR dermotyl OR dermoval OR dermovat OR dermovate OR dermoxinale OR dhabesol OR eczoria OR embeline OR etrivex OR forderm OR glevate OR impeklo OR impoyz OR "karison creme" OR "karison crinale" OR "karison salbe" OR klo-derma OR klonat OR lobate OR lobesol OR lobevat OR lotasbat OR medodermone OR novate OR pentasol OR primolux OR rivelin OR rizlasol OR rubocord OR rubocort OR stivate OR tasoprol OR temovate OR tenovate OR topifort OR tovet OR univate OR xenovate OR yihfu OR yugofin OR Corticosteroid* OR "adrenal cortex hormone*" OR "adrenal cortical hormone*" OR "adrenal cortical steroid*" OR "adrenal steroid*" OR "adreno cortical steroid*" OR "adreno corticosteroid" OR adrenocortical OR adrenocorticosteroid OR "cortical steroid" OR "cortico steroid" OR corticoid OR dermocorticosteroid OR "Dexamethasone Sodium Phosphate" OR aacidexam OR colvasone OR dexadreson OR dexafree OR dexair OR "dexamethasone 21 disodiumphosphate" OR "dexamethasone 21 phosphate" OR "dexamethasone disodium phosphate" OR "dexamethasone phosphate" OR dexavet OR diodex OR etacortilen OR "hexadrol phosphate" OR "maxidex ointment" OR "neodecadron ophthalmic" OR ophthasona OR semdexa OR soldesam OR "solu decadron" OR soludecadrol OR soludecadron OR spersadex OR sterodex OR totocortin OR turbinaire OR wymesone OR "Fluocinolone Acetonide" OR adermina OR alfabios OR "alvadermo fuerte" OR aplosyn OR capex OR cervicum OR cinolon OR clofeet OR cortilona OR cremisona OR cynozet OR dermalar OR dermoflam OR dermoran OR dermotic OR esacinone OR flozet OR fluciderm OR flucinar OR flulone OR fluocet OR fluocid OR "fluocinolon acetonid" OR "fluocinonide acetonide" OR fluoderm OR fluolar OR fluonid OR fluonide OR fluotrex OR fluovitef OR fluquinol OR flurosyn OR flusonlen OR fluzon OR fusalar OR gelargin OR gelidina OR iluvien OR inoderm OR jellin OR lluvien OR localyn OR luci OR medidur OR "nasal synalar" OR neosynalar OR otazem OR otoflamm OR otoken OR psoranide OR radiocin OR retisert OR sinaflana OR supralan OR synalar OR synandone OR synemol OR synotic OR syntopic OR trisyn OR yutiq OR Glucocorticoid* OR Glucocorticoidsteroid* OR Glucocorticosteroid* OR Glucocortoid* OR Glycocorticoid* OR Hydrocortisone Acetate OR "anusol hc" OR "anusol-hc" OR "aphilan dermangeaisons" OR apocort OR barseb OR berlison OR biocort OR calacort OR caldecort OR "clear aid" OR colifoam OR cortaid OR cortamed OR "cortef acetate" OR "cortic cream" OR "cortic-ds" OR cortifoam OR "cortisol acetate" OR dermacort OR dhacort OR dilucort OR dricort OR ekzemsalbe OR enkacort OR "fenistil hydrocortison" OR ficortil OR glycortison OR "hemsol-hc" OR hipoge OR "hy-cor acetate" OR "hycor eye ointment" OR hyderm OR hydrocortal OR "hydrocortison berco" OR "hydrocortison dispersa" OR "hydrocortison streuli" OR hydrocortistab OR "hydrocortone acetate" OR hydrocutan OR hydrosone OR lanacort OR litraderm OR "micort-hc" OR mylocort OR pabracort OR pannocort OR "servicort topical" OR sigmacort OR "siquent hycor" OR steroderm OR stopitch OR wellcortin OR wycort OR "Methylprednisolone Acetate" OR "depmedalone 40" OR "depmedalone 80" OR "depo medrate" OR "depo medrol" OR "depo medrone" OR "depo-medrate" OR "depo-medrol" OR "depo-medrone" OR "depo-moderin" OR "depo-nisolone" OR depomedrol OR depomedron OR depomedrone OR "depot medrate" OR "epizolone-depot" OR "medrol acetate" OR "medrol enpak" OR mepred OR "urbason retard" OR "veriderm medrol" OR "Prednisolone Acetate" OR deppredalone OR econopred OR "flo pred" OR "flo-pred" OR "isopto cetapred" OR "key pred" OR "meticortelone acetate" OR "ocu-pred" OR omnipred OR optilon OR "poly pred" OR "pred forte" OR "pred mild" OR predforte OR predmet OR "predni-ophtal" OR prednigalen OR savacort OR ultracortensol OR ultracortinol OR "triamcinolone acetonide" OR aftab

OR aftach OR ahbina OR albicort OR "allegra nasal" OR allernase OR allernaze OR aquatain OR aristocort OR aristoderm OR aristogel OR azmacort OR centocort OR cinolar OR "delphi creme" OR "denkacort forte" OR facort OR flutex OR flutone OR fougera OR ftorocort OR gemicort OR generlog OR kemzid OR "kena log" OR kenac OR "kenacort a" OR kenalog OR kenalone OR kenlog OR "kortikoid ratiopharm" OR manolone OR maqaid OR metoral OR nasacort OR nasatrim OR "nasocor aq" OR nincort OR oracort OR oralog OR oralone OR oramedy OR orrepaste OR panalog OR pokkortolon OR "polcortolon n" OR respicort OR rhinisan OR shincort OR solodelf OR taioftal OR "telfast spray nasal" OR tibicorten OR tibiocorten OR tramacin OR "tri anemul" OR "trinasal" OR triacet OR triacort OR triaderm OR triam OR "triam-denk" OR triamalone OR "triamcinolide acetonide" OR "triamcinolon acetonide" OR triamcinolonacetonid OR triamcinolonacetonide OR "triamcinolone acetamide" OR "triamcinolone acetonamide" OR "triamcinolone acetonid" OR "triamcinolone benetonide" OR triamcinolone OR triamhexal OR triamvirgi OR trianex OR trianide OR triatex OR tricort OR tricortone OR tricot OR triderm OR tridez OR triesence OR trigon OR trikort OR trinolone OR trivaris OR trymex OR vetalog OR vistrec OR volonimat OR wp0508st OR xipere OR zilretta OR zuprata) OR AB ("Betamethasone Dipropionate" OR alphatrex OR becloson OR beloderm OR bepronate OR beprosone OR betacrem OR betamesol OR betazone OR cleniderm OR cortiderm OR cremirit OR cycloson OR dicortin OR diprocel OR diproderm OR diprolene OR diprophos OR diprosis OR diprosone OR diprotop OR flogoderm OR helpoderm OR maxisona OR maxivate OR mesonta OR metonate OR oviskin OR proson OR sernivo OR skizon OR soluderme OR "taro-sone" OR topilene OR topisone OR "Clobetasol Propionate" OR betasol OR betavate OR butavate OR clarelux OR clobaderm OR clobasol OR clobasone OR clobavate OR clobecare OR clobederm OR clobegalen OR clobenate OR clobesol OR clobeson OR clobet OR clobetan OR clobetaxon OR clobetazol OR clobevate OR clobex OR clobisdin OR clodan OR clonovate OR closanasol OR closol OR clovate OR cormax OR cortimax OR crinale OR crobate OR decloban OR delor OR dermasone OR dermatovate OR dermo OR dermol OR dermosol OR dermotyl OR dermoval OR dermovat OR dermovate OR dermoxinale OR dhabesol OR eczoria OR embeline OR etrivex OR forderm OR glevate OR impeklo OR impoyz OR "karison creme" OR "karison crinale" OR "karison salbe" OR kloderma OR klonat OR lobate OR lobesol OR lobevat OR lotasbat OR medodermone OR novate OR pentasol OR primolux OR rivelin OR rizlasol OR rubocord OR rubocort OR stivate OR tasoprol OR temovate OR tenovate OR topifort OR tovet OR univate OR xenovate OR yihfu OR yugofin OR Corticosteroid* OR "adrenal cortex hormone*" OR "adrenal cortical hormone*" OR "adrenal cortical steroid*" OR "adrenal steroid*" OR "adreno cortical steroid*" OR "adreno corticosteroid" OR adrenocortical OR adrenocorticosteroid OR "cortical steroid" OR "cortico steroid" OR corticoid OR dermocorticosteroid OR "Dexamethasone Sodium Phosphate" OR aacidexam OR colvasone OR dexadreson OR dexafree OR dexair OR "dexamethasone 21 disodiumphosphate" OR "dexamethasone 21 phosphate" OR "dexamethasone disodium phosphate" OR "dexamethasone phosphate" OR dexavet OR diodex OR etacortilen OR "hexadrol phosphate" OR "maxidex ointment" OR "neodecadron ophthalmic" OR ophthasona OR semdexa OR soldesam OR "solu decadron" OR soludecadrol OR soludecadron OR spersadex OR sterodex OR totocortin OR turbinaire OR wymesone OR "Fluocinolone Acetonide" OR adermina OR alfabios OR "alvadermo fuerte" OR aplosyn OR capex OR cervicum OR cinolon OR clofeet OR cortilona OR cremisona OR cynozet OR dermalar OR dermoflam OR dermoran OR dermotic OR esacinone OR flozet OR fluciderm OR flucinar OR flulone OR fluocet OR fluocid OR "fluocinolon acetonid" OR "fluocinonide acetonide" OR fluoderm OR fluolar OR fluonid OR fluonide OR fluotrex OR fluovitef OR fluquinol OR flurosyn OR flusonlen OR fluzon OR fusalar OR gelargin OR gelidina OR iluvien OR inoderm OR jellin OR lluvien OR localyn OR luci OR medidur OR "nasal synalar" OR neosynalar OR otazem OR otoflamm OR otoken OR psoranide OR radiocin OR retisert OR sinaflana OR supralan OR synalar OR synandone OR synemol OR synotic OR syntopic OR trisyn OR yutiq OR Glucocorticoid* OR Glucocorticoidsteroid* OR Glucocorticosteroid* OR Glucocortoid* OR Glycocorticoid* OR Hydrocortisone Acetate OR "anusol hc" OR "anusol-hc" OR "aphilan dermangeaisons" OR apocort OR barseb OR berlison OR biocort OR calacort OR caldecort OR "clear aid" OR colifoam OR cortaid OR cortamed OR "cortef acetate" OR "cortic cream" OR "cortic-ds" OR cortifoam OR "cortisol acetate" OR dermacort OR dhacort OR dilucort OR dricort OR ekzemsalbe OR enkacort OR "fenistil hydrocortison" OR ficortil OR glycortison OR "hemsol-hc" OR hipoge OR "hy-cor acetate" OR "hycor eye ointment" OR hyderm OR hydrocortal OR "hydrocortison berco" OR "hydrocortison dispersa" OR "hydrocortison streuli" OR hydrocortistab OR "hydrocortone acetate" OR hydrocutan OR hydrosone OR lanacort OR litraderm OR "micort-hc" OR mylocort OR pabracort OR pannocort OR "servicort topical" OR sigmacort OR "siquent hycor" OR steroderm OR stopitch OR wellcortin OR wycort OR "Methylprednisolone Acetate" OR "depmedalone 40" OR "depmedalone 80" OR "depo medrate" OR "depo medrol" OR "depo medrone" OR "depo-medrate" OR "depo-medrol" OR "depo-medrone" OR "depo-moderin" OR "depo-nisolone" OR depomedrol OR depomedron OR depomedrone OR "depot medrate" OR "epizolone-depot" OR "medrol acetate" OR "medrol enpak" OR mepred OR "urbason retard" OR "verid-

erm medrol" OR "Prednisolone Acetate" OR dep-predalone OR econopred OR "flo pred" OR "flo-pred" OR "isopto cetapred" OR "key pred" OR "meti-cortelone acetate" OR "ocu-pred" OR omnipred OR optilon OR "poly pred" OR "pred forte" OR "pred mild" OR predforte OR predmet OR "predni-ophtal" OR prednigalen OR savacort OR ultracortensol OR ultracortinol OR "triamcinolone acetonide" OR aftab OR aftach OR ahbina OR albicort OR "allegra nasal" OR allernase OR allernaze OR aquatain OR aristocort OR aristoderm OR aristogel OR azmacort OR cento-cort OR cinolar OR "delphi creme" OR "denkacort forte" OR facort OR flutex OR flutone OR fougera OR ftorocort OR gemicort OR generlog OR kemzid OR "kena log" OR kenac OR "kenacort a" OR kenalog OR kenalone OR kenlog OR "kortikoid ratiopharm" OR manolone OR maqaid OR metoral OR nasacort OR nasatrim OR "nasocor aq" OR nincort OR oracort OR oralog OR oralone OR oramedy OR orrepaste OR panalog OR pokkortolon OR "polcortolon n" OR respicort OR rhinisan OR shincort OR solodelf OR taioftal OR "telfast spray nasal" OR tibicorten OR tibiocorten OR tramacin OR "tri anemul" OR "tri-nasal" OR triacet OR triacort OR triaderm OR triam OR "triam-denk" OR triamalone OR "triamcinolide acetonide" OR "triamcinolon acetonide" OR triamci-nolonacetonid OR triamcinolonacetonide OR "triam-cinolone acetamide" OR "triamcinolone aceton-amide" OR "triamcinolone acetonid" OR "triamcinolone benetonide" OR triamcinolone OR triamhexal OR triamvirgi OR trianex OR trianide OR triatex OR tricort OR tricortone OR tricot OR triderm OR tridez OR triesence OR trigon OR trikort OR tri-nolone OR trivaris OR trymex OR vetalog OR vistrec OR volonimat OR wp0508st OR xipere OR zilretta OR zuprata)

AND

3. TI (injection* OR shot OR intraarticular OR "Intra-articular" OR IACIs) OR AB (injection* OR shot OR intraarticular OR "Intra-articular" OR IACIs)

ClinicalTrials.gov

Date Searched: 3/14/25

Number of Results: 82

Full Search Strategy:

Condition/disease: (("skeletally immature*") OR ("skeletal immature*") OR pediatric* OR child* OR adolscen*)

Intervention/treatment: (corticosteroid OR "be-tamethasone dipropionate" OR "clobetasol propionate" OR "dexamethasone sodium phosphate" OR "fluocinolone ace-tonide" OR glucocorticoid OR "hydrocortisone acetate" OR "methylprednisolone acetate" OR "prednisolone acetate" OR "triamcinolone acetonide") AND (injection* OR shot OR intraarticular OR "Intra-articular" OR IACIs)

Process:

- Used benchmark publications
- Used research question à searchable key concepts/ terms then see if search terms are present in our benchmark citations
- Terms: skeletally immature / pediatric + injection / corticosteroid injection + pediatric orthopedics / or-thopedics / sports medicine
- Remained broad to be inclusive
- Date range: 2005-2025