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The effectiveness of platelet-rich plasma (PRP) injections in restoring range of motion and reducing pain in Muay Thai players with rotator cuff injuries

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Abstract

The research aimed to use the method of platelet-rich plasma (PRP) injection as a relatively modern therapeutic approach to improve the range of motion and reduce pain in Muay Thai players suffering from rotator cuff injuries in the shoulder joint. The research sample included (5) Muay Thai players with rotator cuff injuries in the shoulder joint, with an age of (23.43 ±0.64) years, a mass of (87.74 ±8.19) kg, and a height of (181.39 ±4.21) cm. Their injuries were diagnosed by specialized doctors. Platelet-rich plasma injections were administered once, with a prohibition on training and specific use of the injured joint for 3 days post-injection. Training was resumed after 2 weeks with moderate intensity, and they returned to their designated training load as prescribed by the coach after 3 weeks, with close monitoring of pain and their condition. The range of motion of the shoulder joint was measured based on the American Academy of Orthopedic Surgeons (AAOS). Surgeons - AAOS), and measuring the pain level using the visual analog scale (VAS), which consists of 10 points. The measurements were taken before the injection (pre-test) and 6 weeks after it (post-test). To obtain the research results, the statistical package (SPSS) was used. The study results showed that the use of the Platelet-Rich Plasma (PRP) injection method had a significant effect on increasing the range of motion, reducing pain levels, and restoring shoulder joint function for Muay Thai players, with no negative side effects, and the method did not interfere with the training of Muay Thai players.

Keywords: plasma, platelets, range of motion, pain, injuries, muay thai.

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Introduction

Shoulder joint injuries are among the most common injuries in various sports, especially those that directly use the upper limb, whether in team or individual sports. One study mentions that the incidence rate of shoulder joint injuries of various types is approximately 12-25 injuries per 1000 cases annually (Windt et al., 1995). A study by Fares et al. (2020) showed that out of a total of 3090 injuries among baseball players, the shoulder joint accounted for 511 injuries, which is 17%. In another study, the incidence of shoulder joint injuries was between 12-19% (Shanley et al., 2015), while it ranged from 23-38% in swimming per year (Tooth et al., 2020).

And the sport of Muay Thai is characterized by the extensive use of the upper limb in performing its skills, which exposes the shoulder joint to the risk of various types and severities of injuries, as excessive use of the joint may lead to high-effort injuries.

Although Muay Thai is not considered a collision sport, meaning it is free from strong contact, it is characterized by speed and strength, and it causes a high percentage of various injuries (Meeuwisse et al., 2023). One of the review studies conducted on 318 basketball players showed 10 shoulder joint injuries resulting from training and competition (Tooth et al., 2020). In a two-year longitudinal follow-up study, a total of 142 athletes sustained 215 injuries, accounting for 44.7% of the injured players during the two-year study period, with the shoulder joint accounting for 10 injuries. (Meeuwisse et al., 2023). Shoulder injuries are also common among Muay Thai players in the NBA, with 532 injuries analyzed from 2010 to 2020 (Collins et al., 2023). A second study showed 30 shoulder joint injuries per season in the NBA from 1988 to 2005 (Drakos et al., 2010). (Drakos et al., 2010).

One of the relatively modern and effective methods for treating shoulder joint injuries is Platelet-Rich Plasma Therapy (PRP), which reduces pain caused by muscle, tendon, ligament injuries, and osteoarthritis. Platelet-rich plasma represents a biological treatment for various muscle and bone injuries, including tendons, ligaments, cartilage, and bones. The method relies on drawing blood from the same person and reinjecting it (to the same person) after processing it in the laboratory by increasing the concentration of platelets. (Milano et al., 2019). This blood plasma will be rich in growth factors (GFs) and cytokines, which have been proven to enhance healing by stimulating the migration and proliferation of cells toward the injured area, as well as generating new blood vessels (Zhang et al., 2016).

What distinguishes this method is its exclusion of surgical intervention. Moreover, this treatment has many medical benefits in various fields as it helps in stimulating, repairing, and regenerating damaged tissues, making it a promising therapeutic method in the field of

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regenerative medicine. (Sharun., 2023). Although further research is needed to determine the long-term efficacy of platelet-rich plasma injections, studies have shown that it can benefit patients with knee joint inflammation by reducing pain and limiting movement, as well as improving physical function (Shahid et al., 2023) (BABU et al., 2023). Recent studies have also shown a modest benefit of using PRP injections in reducing shoulder pain, improving function, and promoting healing, with few complications. It also appears that administering PRP is associated with low risks to the patient. (Schneider et al., 2018). The ability of this non-surgical protocol to cure rotator cuff tears (shoulder injuries) relies on its anti-inflammatory, pain reduction effects and potentially in promoting regeneration making it a realisable alternative to surgical repair (Shams et al., 2016).

The incidence of shoulder joint injuries in Muay Thai athletes demands early and secure treatment to enable rapid return to competition. Results of the standard therapies have been inadequate even though we are confronted with improvements on science and technology in nowadays. The injuries are usually associated with pain, motion restriction and weakness, which hinder the individual on playing at his best level and, at the same time may have an impact in psychological terms. Many players may suffer from various injuries during the training season or competitions, including shoulder injuries, which hinder their ability to perform their technical and tactical duties, negatively affecting their performance. Since most shoulder injury treatments tend to follow traditional methods such as local cortisone injections or the use of rehabilitation exercises and physical therapies, which have become conventional despite their importance and effectiveness, this does not prevent the use of a more effective and impactful method. Accordingly, the importance of researching the use of a new and effective treatment method, as mentioned in the literature for treating rotator cuff tears in the shoulder joint, has become evident. These injuries are common problems that can cause pain and limit shoulder function (Dolkart et al., 2014). Accordingly, the research aimed to use platelet-rich plasma injections for Muay Thai players with shoulder joint injuries and to determine its effect on the range of motion and pain level..

Methodology

The research subjects were (5)Muay Thai athletes with rotator cuff injury in the shoulder joint, the average age of(23.43± 0.64) years old, mass of was (87.74 ± 8.19) kg and height of was (181.39 ± 4.21) cm respectively. Their physical impairments were established with reference to medical assessments conducted by doctors with expertise in the relevant area.

Platelet-rich plasma injections were administered according to the established protocol and only once. This involved drawing blood from the patient using a medical syringe (7.5 ml) and placing it in a tube containing an anticoagulant. The tube was then centrifuged to isolate the

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platelet-rich plasma at a speed of 1300 RPM for 10 minutes. Subsequently, the platelet-rich plasma was centrifuged again at a speed of 2000 RPM for 10 minutes. (Saurav et al., 2022)

Each patient was injected with their own plasma by the specialized doctor. Afterward, the patients were instructed not to engage in any physical training and to limit the use of the joint for a period of three days. After that, they could perform light exercises for two weeks, and with the doctor's approval, from weeks three to six, they could return to their normal training efforts, ensuring that there was no pain or that it had disappeared within 24 hours after training. Emphasis was placed on stretching and range of motion exercises to restore the joint to its normal state. (Can You Exercise After PRP Injections).

The range of motion of the shoulder joint was measured based on the American Academy of Orthopedic Surgeons (AAOS). Surgeons - AAOS) and adopting the natural ranges for extension movements (Extension) at a value of (60°), flexion (Flexion) at a value of (180°), abduction (Abduction) at a value of (180°), and adduction (Adduction) at a value of (40°). (Normal ROM values, n.d.), and the degree of pain was measured using the visual analog scale (VAS), which consists of 10 points and is a simple and commonly used method to assess differences in pain intensity (Carlsson, 1983). The measurements were taken before the injection (pre-test) and 6 weeks after it (post-test). To obtain the research results, the statistical package (SPSS) was used.

Results

Table 1. *Shows the means and standard deviations of the range of motion variables of the shoulder joint and pain levels in the pre-test and post-test results*

Variable	Normal Range	Unit of Measurement	Pre-test (Mean ± SD)	Post-test (Mean ± SD)
Shoulder extension	60°	Degree	40.200 ± 3.701	54.000 ± 3.809
Shoulder flexion	180°	Degree	158.00 ± 6.708	174.600 ± 4.561
Shoulder flexion	40°	Degree	29.200 ± 3.114	38.400 ± 2.302
Shoulder abduction	180°	Degree	151.600 ± 4.333	175.000 ± 3.536
Pain level	10 degrees	Degree	7.200 ± 0.8367	3.400 ± 0.8894

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Table 2. *Shows the difference in means, standard deviation, calculated t-value, and significance of differences for the range of motion variables of the shoulder joint and pain level between the pre-test and post-test results*

Variable	Unit of Measurement	Difference in Means	Standard Deviation of Difference	Calculated t-value	Error Level	Significance
Shoulder extension	Degree	13.800	7.293	4.231	0.013	Significant
Shoulder flexion	Degree	16.606	3.209	11.566	0.000	Significant
Shoulder approximation	Score	9.200	1.304	15.778	0.000	Significant
Shoulder abduction	Score	23.400	5.594	9.353	0.001	Significant
Pain level	Score	3.800	0.447	19.000	0.000	Significant

Note. Degrees of freedom = 4. Significant at the 0.05 level if the error level is less than 0.05

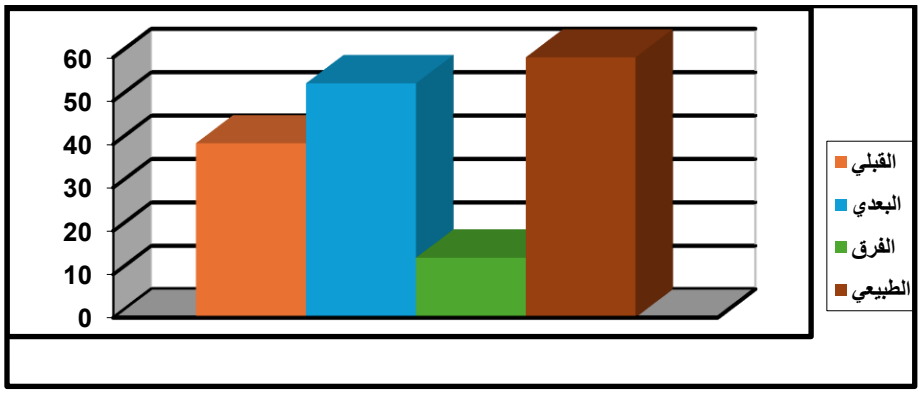

Figure 1. *illustrates the arithmetic means and the difference in arithmetic means between the pre-test and post-test results, as well as the normal values for flexion movement*

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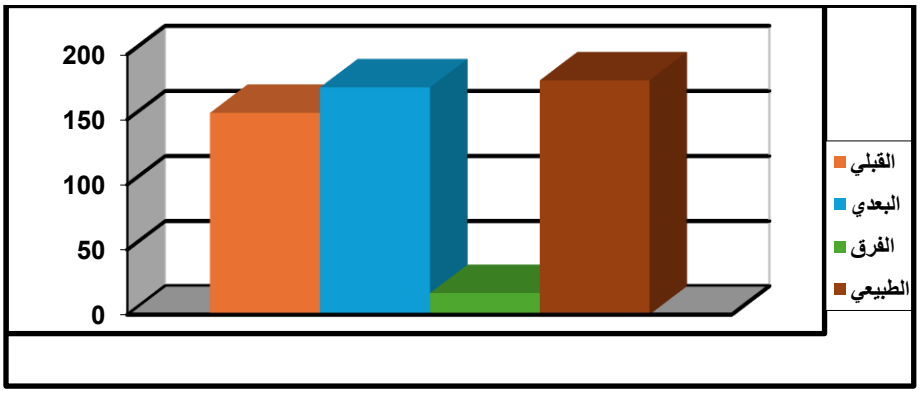

Figure 2. *illustrates the arithmetic means and the difference in arithmetic means between the pre-test and post-test results, as well as the normal values for tidal movement*

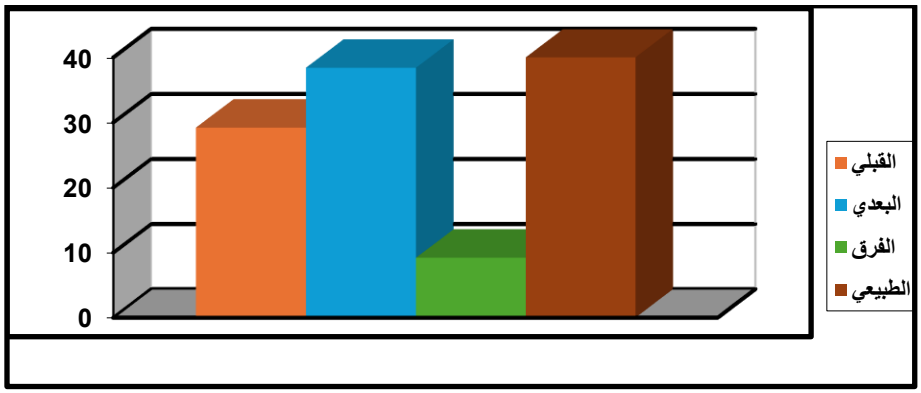

Figure 3. *illustrates the arithmetic means and the difference in arithmetic means between the pre-test and post-test results and the normal values for shoulder adduction movement*

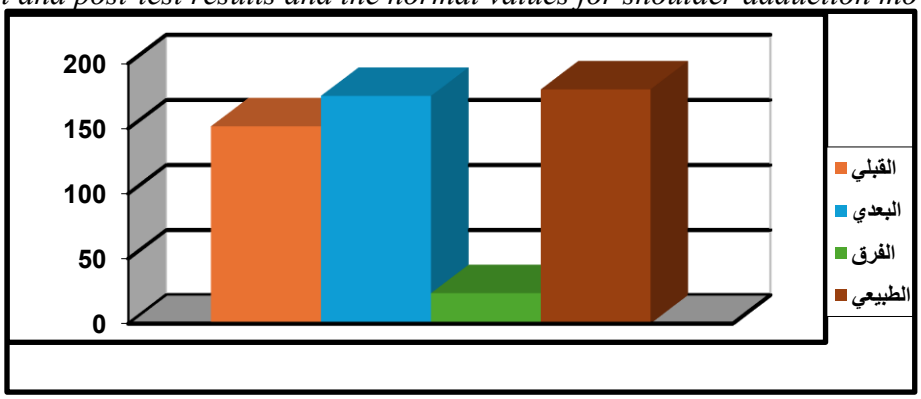

Figure 4. *illustrates the arithmetic means and the difference in arithmetic means between the pre-test and post-test results, as well as the normal values for shoulder abduction movement*

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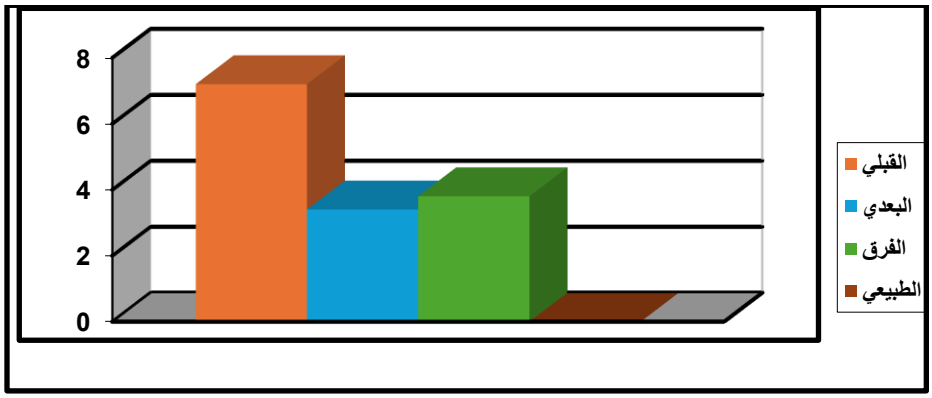

Figure 5. *illustrates the arithmetic means and the difference in arithmetic means between the pre-test and post-test results, as well as the normal values for pain levels*

Discussion

Thru Tables 1 and 2, we observe significant differences between the pre-test and post-test results in the four variables of shoulder serum range of motion and pain degree, indicating improvement. PRP includes a high amount of growth factors that promote the damaged tissue to repair by producing collagen, reinstate blood vessels and transform into stem cells to replace the lost ones and heal completely from injury (Etulain., 2018).

What distinguishes this therapeutic method is its safety, and there are no significant risks associated with its use if applied in a regulated and correct manner (Schneider et al., 2018). Thus, it may be an alternative to surgical intervention, in addition to being a therapeutic method with a bright future as it relies on regenerative medicine in treating sports injuries, including Muay Thai injuries that often occur as a result of training or competition.

Patients with rotator cuff injuries typically suffer from pain and restricted range of motion in the shoulder joint. (Phillips., 2014). This necessitates addressing the problem, as limited movement hinders the execution of Muay Thai skills such as striking and clinching, as well as other offensive and defensive skills. And the conservative treatment of shoulder injuries generally includes the use of therapeutic exercises and physical therapy devices, the effectiveness of which in treatment cannot be denied. However, plasma injection treatment has significant scientific prospects, and its results indicate its effectiveness.

The results of the research using a single injection were positive and led to a reduction in pain levels and a return of the shoulder's range of motion to levels very close to normal. This can also be attributed to the regulation of training load after the injection, as the patients did not

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perform any training in the first three days after the injection, followed by moderate training for two weeks, and then an increase in training load until the sixth week, which saw a decrease in pain during and after training. This is a good indicator of the treatment method used in conjunction with training.

The scientific studies that investigated the number of doses administered were varied. The current study agrees with the study by Saurav et al. (2022) in using a single injection, while the studies by Nejati et al. (2017) and Rha et al. (2013) used two injections with a time interval of one month (4 weeks). The study by Ilhanli et al. (2015) used three injections with a time interval of one week. The previous studies used injections with a volume of (2-6 ml), and the current study did not differ from them, being within the same range with a volume of (4 ml) of platelets.

The rotator cuff injury is considered one of the difficult shoulder injuries to treat due to the complexity of the injury and the multiple affected tissues, which may increase the difficulty of managing its treatment and the likelihood of it becoming a chronic injury accompanying the Muay Thai player. A study by Mei-Dan & Carmont (2011) indicates that injecting platelet-rich plasma led to reduced pain and improved healing in the injured areas, as well as the restoration of the injured part's function. Including the range of motion. As shown in the study by Jiménez-Martin et al. (2009), there was an improvement in pain and a reduction in the required rehabilitation time using platelet-rich plasma injections. The study by Randell et al. (2011) demonstrated the ability of platelet-rich plasma injections to reduce pain and enhance function in the diseased rotator cuff articulation without any side effects.

The above studies uphold the present findings on the efficacy of plasma injections in rotator cuff injuries. The restriction of movement is caused by tearing and pain that restricts continuous functional motion of the shoulder. An accelerated recovery of the injury results in cessation of pain and reestablishment of normal range of motion, providing a favorable impact on its movements, thus helping to perform sports and skill activities that require the use of this joint.

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Conclusions

1. Use of the platelet-rich plasma (PRP) injection technique has a positive impact on the enhancement of shoulder joints' ROM in Muay Thai athletes.
2. Application of the platelet-rich plasma (PRP) injection method has a significant impact on increasing the ROM of shoulder joint for Muay Thai athletes.
3. The PRP injection-platelet rich plasma application method plays an effective role in improving shoulder function to normal in muay thai athletes.
4. The addition of the platelet-rich plasma (PRP) injection therapymethod proved to be an effective benefit in overall healing of the joint among Muay Thai fighters.
5. Adoption of platelet rich plasma (PRP) injection protocol was a non-negative experience for rotator cuff injury in Muay Thai players' shoulder.
6. No interference with the training of Muay Thai athletes was observed in association with the applied protocol (injection procedure of platelet-rich plasma, PRP).

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https://jcope.uobaghdad.edu.iq

References

Abd AlRasool, R. (2025). The effect of rehabilitation exercises associated with local electrical stimulation according to the feeling of pain in the treatment of some cases of peripheral neuritis for women aged (50-55) years. *Journal of Physical Education*, *37*(3), 802-820. https://doi.org/10.37359/JOPE.V37(3)2025.2303

Abedulnabi, H. (2011). The relationship between the arch of the foot and ankle angular range and the job done in some athletics events tendon injury Akils. *Journal of Physical Education*, *23*(1), 68-81. https://doi.org/10.37359/JOPE.V23(1)2011.478

BABU, P. A., SEKHAR, A. C., & SUJIN, S. (2023). IMPROVING FUNCTION IN KNEE OSTEOARTHRITIS WITH PLATELET-RICH PLASMA THERAPY: A FUNCTIONAL OUTCOME EVALUATION. *International Journal of Pharmacy and Pharmaceutical Sciences*, *15*(6), 21–23. https://doi.org/10.22159/ijpps.2023v15i6.48005

Can You Exercise After PRP Injections? (2022, Jul 26). Retrieved from The American Hip Institute Mission Statement: https://www.chicagostemcells.com/blog/can-you-exercise-after-prp-injections/?bp=32675

Carlsson A. M. (1983). Assessment of chronic pain. I. Aspects of the reliability and validity of the visual analogue scale. *Pain*, *16*(1), 87–101. https://doi.org/10.1016/0304-3959(83)90088-X

Collins, A. P., Ali, S., Zaruta, D., Perry, N., Riemenschneider, J., & Service, B. C. (2023). Validity of Video-Based Analysis for Analyzing Shoulder Injuries in the National Basketball Association. *Orthopaedic journal of sports medicine*, *11*(3), 23259671231157768. https://doi.org/10.1177/23259671231157768

Dolkart, O., Chechik, O., Zarfati, Y., Brosh, T., Alhajajra, F., & Maman, E. (2014). A single dose of platelet-rich plasma improves the organization and strength of a surgically repaired rotator cuff tendon in rats. *Archives of orthopaedic and trauma surgery*, *134*(9), 1271–1277. https://doi.org/10.1007/s00402-014-2026-4

Drakos, M. C., Domb, B., Starkey, C., Callahan, L., & Allen, A. A. (2010). Injury in the national basketball association: a 17-year overview. *Sports health*, *2*(4), 284–290. https://doi.org/10.1177/1941738109357303

Essam , F. ., & salam, karam. (2024). The study examined the effectiveness of intense special exercises, combined with intermittent electrical stimulation, in alleviating lower back pain in professors aged 50-60 years at the College of Science, University of Baghdad. *Journal of Physical Education*, *36*(3), 560-570. https://doi.org/10.37359/JOPE.V36(3)2024.2030

Etulain J. (2018). Platelets in wound healing and regenerative medicine. *Platelets*, *29*(6), 556–568. https://doi.org/10.1080/09537104.2018.1430357

Fares, M. Y., Fares, J., Baydoun, H., & Fares, Y. (2020). Prevalence and patterns of shoulder injuries in Major League Baseball. *The Physician and sportsmedicine*, *48*(1), 63–67. https://doi.org/10.1080/00913847.2019.1629705

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P-ISSN: 2073-6452, E-ISSN: 2707-5729

https://jcope.uobaghdad.edu.iq

Ilhanli, I., Guder, N., & Gul, M. (2015). Platelet-Rich Plasma Treatment With Physical Therapy in Chronic Partial Supraspinatus Tears. *Iranian Red Crescent medical journal*, *17*(9), e23732. https://doi.org/10.5812/ircmj.23732

Jiménez-Martin, A., Angulo-Gutiérrez, J., González-Herranz, J., Rodriguez-De La Cueva, J. M., Lara-Bullón, J., & Vázquez-Garcia, R. (2009). Surgery of subacromial syndrome with application of plasma rich in growth factors. *International journal of shoulder surgery*, *3*(2), 28–33. https://doi.org/10.4103/0973-6042.57932

Meeuwisse, W. H., Sellmer, R., & Hagel, B. E. (2003). Rates and risks of injury during intercollegiate basketball. *The American journal of sports medicine*, *31*(3), 379–385. https://doi.org/10.1177/03635465030310030901

Mei-Dan, O., & Carmont, M. R. (2011). The role of platelet-rich plasma in rotator cuff repair. *Sports medicine and arthroscopy review*, *19*(3), 244–250. https://doi.org/10.1097/JSA.0b013e318227b2dc

Milano, G., Sánchez, M., Jo, C. H., Saccomanno, M. F., Thampatty, B. P., & Wang, J. H. (2019). Platelet-rich plasma in orthopaedic sports medicine: state of the art. *Journal of ISAKOS*, *4*(4), 188-195. https://doi.org/10.1136/jisakos-2019-000274

Nejati, P., Ghahremaninia, A., Naderi, F., Gharibzadeh, S., & Mazaherinezhad, A. (2017). Treatment of Subacromial Impingement Syndrome: Platelet-Rich Plasma or Exercise Therapy? A Randomized Controlled Trial. *Orthopaedic journal of sports medicine*, *5*(5), 2325967117702366. https://doi.org/10.1177/2325967117702366

Normal ROM values. (n.d.). Retrieved from American Academy of Orthopedic. Surgeons (AAOS): https://cdn-links.lww.com/permalink/prsgo/b/prsgo_8_6_2020_04_17_hendriks_gox-d-20-00155r2_sdc1.pdf

Phillips N. (2014). Tests for diagnosing subacromial impingement syndrome and rotator cuff disease. *Shoulder & elbow*, *6*(3), 215–221. https://doi.org/10.1177/1758573214535368

Randelli, P., Arrigoni, P., Ragone, V., Aliprandi, A., & Cabitza, P. (2011). Platelet rich plasma in arthroscopic rotator cuff repair: a prospective RCT study, 2-year follow-up. *Journal of shoulder and elbow surgery*, *20*(4), 518–528. https://doi.org/10.1016/j.jse.2011.02.008

Rha, D. W., Park, G. Y., Kim, Y. K., Kim, M. T., & Lee, S. C. (2013). Comparison of the therapeutic effects of ultrasound-guided platelet-rich plasma injection and dry needling in rotator cuff disease: a randomized controlled trial. *Clinical rehabilitation*, *27*(2), 113–122. https://doi.org/10.1177/0269215512448388

Saurav, S., Aggarwal, A. N., Shahi, P., Kamal, S., Bansal, K., & Singla, S. (2022). Efficacy of Single Injection of Platelet-Rich Plasma in Shoulder Impingement Syndrome. *Cureus*, *14*(6), e25727. https://doi.org/10.7759/cureus.25727

Saurav, S., Aggarwal, A. N., Shahi, P., Kamal, S., Bansal, K., & Singla, S. (2022). Efficacy of Single Injection of Platelet-Rich Plasma in Shoulder Impingement Syndrome. *Cureus*, *14*(6), e25727. https://doi.org/10.7759/cureus.25727

Journal of Physical Education

Volume 37 – Issue (4) – 2025 Open Access

P-ISSN: 2073-6452, E-ISSN: 2707-5729

https://jcope.uobaghdad.edu.iq

Schneider, A., Burr, R., Garbis, N., & Salazar, D. (2018). Platelet-rich plasma and the shoulder: clinical indications and outcomes. *Current reviews in musculoskeletal medicine*, *11*(4), 593–597. https://doi.org/10.1007/s12178-018-9517-9

Shahid, A., Malik, A., Bukhari, A., Shaikh, A., Rutherford, J., & Barkatali, B. (2023). Do Platelet-Rich Plasma Injections for Knee Osteoarthritis Work?. *Cureus*, *15*(2), e34533. https://doi.org/10.7759/cureus.34533

Shams, A., El-Sayed, M., Gamal, O., & Ewes, W. (2016). Subacromial injection of autologous platelet-rich plasma versus corticosteroid for the treatment of symptomatic partial rotator cuff tears. *European journal of orthopaedic surgery & traumatology : orthopedie traumatologie*, *26*(8), 837–842. https://doi.org/10.1007/s00590-016-1826-3

Shanley, E., Kissenberth, M. J., Thigpen, C. A., Bailey, L. B., Hawkins, R. J., Michener, L. A., Tokish, J. M., & Rauh, M. J. (2015). Preseason shoulder range of motion screening as a predictor of injury among youth and adolescent baseball pitchers. *Journal of shoulder and elbow surgery*, *24*(7), 1005–1013. https://doi.org/10.1016/j.jse.2015.03.012

Sharun, K. (2023). Prospects of Platelet-Rich Plasma in Regenerative Medicine. *OBM Transplantation*, *7*(2), 1-5. doi:10.21926/obm.transplant.2302187

Tooth, C., Gofflot, A., Schwartz, C., Croisier, J. L., Beaudart, C., Bruyère, O., & Forthomme, B. (2020). Risk Factors of Overuse Shoulder Injuries in Overhead Athletes: A Systematic Review. *Sports health*, *12*(5), 478–487. https://doi.org/10.1177/1941738120931764

van der Windt, D. A., Koes, B. W., de Jong, B. A., & Bouter, L. M. (1995). Shoulder disorders in general practice: incidence, patient characteristics, and management. *Annals of the rheumatic diseases*, *54*(12), 959–964. https://doi.org/10.1136/ard.54.12.959

Zhang, J. Y., Fabricant, P. D., Ishmael, C. R., Wang, J. C., Petrigliano, F. A., & Jones, K. J. (2016). Utilization of Platelet-Rich Plasma for Musculoskeletal Injuries: An Analysis of Current Treatment Trends in the United States. *Orthopaedic journal of sports medicine*, *4*(12), 2325967116676241. https://doi.org/10.1177/2325967116676241