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Comparison of Platelet-Rich Plasma Injections and Hyaluronic Acid Injections in the Treatment of Knee Osteoarthritis

Isaac Knutson
University of North Dakota

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by

Isaac Knutson, PA-S

Bachelor of Science, Minnesota State University Moorhead, 2016

Master of Arts, University of South Dakota, 2017

Contributing Author: Professor Russell Kauffman, MPAS, PA-C

Dr. Jay Metzger, PhD, PA-C

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Abstract

Osteoarthritis is one of the most common diseases that people can suffer from in today's society. This degenerative disease can affect any of the body's joints, but is most common in the knees, hands and spine. Osteoarthritis occurs when the protective cartilage that covers the ends of bones in joints wears down. This lack of protective cartilage leads to the bones grinding on each other causing loss of range of motion, pain, and limited function. This review studied the effects of two specific treatments for knee osteoarthritis: platelet-rich plasma injections and hyaluronic acid injections. Both of these treatments can be provided by a primary care provider that has the proper training as well as an orthopedic specialist. Platelet-rich plasma injections are the patient's own blood products reintroduced into the affected joint to stimulate healing. Hyaluronic acid occurs naturally in the body, and when injected into a joint suffering from osteoarthritis, it can act as a joint lubricator/shock absorber to help decrease pain and improve function. The results of this study show that both platelet-rich plasma and hyaluronic acid injections can be effective in the treatment of knee osteoarthritis. However, platelet-rich plasma was shown to be more effective in reducing pain, increasing range of motion, and improving overall function.

Keywords: Osteoarthritis, knee, injections, platelet-rich plasma, hyaluronic acid, combination injections

Introduction

The two treatments that were analyzed in this project were platelet-rich plasma (PRP) injections and hyaluronic acid (HA) injections. These treatments are relatively new compared to the mainstay treatment options for osteoarthritis consisting of steroid injections and physical therapy. The two different injections under review are usually prescribed and performed by an orthopedic specialist after other conservative treatments have either lost their efficacy or have failed.

Osteoarthritis (OA) is a degenerative condition that can affect any joint in the human body. The chondral cartilage lines the ends of the bones so that when the joint is moved, the bones do not wear down on each other. When a patient begins to experience arthritis, this chondral cartilage wears down and the bones begin to grind on one another. This condition advances with age and overuse of the joints. The most common joints affected are the knees and hands due to their amount of use over a person's lifespan. OA can affect many other joints as well that include the spine, hips, and shoulders. Risk factors that can increase a person's risk of developing OA include obesity, sex (women are more prone to OA), increased joint use, and previous joint injuries.

PRP injections are autologous blood products that are injected directly into the affected joint. The theory behind this treatment is that your own blood products have many different growth factors, such as fibroblast growth factor, and cytokines. These different growth factors and cytokines are believed to be released by platelets after tissue damage and they are involved in the preservation and possible regeneration of the chondral tissue (Moretti et al., 2022). PRP injections are obtained by drawing blood from the patient then using a centrifuge to break the blood down into the PRP. The PRP is then injected into the affected joint.

HA has been used as a treatment for knee osteoarthritis longer than PRP injections. Commonly called “rooster comb” injections, HA injections are similar to PRP injections in how they work on arthritic joints. Hyaluronic acid is found naturally in many different tissues that include animal and human tissues. When HA binds to cells in the chondral tissue, it triggers the release of cytokines and stimulates cell cycle proteins. When a joint starts to lose its cartilage, the joint has less natural HA than a healthy joint. When HA is injected into the knee joint, the binding of the acid with the cell receptors can trigger the release of cytokines and stimulation of cell cycle proteins, which can lead to increased joint lubrication and possible chondral tissue proliferation (Petterson and Plancher, 2019). HA injections are injected into the affected joint, usually at the rate of 3-5 injections over many weeks. However, depending on each individual patient, one injection can relieve symptoms.

This literature review will compare PRP injections and HA injections with regards to their effectiveness at decreasing pain and delaying joint replacement surgery in patients with knee osteoarthritis.

Statement of the Problem

Osteoarthritis is one of the most common diseases diagnosed in the United States. It can be debilitating and painful due to the symptoms that patients experience. Patients are always looking for safe, effective, and affordable treatments to alleviate their pain. By using these treatments, they are looking to delay the eventual surgical intervention that may be required.

Research Question

In patients with knee osteoarthritis, do platelet-rich plasma or hyaluronic acid injections have better pain reduction and delay joint replacement surgery?

Methods

A literature review was performed using the online databases CINAHL and PubMed. Keyword searches were used to find articles that discussed the use of platelet-rich plasma injections or hyaluronic acid injections in the treatment of knee osteoarthritis. Keywords that were used were osteoarthritis, injections, platelet-rich plasma, hyaluronic acid, knee, and combination injections. Between the two databases, there were a total of 417 studies found. Most of the studies were excluded because they either discussed different types of injections for treatment (such as corticosteroid injections) or they discussed other joints that were treated besides the knee joint.

Literature Review

Treatment of Knee Osteoarthritis using PRP Injections

Fernandez-Fuertes et al. (2022) conducted a study looking at the clinical response of patients with knee osteoarthritis that were treated with PRP injections. In this study, there were 130 patients, 60 were men and 70 were women. Both the left (43.8%) and the right knee (56.2%) were represented in this study. The mean age of the participants was 63.04 ± 10.7 years and a median BMI of 28.37 ± 3.98. The most common grade of OA in the study was grade 2, but all 4 grades of OA were represented. The patients' knees were injected with autologous blood three times, with four weeks in between each injection. Before the PRP was injected, the blood was frozen which allowed for "platelet disruption, platelet factor release and long-term storage" (Fernandez-Fuertes et al., 2022). The scale that was used to assess their pain was the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). This scale considers knee pain, stiffness, and function. WOMAC scores are rated as follows: Low=<35.3, Medium=35.4-51.4, and high=>51.5. The researchers reassessed each patient using the WOMAC scale at 3

months, 6 months, and 1-year post-injection. This study used chi-sqaure tests as well as a *t* test. Results of the study showed that in 70% of patients, there was a reduction in their WOMAC pain score, improvement in both stiffness and function of their osteoarthritis, and there was no report of any adverse events.

When comparing the statistics from the baseline pain scale scores and a one-year follow up on that same scale, there was a 25.72% ± 46.04% reduction in pain across the study. In the WOMAC global scale, patient responded as follows: Baseline: 44.2 ± 17.2, 3-month follow up: 31.8 ± 20.6, 6-month follow up: 31.7 ± 21.2, 1-year follow up: 31.9 ± 20.8. There was statistically significant improvement at the one-year mark, with p values < 0.001 for the medium WOMAC score as well as the high WOMAC score compared to baseline.

According to the results of this study, using PRP injections for knee osteoarthritis is an effective way to reduce pain/stiffness. This study was good at showing that there was improvement post-PRP injection throughout the study by being reassessed at the 3-month, 6-month, and 1-year intervals (Fernandez-Fuertes et al., 2022). A weakness of this study is that there wasn't really a possible way to have a solid control group. Most of their patients had already tried other treatments such as NSAIDs in the past, so it was difficult to gather a group of people with zero previous treatments for osteoarthritis. There also was no placebo group in this study and there was limited exclusion criteria. This could include comorbidities, surgical history, and the grade of knee osteoarthritis.

Altamura et al. (2020) evaluated the effectiveness of PRP injections in sport-active patients that have been diagnosed with osteoarthritis and/or cartilage degeneration in their knees. The inclusion criteria for this study was as follows:

> "(1) unilateral symptomatic knee with history of chronic pain (at least 4 months) or swelling, (2) imaging findings of cartilage degeneration (Kellgren–Lawrence score of 0 but with chondropathy detected by magnetic resonance imaging) or OA (Kellgren–Lawrence score of 1-3) (3) playing a sport at any level, (4) ≤50 years old." (Altamura et al., 2020).

Patients were excluded because of "age greater than 50 years, Kellgren–Lawrence score more than 3, major axial deviation (varus> 5°, valgus> 5°), focal chondral or osteochondral lesion, presence of any concomitant knee lesion causing pain or swelling (i.e., meniscal or ligamentous injury), inflammatory arthropathy, hematological diseases, severe cardiovascular diseases, infections, immunodepression, treatment with anticoagulants or anti-aggregants, use of nonsteroidal anti-inflammatory drugs in the 5 days before blood harvesting, hemoglobin lower than 11 g/dL, and platelet count lower than 150,000/mm^3" (2020).

The participants in the study were treated with 3 PRP injections in their affected knee, scored at baseline using the Kellgren-Lawrence scale, International Knee Documentation Committee (IKDC) scale, Tegner scores, and a EQ-VAS score. They were then retested at 2, 6, 12, and 24 months post injections. The Kellgren-Lawrence scale uses radiographs to classify severity of osteoarthritis by looking at osteophyte formation and joint space narrowing. The scale is 0-4 with 4 being the most severe. The Tegner scores are based on the patients' level of activity with a score of 0 being disabled and a score of 10 being at the level of a professional athlete. EQ-VAS scores are a subjective score made by the patient based on their current health. A score of 0 would be that the patient is in the worst possible health and a score of 100 means that they are in their best possible health. The IKDC scale is a subjective questionnaire that assess daily function and activity level of the patient. Patients were also asked about how they

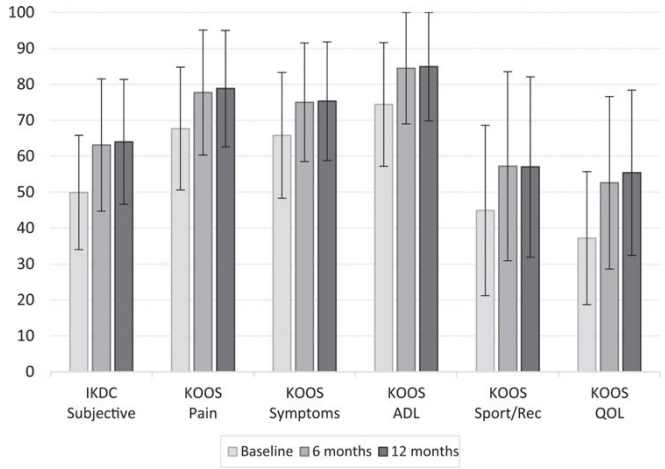
were able to return to their sport with regards to activity level/performance before their knee symptoms started. The results showed improvement in the IKDC scores following the treatment at the different follow ups. From baseline to 2 months the IKDC score went from 59.2 ± 13.6 to 68.0 ± 13.9, at 6 months it went up to 69.9 ± 13.8, at 12 months the scores went up to 70.6 ± 13, and at 24 months the scores went up to 76.7 ± 12.5. These were statistically significant at $p<0.001$. The EQ-VAS score improvement was also statistically significant at 24 months: 85.5 ± 8.6, $p < 0.001$ vs. baseline. Return to sport (RTS) was a more difficult aspect of this study because only half of the patients were able to return to the level of activity that they had previously experienced. This poor outcome was not new information for the researchers. They expected diminished results because with high impact activities, RTS is difficult even with proper treatment.

This was a suitable study because it took multiple scoring systems to rate how the patients improved such as the IKDC, EQ-VAS and their functional return to sport. Weaknesses of this study include that there was no control group studied, no post-injection imaging was performed on the patients to assess the effectiveness of the treatments at a tissue level, and the study had a large enough population to find sufficient data, but having more patients would have been more beneficial.

Boffa et al. (2021) wanted to evaluate how injection-based treatment results were scored. In the past, the International Knee injury Documentation Committee subjective score (IKDC) and the Knee injury Osteoarthritis Outcome Score (KOOS) were used regularly. This study wanted to better measure patient outcomes by using the Minimal Clinically Important Difference (MCID) and Patient Acceptable Symptom State (PASS) to better interpret patient outcomes from their IKDC/KOOS scores. “This study included 215 patients with knee OA (68% men, 32%

women; age, 53.2 ± 11.3 years; body mass index, 26.8 ± 4.3 kg/m2) who underwent intra-articular PRP injections" (Boffa et al., 2021). The patients were measured at their baseline as well as at 6 and 12-month post injections. Each injection consisted of 5 mL PRP which was 4 to 5 times higher blood concentrations than baseline blood values. The results showed that all the scores significantly improved over the course of the study (p<0.001). The graph below demonstrates how each type of scoring improved over the baseline at 6 months and at 12 months (the higher the score, the more improvement there was in that section). This study showed that these two newer parameters may help interpret patients' scores better. Weaknesses of this study include that the patients were treated in a research facility so this cannot be called real practice, their patient sample size was not large, and they found that sex/age seemed to alter the results, but this did not show up in the "multivariate analysis". There was also more men than women, which could have skewed the study, and a larger patient population may have helped fixed that issue.

Graph 1



- Graph 1: Graph comparing the different scoring systems that are used when evaluating PRP injections and their effectiveness (Boffa et al., 2021).

Treatment of Knee Osteoarthritis using HA Injections

Petterson and Plancher (2019) conducted a study to test the effectiveness of HA injections in patients with idiopathic knee osteoarthritis compared to a placebo injection of 0.9% saline. There were 369 patients that were randomly placed in the HA injection group or the saline injection group. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scale was used to assess the effectiveness of the injections at intervals of 2, 4, 8, 12, 20 and 26 weeks after the injections. The results of the study showed that there was a >50% improvement in patient outcomes using the HA injections compared to the placebo saline injections. There was a significant improvement from the baseline in the HA group (p=0.001) compared to the saline injection group (p=0.043). The conclusions from the study showed that HA injections are a "safe and effective treatment for providing a clinically meaningful reduction in knee pain in 2 weeks" (Petterson & Plancher, 2019). A quality aspect of this study is that it is a randomized control trial with a good treatment group as well as a good control group. A weakness of this study is that they used one brand name of the HA and there may be different brand names that may lead to different results.

Tschopp et al. (2023) performed a study that was different than many of the studies in the article search. The researchers decided to perform their trial on patients with less severe knee osteoarthritis. In this double-blind, placebo controlled, single-center trial they used three different types of injections along with the placebo. The different injections included glucocorticoids, PRP, HA and the placebo injection. 120 knees in 95 patients were able to be treated in this study after exclusion criteria. There was 30 per treatment group and each patient was given a type of treatment at random. These patients' knee osteoarthritis was mild-moderate, which was the main difference from other studies that mainly performed testing on patients with

severe knee osteoarthritis. Inclusion criteria included "radiographically confirmed knee osteoarthritis (Kellgren-Lawrence grades 1-3)" (Tschopp et al., 2023), knee pain or swelling for at least 3 months, German speaking, and consent to join the trial. Exclusion criteria included, but is not limited to, being younger than 18, end-stage osteoarthritis (grade 4), inflammatory disease, which includes conditions such as rheumatoid arthritis, and pregnancy. The trial started by randomly assigning each patient to a treatment group. They were then intraarticularly injected using fluoroscopy-guided techniques with 1 mL of contrast agent and one of the following medications: 1 mL of glucocorticoid, 6 mL of HA, or 3 mL of their own PRP. The placebo group received contrast agent only. This trial evaluated the treatment results based off a primary outcome, NRS pain scale (0-100 rating) and a secondary outcome, WOMAC scale.

The results showed that the only time there was a statistically significant improvement with any of the treatments when the patients were taking more oral analgesics than other patients based off a questionnaire ($p<0.001$) (Tschopp et al., 2023). This study shows that it is very difficult to test and accurately measure results when it comes to knee pain and overall improvement. This was a good trial and study since it was double-blind and randomized control trial with a placebo. However, they only were able to test 120 knees when they started off with 184 patients. This study could be improved if they increased their patient data pool. As stated in the article, the researchers recommended that based off their results, medical providers should use caution when using these medications for knee osteoarthritis due to the high likelihood that injections cause a placebo effect (Tschopp et al., 2023).

Shewale et al. (2017) studied different molecular weight HA injections in the treatment of knee osteoarthritis (low, medium and high molecular weight hyaluronic acid). The study was aimed to find out if these injections would help prevent or delay knee surgery. The results

showed that patients who received the LMWHA and the MMWHA injections had a lower incidence of surgery compared to those that used the HMWHA injections. However, this result was before the researchers factored in confounders. Once the confounders were accounted for, the results showed that there was no significant statistical difference between the three different levels of HA injections.

One interesting statistic in this study is they found that MMWHA injection users were more likely to use corticosteroid injections (61.94%, p=0.001) compared to LMWHA (57.1%, p=0.001) and HMWHA (60.4%) (Shewale et al., 2017). Overall, they found that the difference in molecular weight HA injections does not change the chance of needing surgery in the future. All three types of HA can help extend the time until surgery is needed, but the difference between the three injections is not significant (LMWHA hazard ratio 0.939, 95% CI, 0.870-1.013 and MMWHA HR, 1.032; 95% CI, 0.952-1.119). One strength of this study is that it had a very large patient base to study, n=30,417. A weakness of this study is they did not use a direct indicator to score knee pain or loss of function. They based the study off surgical outcomes instead of reducing pain, gaining ROM, or return to activity.

Treatment of Knee Osteoarthritis using a Combination Injection (PRP and HA)

Abate et al. (2015) performed a study that was designed to test the treatment success of knee injections comprised of PRP and HA. At the time, this combination was not studied. The combination of PRP/HA was compared to a second group that received PRP injections only. To be included in the study, patients must have had more than 3 months of mild-moderate knee osteoarthritis, based off the Kellgren-Lawrence score with proof from radiographs.

> "Exclusion criteria were the following: age >80 years, recent knee trauma, intra-articular injection with steroids, HA and/or PRP, current systemic treatments with steroids or

NSAIDs within the previous 3 months, rheumatic pathologies (rheumatoid, psoriatic and reactive arthritis, arthritis associated with inflammatory bowel diseases, and spondyloarthritis), severe systemic diseases (renal, hepatic, cardiac, infections, endocrinopathies, malignancies), immunodepression, anticoagulant or antiaggregant therapies, Hb values <11 g/dl, and/or platelet values <150.000/mm3" (Abate et al., 2015). The patients were injected using the same procedural techniques for both treatments. Results were measured with the visual analogue scale (VAS) and the study showed that both the combination injection as well as the PRP only injection both had significant reductions in their VAS. This study also showed that both treatments reduced the use of NSAIDs in the patient populations (in the PRP+HA group, NSAID use dropped from 37.5% to 12.5% after 6 months, in the PRP only group the rate dropped from 32.5% to 10% after 6 months). The statistics showed significant improvement in scores at rest as well as during activities compared to baseline, at the 1-month, 3-month, and 6-month marks (p<0.001 at all three stages for "at rest" and "activity"). Weaknesses of this study are the limited number of patients in the study as well as the fact that this is a "retrospective observational trial". This study also cannot rule out the possibility of a placebo effect.

Zhao et al. (2020) conducted a meta-analysis to study the effectiveness of a combination injection comprised of PRP and HA. This meta-analysis consisted of 5 randomized control trials and 2 cohort studies with 941 patients studied (Zhao et al., 2020). Inclusion criteria was a clear diagnoses of knee osteoarthritis (no matter age, gender, or nationality), administration of the PRP/HA combination, use of one of the following scales: Western Ontario and McCaster Universities Arthritis Index (WOMAC), Lequense Index, Visual Analogue Scale (VAS), or adverse events (AE), and no language barriers. Exclusion criteria included reviews, patients with

hip and knee arthritis, studies that did not use the combination of PRP/HA injections, and duplicate studies. The analysis of the studies showed that the combination injection showed statistically significant improvement in WOMAC scores, Lequense Index, and VAS scores compared to PRP injections alone (SMD: − 0.31; 95% confidence interval (CI): − 0.55 to − 0.06; $p = 0.01 < 0.05$). However, when it came to adverse events, there was not a significant difference when comparing the combination injection to the PRP-only injection. The meta-analysis looked over many studies that had a high number of patients that were treated for their knee arthritis. Some limitations of this review is that some of the studies were not randomized control trials and the follow up appointments for the studies were limited. They discussed that the studies would have been improved if they had a longer time frame of follow up appointments to reassess treatment efficacy (the longest study only followed up after 1 year). The studies also did not discuss if the patients that were treated had other knee conditions such as ligament instability, meniscus issues, or limb malalignment (Zhao et al., 2020). Conclusions from this meta-analysis are that a combination injection of PRP and HA would be beneficial to a patient suffering from severe knee osteoarthritis. The combination injection produced better treatment results when compared to a PRP injection series alone (three injections over 5 weeks).

Platelet-Rich Plasma Injections vs. Hyaluronic Acid Injections

Raeissadat et al. (2015) wanted to find out the long-term effects of using PRP injections compared to HA injections in patients with knee osteoarthritis. There were 160 patients total in the study (PRP *n*=87 and HA *n*=73) with no placebo or control group. 2 PRP injections, 4 weeks apart were administered to the PRP group, and three HA injections one week apart were administered to the HA group. Both groups were evaluated at the beginning of treatment and then 1 year after the treatment using WOMAC scoring (pain, stiffness, mobility). Results of the

study showed that both types of injections had reduction in knee pain, but the PRP injections had better results compared to HA injections (p=0.001). There was also more improvement in joint stiffness, mobility, and function in the PRP injection group compared to the HA group (p<0.001). In both treatment groups, there was a positive response to treatment, but it was not statistically significant (PRP p=0.47 and HA p=0.60). There was no difference in response to the different treatments in people over or under 55. The strength of this study is that it was a randomized controlled clinical trial. Two weaknesses of this study were lack of a placebo group and the fact that it is not a blind study.

Park et al. (2021) designed a study to compare the effects of PRP injections compared to HA injections in the treatment of knee osteoarthritis. This study was a randomized control trial that consisted of 110 patients, both male and female, that experienced symptomatic knee osteoarthritis. They were either given one injection of PRP (commercial kit) or an injection of HA. Their symptoms were assessed to obtain a baseline score before the injection using the International Knee Documentation Committee subjective score as well as a WOMAC and VAS score which has been discussed previously (Park et al., 2021). Their symptoms were then reassessed at the 6-week, 3-month, and 6-month intervals using the same scales as the baseline scores. The results showed that PRP injections showed significant improvement in the IKDC scores at the 6-month interval (11.5 PRP vs. 6.3 HA; p=.029) (Park et al., 2021). Growth factors and cytokines were measured in the PRP before injection to determine their effect on the outcomes. This showed that patients with higher counts of growth factors and cytokines in the PRP injection were more likely to have better symptom outcomes.

This study shows evidence that PRP injections are more effective at reducing symptoms of knee osteoarthritis when compared to hyaluronic acid. HA injections still showed

improvement but not as much as the PRP injections. A weakness of this study is that there was no control or placebo group. They also only used one specific commercial PRP injection kit, which could have led to different results if they used either the patient's own blood products or a different brand of PRP (Park et al., 2021).

Discussion

Numerous studies have compared the effect of PRP and HA injections for knee osteoarthritis. While many of the study results show that PRP injections are more effective than HA injections, most agree that either of these treatments can help reduce the symptoms of pain, stiffness, and limited range of motion in joints with OA. Both PRP injections and HA injections can help delay the need for surgical intervention, such as a total knee replacement. For many patients, the goal of treatment is to reduce their symptoms but, ultimately, delay surgery for as long as possible. Many patients will eventually progress to the point where they need surgical intervention, but only as a last resort when conservative treatments are no longer effective.

In most of the studies that were analyzed, it was shown that PRP injections were more effective at reducing symptoms (Altamura et al., 2020) and reducing NSAID use (Abate et al., 2015) compared to HA injections. In these studies, a few different scores were used to achieve an objective baseline of the patients' symptoms before and after treatment. These scales included the WOMAC and the VAS score. The WOMAC is the most widely used pain scale when studying patients with any type of osteoarthritis. The WOMAC is a self-administered questionnaire that is divided into three different sub-categories. These include pain, stiffness, and function with 24 questions in total. Both treatments showed a reduction in the WOMAC scores at different times during the treatment (3, 6, and 12-month intervals), but PRP was shown to have a larger decrease in scores compared to HA injections (Fernandez-Fuertes et al., 2022).

Petterson and Plancher (2019) conducted a study that showed some different results than most studies that were analyzed. They conducted their study using HA injections and compared them to placebo injections, which were saline only. Their research showed that there was a statistically significant improvement in the patient's symptoms when using the HA treatment (Petterson & Plancher, 2019). However, another study that researched the effectiveness of HA injections showed that the only time there was a significant improvement in knee osteoarthritis symptoms was when the patients were taking more oral analgesics along with their injections (Tschopp et al., 2023).

Combination therapy has also been studied, where a patient's knee is injected with a combination of PRP and HA, which was compared with a group that received PRP-only injections. This study found that the combination injection was slightly more proficient in reducing NSAID use compared to the PRP injection only (Abate et al., 2015).

There are some limitations when osteoarthritis treatments are studied. Pain is an extremely subjective measure, which makes it difficult to quantify when comparing treatments. The WOMAC scale helps with this issue, but it is still not an exact representation (Tschopp et al., 2023). The studies also cannot control if the patient is attempting other treatments, such as NSAIDs, while they are participating in the study, which can lead to skewed results. The best way to measure the effectiveness of PRP and HA injections is to determine whether the function of the knee joint was improved with either treatment. Function is a more objective measurement compared to pain level and this leads to more accurate results.

This research study has shown that PRP injections, HA injections, and combination injections can all lead to improved patient outcomes in the treatment of knee osteoarthritis. PRP injections have been shown to be the most effective at treating the symptoms of OA, but both

treatments can be of benefit to the patient. All three treatments, PRP alone, HA alone and PRP + HA injections, can help reduce symptoms of OA, reduce NSAID use, and delay surgical intervention. The studies have also found that with advances in medical technology, PRP injections can also be more cost-effective when compared to HA injections. These treatments are normally not the final answer or a cure for OA. They are only a stall tactic that can be employed to improve the patient's quality of life before more invasive treatments are required.

The results of the study performed by Tschopp et al. showed that PRP injections and HA injections both have benefits when treating knee osteoarthritis; however, medical providers should use caution. There was no statistically significant improvement with either treatment during their study. They believe that injections of any kind can have a significant placebo effect. Medical providers should consider each patient's case individually when it comes to determining a treatment.

Both HA and PRP injections are great ways to improve the quality of life of people diagnosed with OA, but they should be used in combination with other conservative treatments as well as lifestyle modifications. Working with dieticians to decrease BMI and promoting exercise will improve the results of the injection therapy. This will lead to a greater reduction in patient symptoms and an improvement in quality of life. Combination therapy can also help the patients reach the ultimate goal of delaying surgical intervention as long as possible (Zhao et al., 2020).

Conclusion

In this research study, PRP injections and HA injections were compared in their effectiveness in treating knee osteoarthritis. Overall, knee osteoarthritis is one of the most common diseases that people suffer from. There are many different treatments that can help

alleviate symptoms such as oral analgesics, physical therapy, injections and eventually surgery. This research has shown that individually, PRP injections are more effective at treating osteoarthritis compared to HA injections. There is strong evidence that combination therapy (PRP and HA combined in an injection) may be the best option when compared to the individual injections. These beneficial treatments should also come with instruction on improving lifestyle habits as well. Weight management and exercise are two crucial factors, not only in prevention of osteoarthritis, but also in the effectiveness of treatments such as HA and PRP injections. Medical providers should continue to use evidence such as the articles discussed in this project in the decision-making process. However, the research has shown that they should also base each decision off each patient on an individual basis to determine the best treatment possible. Future research should investigate different ways to enhance the effectiveness of the PRP injections. Researchers may also study how other treatments such as stem cells may be used in conjunction with PRP or HA injections to increase effectiveness.

Applicability to Clinical Practice

With the research that has been conducted, it has been shown that PRP injections and HA injections can be beneficial to patients with knee osteoarthritis. This information can help streamline the treatment of osteoarthritis. Primary care providers who receive formal training to perform PRP and HA injections may provide this treatment. Otherwise, referral to an orthopedist would be required. If a primary care provider has researched the information about these treatments and taken the formal training, they can make informed decisions with their patients so they necessarily would not have to be referred to an orthopedic provider as soon as they would have been in the past. This would lessen the load that specialist providers encounter by treating them without having to refer them until they would need surgical intervention.

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