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Overview of Available Treatments and Their Limitations for Hypertrophic Facet Joints—A Systematic Review of the Literature

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Data Sources: PubMed, Google Scholar, National Library of Medicine, prior systematic reviews, and reference lists. The literature search was done from 2015 through 2023.

Study Selection: We selected randomized trials, observational studies, and case reports of injections of biologics into the epidural space, facet joints, or sacroiliac joints.

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ABSTRACT

Background: Physicians worldwide face the challenging task of improving patient satisfaction by reducing pain in injured patients. Currently, available therapeutic approaches provide only short-term relief of symptoms without addressing long-term satisfaction. This has led to exploring regenerative treatment options that can deliver better outcomes. One such promising option is platelet-rich plasma (PRP) injections, which are gaining popularity as an alternative to standard steroid injections.

Objectives: This study examines the therapeutic effects of PRP injections in adult patients with stress or traumatic injuries.

Methods: The systematic literature review yielded 60,301 articles, books, and websites verified and removed from the final project. The final studies used in the report comprised randomized trials, observational studies, and case reports on injecting biologics into the epidural space, facet joints, or sacroiliac joints. In total, 15 reviews and 13 studies were included in this review.

Results: In the Wu et al study, 46 participants were randomly divided into group A (0.5 mL PRP injection) and group B (1.5 mL methylprednisolone injection). Although group B initially showed a notable pain reduction at one week, it diminished over 6 months, with group A consistently improving, reaching an 80.96% success rate and higher patient satisfaction. In the study by Singla et al comparing PRP (group P) and corticosteroid (group S) in 40 participants, PRP demonstrated a markedly greater reduction in VAS Scale at 6 weeks and 3 months, with a 90% effectiveness compared with 75% for steroids.

Conclusion: PRP injections offer greater pain alleviation, disability reduction, and overall patient satisfaction improvements due to their effect on the immune response to promote the growth and proliferation of damaged tissue. It has also been shown to offer a safer alternative that carries fewer risks than that of transforaminal steroid injections due to promising clinical trials and scientific investigation outcomes. Several

of the steroid injection studies proved to have mixed results and efficacy because patients reporting having similar pain relief with placebo groups that used saline injections. Further studies will be needed to evaluate PRP's long-term efficacy and cost-effectiveness for practical patient use in the future.

Ferreira et al,[1] 2023 reported that in 2020, there were 619 million people worldwide suffering from low back (nearly 10% of the world's population), and it is estimated that by 2050, that number will reach up to 843 million. Mechanical conditions are the most frequent cause of low back pain (LBP), particularly with facet joints, which represent 15% to 41% of patients with chronic LBP. The facet joints are synovial joints localized on the spinal column in cervical, thoracic, and lumbar portions. These joints are contact points between the superior and inferior vertebral processes essential in flexion and extension movements. They are often treated to improve mobility and pain management without treating the real cause of the pain.[2] Furthermore, LBP is the main cause of years living with disability worldwide.

The literature reports new ways to deal with this chronic disease using nonsurgical regenerative medicine for patients experiencing musculoskeletal pain, sports-related injuries, and chronic conditions. Nonsurgical regenerative medicine is a relatively new field that has emerged and garnered notable attention lately. Platelet-rich plasma (PRP) and corticosteroids are treatments in research for hypertrophic facet joints, corticosteroids are a special hormone that focus primarily on the inflammatory process, the regulation of the organism, immune response, and are effective in relieving pain immediately for the patient. These hormones are secreted by the adrenal glands and are mainly cortisol.[2] PRP is the modification of the platelets from a plasma concentrate that is enriched to achieve 95% platelets and 5% of red blood cells; this enriched plasma contains growth factors and cytokines that promotes the migration and proliferation of fibroblast to damaged connective tissue.[3] This is the reason for the interest in carrying out a systematic review, in which a possible result can be established with respect to the studies already conducted on the therapeutic use of PRP and corticosteroids.

Methodology

Literature Search Strategy

The systematic literature review yielded 60,301 articles, books, and websites verified and removed from the final project.

Study Selection

The systematic literature search criteria were conducted with Pubmed, Google Scholar, and the National Library of Medicine. The following terms were used in our search: Plasma Rich Protein, Corticosteroids, Injections, Efficacy, facet joints, Hypertrophy, Spine, and Joints. All articles with the aforementioned words were verified to include them. All articles need to have the following criteria to be included in this systematic review: (1) written in English and/or Spanish, (2) the articles had to be written in the past decade, and (3) only include free articles and books. The search process was carried out from June 2023 to September 2023.

Specific Inclusion Criteria

(1) Zygapophyseal joints
(2) Corticosteroid injections
(3) Lumbar spine
(4) Efficacy
(5) Platelet-rich plasma

Specific Exclusion Criteria

(1) Articles before 2015

PICO

In adult patients (P) with stress or traumatic injuries, comparisons (C) between corticosteroid injections and PRP injections (I) for patients' satisfaction in the form of pain reduction (O).

PRISMA

Detailed description of the articles retrieved and processed are outlined in Figure 1.

Background

Epidemiology Hypertrophic Facet Joints

LBP is one of the major disabling health conditions among older adults aged 60 years or older. Although most cases are nonspecific and self-limiting, older patients are more prone to develop chronic and severe forms of LBP pathologies because of undiagnosed physical changes in their bodies or through traumatic injuries. More than 80% of individuals have lumbar spondylosis. This

number increases from 3% of individuals after 20 to 29 years, which is why spondylosis is one of the leading causes of this disability in the United States. Having a diagnosis like this can cause major pathological malfunctions if not treated, ranging from nerve compression to occlusion of arteries and veins.[4]

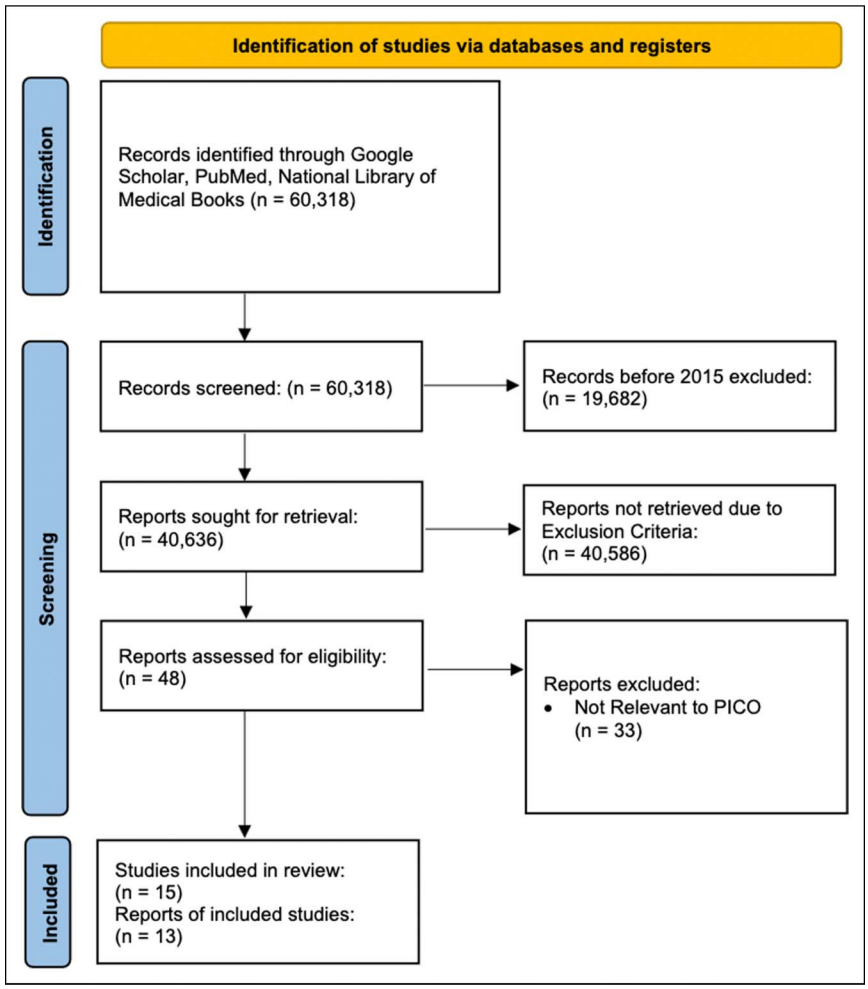
Mechanism of Action of Platelet-Rich Plasma

Therapies aimed to treat lower back pain should meet the criteria to stimulate regeneration by promoting extracellular matrix production or ameliorating the inflammatory response caused by cytokine release. A popular and ever-growing treatment of lower back pain is PRP. PRP is obtained from each patient through a centrifugation process of venous blood collected. With centrifugation, the liquid and solid components of blood are separated and layers of plasma, white blood cells, and red blood cells appear. The separated plasma is then separated and collected with the aim of being injected into an injured tissue.[5]

PRP has been found to be an efficient treatment of tissue insults, such as ligament tears, osteoarthritis, lateral epicondylitis, and tendinopathies, to name a few. Although limited data are available regarding the efficiency of PRP treatment for lower pain, it has been an emerging treatment. Physiologically, it is hypothesized that PRP promotes "recruitment, proliferation, and differentiation of cells involved in regeneration through a number of growth factors and proteins released from the platelets," leading to tissue healing.[5] PRP also plays a role in cytokine regulation by promoting the release of anti-inflammatory cytokines and chemokines.

Regarding lower back pain, PRP is through to assist disk regeneration by pulling tears at degenerated discs

Figure 1



Preferred reporting items for systematic reviews and meta-analyses flowchart showing systematic literature review. Study's selected accordingly of the inclusion, exclusion, and patient or population, intervention, comparison, and outcome criteria.

together and enhance the healing process; a limitation of PRP treatment for lower back pain is the lack of vasculature present at vertebral disks, which in turn limits the amount of PRP reaching the damaged tissue site. Reports in the literature have shown that PRP treatment injections for lower back pain are efficient to lower pain and improve function. In all, lower back pain therapies should treat the pathological conditions responsible for causing matrix degradation, loss of disk space height, and an increased load on posterior elements of a vertebral body.[5]

Mechanism of Action of Corticosteroid Injections

Of the pharmacologic treatments available for lower back pain, corticosteroids are commonly recommended to counter inflammatory insults. Corticosteroids are a group of molecules resembling the hormone cortisol that have anti-inflammatory effects, and they can be administered in multiple ways, most commonly orally or through injection. Common corticosteroids used clinically consist of prednisone, prednisolone, and dexamethasone, to name a few. Each corticosteroid has different potencies and action duration that should be considered for each patient, depending on the severity of the pathology. Corticosteroids reduce inflammation and compression of affected nerves related to lower back pain. At the molecular level, corticosteroids bind to receptors expressed in almost all cell types that act as transcription factors that modulate gene expression, downregulate inflammatory genes, and upregulate anti-inflammatory genes.[6] Some limitations and common adverse events to the use of corticosteroids are hyperglycemia and immune system depression, which would prevent diabetic patients from using these medications and also immunocompromised patients whom would be at an increased risk of infection.[7]

Current Treatments and Limitations

Lower back pain can have three sources. The first source is axial lumbosacral pain, which arises from the lumbar (L1-5), sacral (S1), and sacrococcygeal junction vertebral regions. The second, radicular pain originates from a dorsal root ganglion irritation and then travels down an extremity following dermatome innervation. The third is referred pain, which is pain that travels to a region distant from the source, it does not follow dermatome innervation. Lower back pain being the leading contributor to disability and workdays lost, many treatments have been established.[4]

In an acute setting, treatments for lower back pain include pharmacological and nonpharmacological options. Nonsteroidal anti-inflammatory drugs, acetaminophen, and muscle relaxants are considered the best treatment in an acute setting. Topical patches and creams can also provide some amelioration to the pain. Heat and cold therapy can alleviate symptoms of facet joints syndrome because they increase blood circulation by dilating vessels and relaxing muscles or constricting vessels to reduce inflammation, respectively. Under the guidance of a physical therapist, physical therapy and exercise can also aid in lowering back pain by speeding the healing process. By having good posture and knowing how to stretch the lower extremities, abdomen, and back muscles, a patient can speed the healing process. Another option in an acute setting is a mechanical back brace. By using a brace, it forces the vertebral column to remain upright in orthostasis and orthopneic positions while limiting torsion, bending, and any other movements that may contribute to the pain.[8]

In a chronic setting, the treatment of lower back pain requires more potent pharmacotherapeutics. If pain is severe and unresponsive to conservative medications, patients are prescribed opioids. Opioids are highly addictive and should be given in a time-limited course with constant monitoring of the patient to assess the efficacy of the treatment; they should not be given to patients at risk for addiction or abnormal behavior. For short-term treatment of back pain. An epidural steroid facet injection can also be given to a patient; it is a useful tool to diagnose and treat a patient with facet joint syndrome; the injection typically includes an anesthetic or an anesthetic with a combination of steroids. Another type of injection is a medical branch injection; it is applied near branch nerves and reduces nerve fiber permeability, blood flow to nerves, and pain signals from the nerve to the brain.[8]

Stem cell therapy has become a high interest topic over the past years, especially for tissue regeneration. The use of stem cells in medicine has grown rapidly; they can be used as tools to study human development at the cellular level, as targets for pharmacological testing, as well as therapies. Based on the biology totipotent and pluripotent stem cells follow, they can be used to study the embryological differentiation of cells from the time a blastocyst is formed to their destination such as a hepatocyte. The use of stem cells for pharmacological testing is highly effective; stem cells being living tissue allows for safe experimentation and can be considered as an alternative to animal studies. However, the conditions of the cells must be in a desirable stage, and thus, it can be a difficult challenge controlling and halting cell differentiation. The potential of stem cells for therapies can be

summarized by noting that they are most optimally used whenever there is damaged tissue that needs repair: these include diabetes, macular degenerations, strokes, osteoarthritis, and so on. As an example, stem cells can be used in diabetes mellitus type 1, an autoimmune condition in which pancreatic beta cells are destroyed, a treatment can be induced to differentiate stem cells from the patient into pancreatic beta cells. However, the advantages of this new therapeutic option come with its own risks and disadvantages. Stem cell therapy can extract stem cells from embryos or adults, which makes the procedure personalized for every patient. This approach is not ideal for most patients due to its high cost and limited ability to produce large quantities of stem cells for regenerative purposes.[9]

Finally, the most invasive option for lower back pain is surgery. A lumbar spinal fusion can be performed to fuse vertebrae of the lower back together and eliminate any motion that previously was the source of the pain. Table 1 provides the current available treatment options. A laminectomy can also be done in which the back part of a vertebra is removed, thus decompressing the lumbar area allowing more space for neural tissues. If the patient is found to have bone spurs in their vertebra, a facetectomy can be performed to remove the excess bone to protect the spinal cord and nerves from further damage. A nerve ablation can also be executed to detach the sensory nerves (medial branch) involved in pain from the facet joints. A diskectomy could be another option in which a damaged part of a disk is removed to avoid damage to nerves around it.[9]

Corticosteroids

Intra-articular (IA) corticosteroid injections are commonly used to treat osteoarthritis pain in peripheral joints.[10] For this reason, IA corticosteroid injections into the z-joints have been proposed as a possible treatment method for back pain. However, there is insufficient evidence that shows the efficacy of z-joint corticosteroid injections for the treatment of back pain and associated conditions.

Platelet-Rich Plasma

PRP has been gaining popularity in recent years among various medical specialties to treat various conditions. Specifically, PRP has been used in the treatment of cervical and lumbar facet–mediated pain.[11] PRP is a sample of blood typically taken from the patient himself/herself and centrifuged to separate into three layers (PRP, platelet-poor plasma, and red blood cells). PRP has an increased concentration of growth factors, platelets, and fibroblasts/osteoblasts, which increases blood flow to new tissues through angiogenesis and increases the new tissues' tensile strength.[11] Overall, PRP attempts to enhance the body's natural healing methods.

Bone Marrow Aspirate Concentrate

Bone marrow aspirate concentrate (BMAC) is another biologic therapy available for musculoskeletal pain. Bone marrow consists mainly of growth factors and pluripotent mesenchymal stem cells, cells that promote differentiation and development of cartilage, bone, fat, muscle, meniscus, and ligaments, and is associated with anti-inflammatory and regenerative properties. Being approved by the FDA, BMAC has been a promising treatment of musculoskeletal pain and cartilage regeneration.[12] BMAC is most commonly harvested from the iliac crest using a syringe, and a volume ranging from 60 to 120 mL is collected. A study in 2020 by Wolff et al[13] used BMAC for discogenic pain; they identified a 50% improvement in patient-reported back pain. In this study, the researchers injected the BMAC directly into the vertebral disk.[13] Another study in 2021 by El-Kadiry et al[14] used BMAC for discogenic pain and facetogenic joint pain. Improvement was seen in patients with discogenic pain, but only 2% improvement was reported in patients with facet joint pain. Also, the usage of Percocet in patients after the BMAC intervention decreased approximately a 50%, yet no statistical significance was observed or reported.[14] A limitation of the use of BMAC is that the harvesting method can be painful for patients. Another limitation is that there still lacks evidence demonstrating the use of BMAC in hypertrophic facet joints. Note that the small sample size of the studies using BMAC is also a limitation.

Results

Sixty thousand three hundred eighteen studies were identified during the preliminary search using PubMed (156), the National Institute of Health (11), and Google Scholar (60,151). Of the 60,318 studies, 19,682 were excluded because they were published before 2015. Of the remaining 40,636 studies, 48 studies met all of the inclusion and exclusion criteria and were selected for further investigation. Thirty-three articles were excluded because they did not meet our established patient or population, intervention, comparison, and outcome criteria model for this article. In this systematic review, the research was separated into two main categories: previous studies that focused on (1) the efficacy of

Table 1. Current Available Treatments Options

Treatment Options	Advantage	Disadvantage
Nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen	Short-term relief, rapid onset time	Frequency of dosages
Topical patches and muscle relaxants	Short-term relief, rapid onset time	Frequency of dosages
Physical therapy and exercise	Moderate relief	Long onset time
Mechanical braces	Moderate relief	Muscle atrophy
Opioids	Rapid onset time, moderate relief	Addictive properties
Steroid facet injection	Long-term relief, rapid inflammation reduction	Invasive, severe complications
Stem cell therapy	Long-term relief, personalized medicine	Expensive procedure, long preparation times, low blood cell counts following procedure, invasive, severe complications
Surgery	Long-term relief	Invasive, sever complications
BMAC	Substitute for surgery	Lacks evidence for hypertrophic facet joints and painful harvesting

BMAC, bone marrow aspirate concentrate
Of the mentioned treatments in the literature, each of the advantage and disadvantages is mentioned.

corticosteroid injections into lumbar facet joints for the treatment of chronic back pain and (2) the efficacy of PRP into cervical, thoracic, and lumbar facet joints for the treatment of chronic back pain. Table 2 shows the results of different therapeutic doses and drugs in spinal pathologies, and Table 3 provides results of studies selected for their clinically notable results.

Outcomes: Corticosteroid Injections

Table 2. provide results of different therapeutic doses and drugs in spinal pathologies

Summary of Efficacy Outcomes from Recent Studies

Five studies were selected for their clinically notable results. These studies included a total of 217 patients, each monitored at various follow-up intervals ranging from 1 to 6 months. The primary outcomes in all studies were measured using either the visual analog scale (VAS) or the numeric rating scale (NRS). The two studies that use VAS showed PRP had a better long-term, statistically significant reduction than that of corticosteroid treatment. Singh et al[11] found that one month postinjection, group S (corticosteroid) had better improvement than group P (PRP). At 3 and 6 months postinjection, group P had lower VAS scales than group S. Finally, at 6 months postinjection, group P had a greater decrease in ODI than group S. Nonsteroidal anti-inflammatory drug usage and patient satisfaction scales were greater in group P compared with those of group S.[17] Two studies that investigated corticosteroid therapy found no statistically significant difference between injections versus placebos. The Kennedy et al[10] study was a double-blind, prospective, randomized, placebo-controlled trial that included 28 study participants randomly divided into two treatment groups. The results of this study showed that four out of 28 participants did not have 80% or more relief with the second confirmatory medial branch block, and therefore, the results of these four participants were not used in the overall results. Study participants who did not respond to the second block were equally assigned between the placebo group (receiving saline injections) and the corticosteroid group. Nine of the 12 participants (75%) who received saline injections received radiofrequency neurolysis treatment, whereas 10 of 12 participants (85%) who received corticosteroid injections received radiofrequency neurolysis treatment.[10] The study by Kwak et al[16] was a retrospective one conducted in Korea that included 50 participants with lumbar facet joint osteoarthritis (FJOA). All groups (groups A, B, and C) experienced decreased NRS (numerical rating scale) scales and NRS scales decreased markedly ($P < 0.001$) at each time point patients were evaluated. However, the rates of successful pain relief 3 months posttreatment did not differ markedly ($P = 0.805$) between groups A, B, and C. Overall, 52% of patients (26) experienced successful pain relief (≥50%) from FJOA pain post IA lumbar facet joint (LFJ) corticosteroid injection.[16]

Table 2. Results of Different Therapeutic Doses and Drugs in Spinal Pathologies

Study	Participants	Spinal Pathology Studied	Treatment	Follow-up	Results	Conclusion
Appeadu et al[15]	64	Cervicogenic headache (CGH)	(1) At least 2 AO intra-articular injections with 1-mL injection of a mixture of 0.75 mL of 2% lidocaine and 0.25 mL of 10-mg triamcinolone. (2) Single injection: 1.0 mL of a mixture of bupivacaine 0.5% and 10 mg of triamcinolone. (3) at least 2 injections of 0.8 mL of betamethasone and 0.2 mL of 1% lidocaine into the C2-C3 facet joint within a 2-week interval	Study 1 = follow-up at 1 and 2 months Study 2 = 1, 3, and 6 months Study 3 = 19 months on average (12 to 29 months)	Intra-articular cervical facet injections showed a decreased VAS scale	The results of this study show that intra-articular cervical facet joint injections might be effective to treat cervicogenic headaches
Kennedy et al[10]	28	Low back pain/ Zygapophy sial (z-joint)	Intra-articular corticosteroid (triamcinolone 20 mg) or saline	There is no follow-up; the researchers only tested for the time post injection for which participants required radiofrequency neurotomy therapy	No statistically significant difference in the need for radiofrequency neurotomy between the saline (6.1 weeks) and the corticosteroid group (6.5 weeks)	Corticosteroid injections into lumbar z-joints did not reduce the need for radiofrequency neurotomy in patients with z-joint pain. Saline injections showed no statistically significant difference in results
Kwak et al[16]	50	Lumbar facet joint (LFJ) osteoarthritis	0.3 mL of contrast into the LFJ space, 10 mg (0.25 mL) of dexamethasone mixed with 0.25 mL of 0.125% bupivacaine was injected	3 months	52% of participants in this study experienced >50% reduction in NRS scales at 3 months. The effect of IA LFJ corticosteroid injection was not markedly different among the three groups (P = 0.889)	Intra-articular lumbar facet joint markedly reduced the facet joint-origin lower back pain, no matter the severity of facet joint osteoarthritis

(*continued*)

Table 2. (*continued*)

Study	Participants	Spinal Pathology Studied	Treatment	Follow-up	Results	Conclusion
Singh et al[17]	45	Chronic lower back pain due to facet joint arthropathy	Group S: steroid (triamcinolone) + RFA or group P: PRP + RFA or group R: 0.9% saline + RFA as control	6 months	1 month postinjection: group S had better improvement than that of group P. Three and 6 months postinjection: group P had lower VAS scales than that of group S. 6 months postinjection, group P had a greater decrease in ODI than that of group S. NSAID usage and patient satisfaction scales were greater in group P compared with those of group S	Corticosteroid injections and PRP proved to be effective treatment methods for lumbar facet joint syndrome, even 6 months post initial injection. The results of this study show that autologous PRP may be the better option for longer efficacy
Yang and Chang[9]	30	Chronic and persistent cervical facet joint pain after whiplash trauma (despite PT and oral medication)	10 mg (0.25 mL) of triamcinolone acetonide, mixed with 0.25 mL of 0.125% bupivacaine and 0.5 mL of normal saline	1 and 2 months post injection	NRS scale was 5.4 ± 1.7. The mean NRS scales at 1 and 2 months after treatment were 3.9 ± 1.7 and 4.0 ± 1.6, respectively. The NRS scales at both follow-ups were markedly decreased compared with pretreatment scales Finally, 26.7% of patients reported pain relief of ≥50% 2 months after the treatment	The results of this study show that IA corticosteroid injection may be a good treatment option for whiplash-related cervical facet joint pain

AO = adverse outcome, CGH = cervicogenic headache, FJOA = facet joint osteoarthritis, IA = intra-articular, LFJ = lumbar facet joints, NRS = numeric rating scale, NSAID = nonsteroidal anti-inflammatory drugs, ODI, Oswestry Disability Index, PT = physical therapy, PRP = platelet-rich plasma, RFA = radiofrequency ablation, VAS = visual analog scale

Outcomes: Platelet-Rich Plasma

The collected studies on PRP therapy were aimed at highlighting the benefits of transitioning to a more personalized approach to medical treatment (Table 4 provides the results of PRP as therapy). Four of these studies concentrated on lumbar facet injections, whereas one examined sacroiliac injections. Among the five studies, two demonstrated promising outcomes. In the study of

Table 3. Results of Studies Selected for Their Clinically Notable Results

Study	Year	Outcome
Wu et al[18]	2016	In a short span of 3 months, PRP injections showed a statistically significant efficacy for patients without severe relevant complications
Kwak et al[16]	2019	Intra-articular lumbar facet joint markedly reduced the facet joint-origin lower back pain, no matter the severity of facet joint osteoarthritis
Singh et al[17]	2023	Corticosteroid injections and PRP proved to be effective treatment methods for lumbar facet joint syndrome, even 6 months post initial injection. The results of this study show that autologous PRP may be the better option for longer efficacy
Singla et al[11]	2018	PRP injections showed to be 25% more effective than steroidal injections
Wu et al[18]	2017	PRP injections showed a better effectiveness in both patient satisfaction and success rate

PRP = platelet-rich plasma
The primary outcomes in all studies were measured using either the Visual Analog Scale (VAS) or the Numeric Rating Scale (NRS).

Wu et al,[18] the researchers conducted a randomized division of 46 participants into two groups, namely, group A, which received a 0.5 mL of PRP injection, and group B, which received a 1.5 mL of methylprednisolone (5 mg/mL) injection, with 23 participants in each group. Notably, the objective success rate for group A consistently increased, reaching its highest point at 80.96%. In addition, patients in group A reported greater satisfaction compared with those in group B ($P > 0.05$). In the study by Singla et al,[11] they divided 40 participants into two groups: group P (PRP) and group S (Corticosteroid). Their results indicated that group P experienced a 10.91-fold greater reduction in the VAS score at 6 weeks compared with that of group S, and this difference increased to 37.28-fold at 3 months.[11]

Discussion

The current systematic review comprehensively includes clinical studies, randomized clinical trials, retrospective studies, meta-analyses, systematic reviews, and prospective randomized unblinded controlled studies. The objective of this study was to perform a systematic review among adult patients with stress or traumatic injuries and comparisons between corticosteroid injections and PRP injections for patients' satisfaction in the form of pain reduction. This systematic review has a clinical orientation and was written to provide clinicians with the most recent information about the use of corticosteroid injections and PRP injections, including the advantages and disadvantages of each treatment method.

Back pain is one of the major disabling health conditions among adults aged 60 years and older. Because back pain is such a common condition that can lead to a wide variety of health problems, there are several upcoming invasive treatment methods that are being used in an attempt to achieve higher patient satisfaction scales, decreased Oswestry Disability Index scores, and decreased visual analog scales (VAS).[17]

Corticosteroid Injections

IA corticosteroid injections are commonly used treatment methods to treat osteoarthritis pain in peripheral joints.[11] For this reason, IA corticosteroid injections into the z-joints have been proposed as a possible treatment method for back pain. However, there is insufficient evidence that shows the efficacy of z-joint corticosteroid injections for the treatment of back pain and associated conditions.

In the article by Kwak et al,[16] the investigators sought to determine whether corticosteroid injections placed intra-articularly in lumbar facet joints are effective and safe for treating lumbar back pain secondary to facet osteoarthritis. This study concluded that IA LFJ corticosteroid injections markedly decreased the facet joint-origin lower back pain, regardless of the patient's FJOA.[16] From the results of this article, IA corticosteroid injections are a good treatment option for peripheral joint osteoarthritis

Table 4. Results of Studies With Platelet-Rich Plasma as Therapy

Study	Participants	Spinal Pathology Studied	Treatment	Follow-up	Results	Conclusion
Wu et al[19]	19	Lumbar Facet joint	PRP	Followed up immediately, at one week, one month, 2 months, and 3 months following treatment	The outcomes were assessed as "good" or "excellent" for 9 patients (47.37%) immediately after treatment; 14 patients (73.68%) at 1 week; 15 patients (78.95%) at 1 month; 15 patients (78.95%) at 2 months; and 15 patients (78.95%) at 3 months	After 3 months, PRP injections were shown to be safe and effective for treating lumbar facet joint pain
Wu et al[18]	46	Lumbar facet joint(s)	PRP	6 months	PRP: 80.96% Success rate with no acetaminophen use// CS: 85% success rate with acetaminophen usage	PRP was more effective because patients did not have to use acetaminophen after the treatment began
Singla et al[11]	40	Sacroiliac joint	PRP	3 months	PRP was 10.9 times better at 6 weeks and 37.3 times better at 3 weeks, with a 90% effectiveness (CS at 75%)	PRP was 90% effective, whereas steroids were only 75% effective
Kotb et al[20]	30	Lumbar facet joint	PRP	3 months	PRP injections promoted better performance markedly in all parameters including range of motion with a *P* value of <0.001 compared with CS injections	PRP showed a clinical improvement in lumbar facet joint tenderness and overall range of motion
Aufiero et al[21]	5	Lumbar facet joint	PRP	6, 9, and 12 months	PRP injections in the case series showed an improvement of functionality and a return to active sports at about 50% of patients after the second injection	Patients also reported reduced fear and anxiety over inciting events, improved sleep, and decreased pain medication use after PRP injections

CS = ceftriaxone and sulbactam, PRP = platelet-rich plasma

pain. However, this study did not treat patients with PRP, so it cannot be concluded that corticosteroid injections are the superior treatment option for lumbar back pain secondary to osteoarthritis. Furthermore, it would be beneficial for future research to include studies that not only compare the efficacy of PRP versus corticosteroid injections for treating LBP but include different regions of the back as well.

One such article that investigated the efficacy of PRP versus corticosteroid injections for the treatment of LFJ syndrome was the article by Singh et al.[17] This study implemented a longer follow-up period compared with

other studies evaluated for this review (6-month follow-up period). For 6 months posttreatment, both corticosteroid injections and PRP were safe and effective in treating LFJ syndrome, with no clear difference between the two treatments.[17] However, for patients who suffer from LFJ syndrome, PRP was shown to be the better option for longer efficacy.[17] Ultimately, for the treatment of LFJ syndrome, autologous PRP is the best choice based on current research. Further studies are required to investigate if autologous PRP is the best treatment option for any type of facet joint–related back pain, not just LFJ syndrome.

Platelet-Rich Plasma

PRP has been gaining popularity in recent years among various medical specialties to treat various conditions. Specifically, PRP has been used in the treatment of cervical and lumbar facet-mediated pain.[11] PRP is a sample of blood typically taken from the patient himself/herself, then centrifuged to separate into three layers (PRP, platelet-poor plasma, and red blood cells). It has an increased concentration of growth factors, platelets, and fibroblasts/osteoblasts, which increases blood flow to new tissues through angiogenesis and increases the new tissues' tensile strength.[11] Overall, PRP attempts to enhance the body's natural healing methods.

Per the results found in the study of Xuan et al,[22] PRP had the same objective results regarding VAS scale and baseline pain scales as corticosteroid injections, which led to the conclusion that PRP injections require further research. Nevertheless, PRP showed a higher patient satisfaction rate than corticosteroid injections. Furthermore, this indicates that PRP is more efficient in reducing pain from the patient's point of view.[22] On the other hand, in the Singla et al[11] study, the results showed that group P experienced markedly greater reductions in the VAS scale at 6 weeks and 3 months compared with that of group S. Moreover, the results of Wu et al[18] demonstrated that more than 40% of the patients who received steroid injections had to use acetaminophen to further help alleviate the pain, whereas only 23.8% of the patients who were treated with PRP had to use acetaminophen. This shows that PRP, although objectively it did not reduce the pain more than steroid injections, still had a more efficacious outcome. Also, patients who suffer from hip, knee, and ankle osteoarthritis reported substantial pain relief and improved functionality following IA PRP injections, according to the study's finding.[16] Moreover, in the study of Singla et al,[11] a 25% difference was observed in success rate from PRP and corticosteroid injections. In conclusion, the results of these two trials imply that PRP injections, as opposed to corticosteroid injections, may provide a more efficient and long-lasting pain reduction and higher levels of patient satisfaction in treating LFJ(s) atrophy. It is crucial to remember that precise numerical outcomes and patient reactions differed across the two trials, and more investigation may be required to corroborate these findings and create a more widespread agreement on the best course of action for treating this problem.

Ultimately, based on the articles studied in this systematic review, results show that PRP is the better treatment option for facet-joint back pain. The Singh et al[11] study showed that PRP leads to longer efficacy. Further studies are required to determine whether PRP is the better treatment option (compared with corticosteroid injections) for treating hypertrophic facet joints in the spine, not just in the lumbar spine. In addition, there is no definitive standardized concentration of platelets and amount of PRP that is required to achieve a minimal efficacy for any condition. This is a huge gap in research that could help lead to increased patient satisfaction scales, longer efficacy, and reduced pain once a standardized PRP treatment is created.

Future Considerations

It is important to acknowledge potential risks and benefits to evaluate future side effects of PRP and corticosteroid injections as treatment for hypertrophic facet joints. Because these are innovative treatments, it is not known with certainty what implications patients may have long term. Additional key points to consider are the price of each treatment and the capacity to mass produce each treatment method.

PRP is a regenerative medicine option that has become the center of attention for its effectiveness and safety of the patient's result. This is more commonly seen in therapeutic applications, such as in the field of orthopaedics, just as is shown in our study, because innovation has made it effective for the use of reducing pain and tissue healing, sports medicine and dermatology being the most common areas in which it has been applied.

Limitations

During this publication, there is still notable room for expanding on the effects of PRP in facet joints. Future studies should be conducted to further explore these effects. Some notable topics to include would be what the

proper injectate should be inserted to not rupture facet joints but rather promote regeneration, what a sufficient concentration of cells to use in PRP would be to generate a beneficial therapeutic response in patients, and a meta-analysis and cohort study would also help show the efficacy of PRP versus corticosteroids.

Conclusion

This research aims to assess the efficacy of PRP as a treatment for facet joint-originating back pain. After an extensive review of the currently available research, it has been concluded that PRP should be pursued more as a viable treatment option for spinal injuries like spondylosis.

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