“INTRA-ARTICULAR AUTOLOGOUS PLATELET RICH PLASMA VS CORTICOSTEROID INJECTION IN OSTEOARTHRITIS OF KNEE: A ONE YEAR HOSPITAL BASED COMPARATIVE STUDY”

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LIST OF ABBREVIATIONS

GLOSSARY	ABBREVIATIONS
OA	OSTEOARTHRITIS
NSAIDS	NON-STEROIDAL ANTI-INFLAMMATORY DRUGS
IA	INTRA-ARTICULAR
HA	HYALURONIC ACID
PRP	PLATELET RICH PLASMA
LCL	LATERAL COLLATERAL LIGAMENT
MCL	MEDIAL COLLATERAL LIGAMENT
ACL	ANTERIOR CRUCIATE LIGAMENT
PCL	POSTERIOR CRUCIATE LIGAMENT
IL	INTERLEUKIN
TNF	TUMOUR NECROTIC FACTOR
VAS	VISUAL ANALOG SCORE
WOMAC	WESTERN ONTARIO AND MCMASTER UNIVERSITIES OSTEOARTHRITIS
KOOS	KNEE INJURY AND OSTEOARTHRITIS SCORE
KL	KELLGREN AND LAWRENCE SCALE

ABSTRACT

Introduction: Osteoarthritis (OA) of the knee is one of the most common degenerative joint disorders worldwide and is characterized by progressive structural changes that affect the entire joint, including cartilage, subchondral bone, synovium, and periarticular tissues. The global prevalence of knee OA is increasing due to aging populations and risk factors such as obesity, female sex, biomechanical stress, and prior joint injuries, leading to a significant burden on healthcare systems and patient quality of life. Biologic agents have recently attracted significant attention in the context of regenerative medicine and orthopedics, particularly platelet-rich plasma (PRP). PRP is produced by centrifuging a patient's own blood to concentrate platelets, which release growth factors and cytokines that can modulate inflammation, encourage chondrogenic activity, and enhance tissue repair. Growth factors such as platelet-derived growth factor, transforming growth factor-beta, and insulin-like growth factor have been implicated in chondrocyte proliferation and matrix synthesis, potentially restoring or stabilizing cartilage structure over time. Corticosteroid injections remain a pragmatic and cost-effective choice in clinical practice, providing rapid relief for patients experiencing acute exacerbations of pain.

Objective: The objective of this study is to compare the efficacy of intra articular platelet rich plasma versus intra articular corticosteroid in mild to moderate knee osteoarthritis.

Methods: patients with osteoarthritis knee joint will undergo under treatment in department of orthopaedics in KLES Dr. Prabhakar kore charitable hospital & mrc, Belagavi will be evaluated for one year i.e 2023-2024. Patient will be evaluated clinically and radiologically at 0, 3, and 6 months. Patient will be evaluated using various scale like VAS score, WOMAC score and KOOS score.

Result: This study's findings have provided a comparison of intra-articular autologous platelet-rich plasma injections versus corticosteroid injections in patients suffering from knee OA over a year. A primary assumption was that PRP, rich in growth factors and drawn from the patient's own blood, might deliver sustained symptom relief and functional improvement, whereas corticosteroids often provide prompt but potentially fleeting analgesia. The trajectories of these treatments were assessed by using a set of outcome measures: the VAS for pain, the WOMAC, and the KOOS. Baseline demographic factors including age, sex, KL grade, and knee laterality were documented in detail to investigate whether they influence the choice or efficacy of treatment.

Corticosteroids offered strong but sometimes transient relief, while PRP demonstrated slower onset yet more sustained pain improvement, especially noticeable by the six-month mark.

Both groups improved significantly in WOMAC and KOOS over time, but PRP showed a particularly favorable trajectory in KOOS at six months, indicating potential long-term benefits.

Conclusion: This comparative study highlights the clinical value of both intra-articular PRP and corticosteroid injections in the treatment of osteoarthritis of the knee, both with their associated strengths and time-dependent activities. The biologically active growth factors may give PRP a more prolonged advantage, while corticosteroids remain the gold standard, cost-effective treatment for immediate symptomatic relief.

Key words: osteoarthritis, PRP, corticosteroids, knee, inflammation, ACL. MCL, cartilage, p value, VAS score, WOMAC score, KOOS score.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Osteoarthritis (OA) of the knee is one of the most common degenerative joint disorders worldwide and is characterized by progressive structural changes that affect the entire joint, including cartilage, subchondral bone, synovium, and periarticular tissues [1]. The global prevalence of knee OA is increasing due to aging populations and risk factors such as obesity, female sex, biomechanical stress, and prior joint injuries, leading to a significant burden on healthcare systems and patient quality of life [2]. Existing management strategies focus on symptom relief, functional improvement, and slowing disease progression rather than providing a cure [3]. Common initial interventions include patient education, weight management, physiotherapy, and pharmacological agents such as nonsteroidal anti-inflammatory drugs (NSAIDs) or simple analgesics [4]. However, these may be inadequate for moderate to severe disease, and the systemic side effects of NSAIDs—particularly gastrointestinal, renal, and cardiovascular complications—limit their prolonged use in many patients [5]. Surgery, especially total knee arthroplasty, offers a more definitive remedy in end-stage disease but carries risks of complications, high costs, and lengthy rehabilitation, making it imperative to explore effective, minimally invasive alternatives [6,7,8].

Intra-articular (IA) therapies aim to provide localized pain relief and possibly modify joint environment without exposing patients to the systemic toxicities of oral medications [9]. Corticosteroid injections have long been employed to counter inflammatory flare-ups in knee OA, and they often yield rapid symptomatic relief [10]. While these injections are considered effective for short-term management, their benefits tend to wane within weeks to a few months, and repeated administration can raise concerns about potential adverse effects on cartilage and subchondral bone [11]. Another IA option, hyaluronic acid (HA), functions as a viscoelastic supplement meant to restore lubrication and shock absorption in the joint, offering moderate improvements in some cases but with varying efficacy influenced by product types, molecular weight, and disease stage [12,13,14]. Such limitations have spurred ongoing investigations into additional or alternative injectable treatments that address both symptom control and potential joint preservation.

Biologic agents have recently attracted significant attention in the context of regenerative medicine and orthopedics, particularly platelet-rich plasma (PRP). PRP is produced by centrifuging a patient’s own blood to concentrate platelets, which release growth factors and cytokines that can modulate inflammation, encourage chondrogenic activity, and enhance tissue repair [15]. This focus on amplifying the body’s intrinsic healing cascade is especially appealing in a degenerative condition like OA, where cartilage lacks robust regenerative capacity [16]. Growth factors such as platelet-derived growth factor, transforming growth factor-beta, and insulin-like growth factor have been implicated in chondrocyte proliferation and matrix synthesis, potentially restoring or stabilizing cartilage structure over time [17]. Although preliminary clinical studies point to notable reductions in pain and improvements in function after IA PRP injections, the literature also reveals substantial heterogeneity in patient selection, PRP processing methods (single-spin vs. double-spin, leukocyte-rich vs. leukocyte-poor), and injection protocols [18,19,20]. These inconsistencies make it challenging to draw definitive conclusions about optimal PRP regimens or its absolute superiority over established interventions.

Despite the variability, there are distinct theoretical advantages of PRP over corticosteroids. As an autologous product, PRP poses minimal risk of immunological reactions or disease transmission, and there are fewer concerns regarding systemic toxicity [21]. Unlike corticosteroids, which predominantly target inflammation and may not halt degenerative processes, PRP conceivably promotes cartilage matrix anabolism and attenuates destructive pathways in OA [22]. Meta-analyses and systematic reviews of PRP in knee OA suggest greater and more sustained relief compared to placebo or HA in certain patient populations, especially those with milder or moderate disease [23]. However, limitations such as short follow-up intervals, small sample sizes, and varying outcome measures underscore the need for high-quality, long-term comparative studies [24]. In many existing trials, follow-up extends only to six months, leaving unanswered questions regarding the durability of PRP-induced improvements or potential long-term differences in structural outcomes when juxtaposed with corticosteroids.

Corticosteroid injections remain a pragmatic and cost-effective choice in clinical practice, providing rapid relief for patients experiencing acute exacerbations of pain [9,10]. Given that no universally accepted guidelines exist for their optimal frequency, treatment courses can become inconsistent, and some clinicians worry about cartilage or bone deterioration over repeated use [11]. In contrast, PRP has gained momentum as a biologically oriented therapy that aligns with an era increasingly focused on regenerative solutions, yet definitive evidence of its longevity and disease-modifying effect over a span of one year or more remains limited [25]. Considering that knee OA is a chronic condition often requiring repeated interventions to maintain functional status and acceptable pain levels, establishing whether PRP injections confer extended benefits compared to corticosteroids is vital.

In light of these considerations, this study "Intra-Articular Autologous Platelet Rich Plasma vs. Corticosteroid Injection in Osteoarthritis of Knee: A One Year Hospital-Based Comparative Study"—aims to present a robust head-to-head evaluation over an extended follow-up period. By assessing parameters such as pain scores, functional performance, quality of life, and the incidence of adverse events at multiple points across a year, it is possible to elucidate not only the short-term outcomes but also the sustainability of symptom relief and potential protective or regenerative effects in the knee joint. If PRP demonstrates longer-lasting or comparable benefits without the theoretical drawbacks associated with recurrent corticosteroid use, it could reorient current management strategies to favor more frequent integration of PRP for knee OA. Conversely, if corticosteroids provide equal or better outcomes without notable cartilage harm during the same period, they may remain a primary, cost-effective option. The insights gleaned from this hospital-based design will also speak to real-world applicability, particularly in diverse patient populations that vary in disease severity, comorbidities, and demographic factors.

This comparative study's findings also might be important for refining clinical recommendations both from the practitioner perspective and for patient counseling. Both treatments involve considering a variety of factors when it comes to selecting between PRP and corticosteroid injections: cost and injection frequency and safety profiles in addition to times to relief end. Further information on whether any subgroup—age, radiographic severity of OA, body mass index, or prior treatments—benefits particularly from PRP could help tailor therapies to individual needs. Clarity on these matters would eventually shift the paradigm in knee OA management, guiding practitioners toward evidence-based practice that balances efficacy, longevity, safety, and cost.

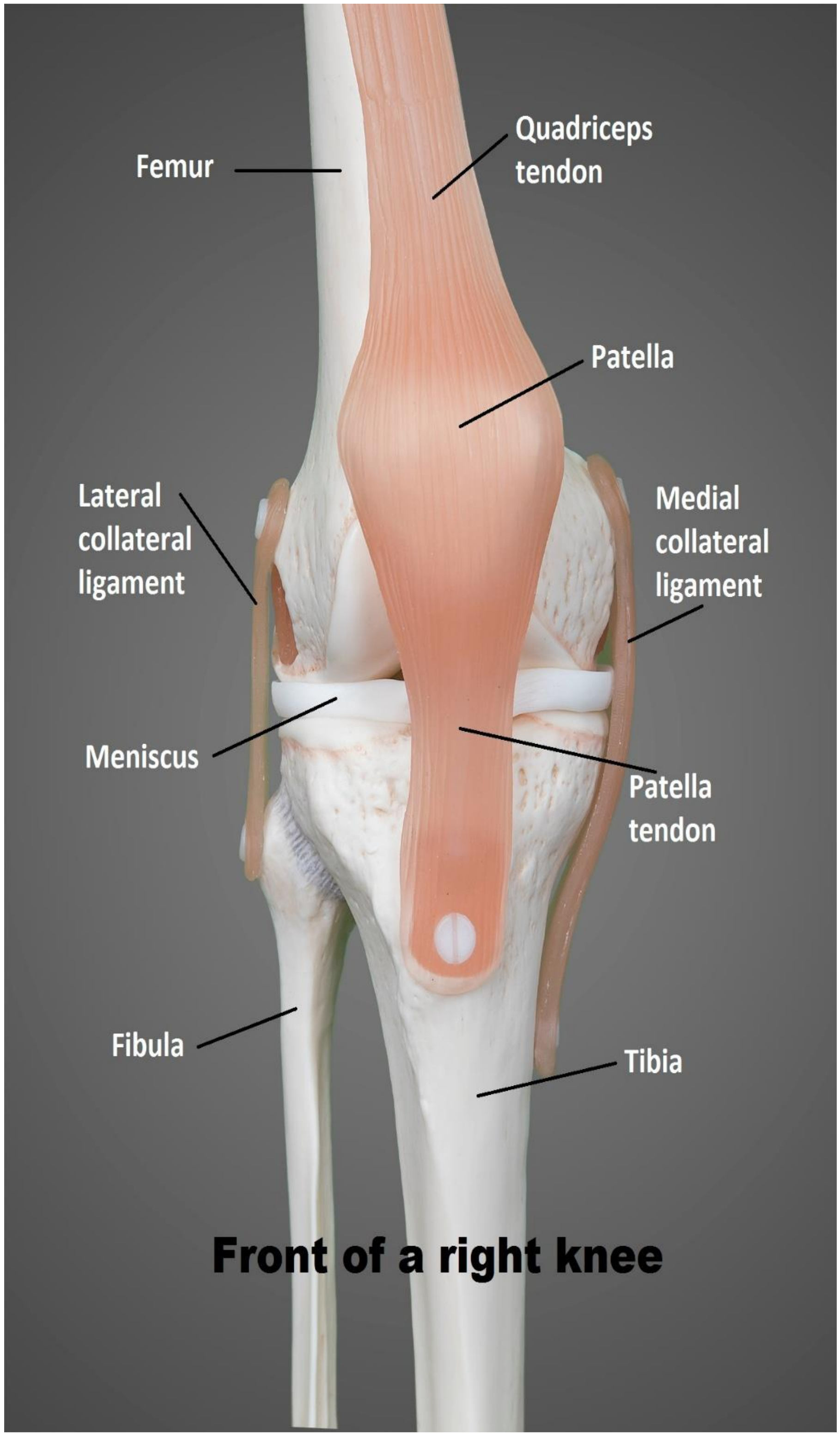
In summary, knee osteoarthritis is a leading cause of disability and severely impairs quality of life. Current non-surgical treatments are valuable but frequently fail to provide long-term relief or alter the course of the disease. Corticosteroid injections have been a lifeline for millions of patients to manage painful inflammatory flares, but repeated use has its concerns. PRP, a regenerative biologic treatment, promises to provide more durable symptom control and potentially joint-preserving effects. It may solidify this place in actual everyday clinical practices if well-balanced comparisons exist with established treatments. This investigation is designed as a one-year longitudinal study exploring the effects of intra-articular autologous PRP compared with corticosteroid injection to provide systematic evidence regarding efficacy, safety, and patient-focused advantages. Such findings may represent an important step in optimizing treatment algorithms for patients who wish to avoid or delay surgical interventions, thus improving both outcomes and patient satisfaction in the emerging landscape of knee OA management.

ANATOMY OF THE KNEE JOINT

INTRODUCTION AND CLINICAL SIGNIFICANCE

The knee is the largest synovial articulation in the human body, formed by three key bones: the femur, tibia, and patella. Although it functions primarily as a hinge joint, slight rotational movements occur, particularly when the knee is flexed. Because it carries the body's weight and endures considerable mechanical forces during walking, running, and other activities, the knee is highly susceptible to degenerative changes such as osteoarthritis (OA). Understanding knee anatomy is thus essential for evaluating different therapeutic interventions, including intra-articular injections of platelet-rich plasma (PRP) and corticosteroids, both of which aim to alleviate pain and potentially slow the progression of osteoarthritis.

Figure 1: Overview of knee joint anatomy, indicating key bones (femur, tibia, patella) and surrounding soft tissues.

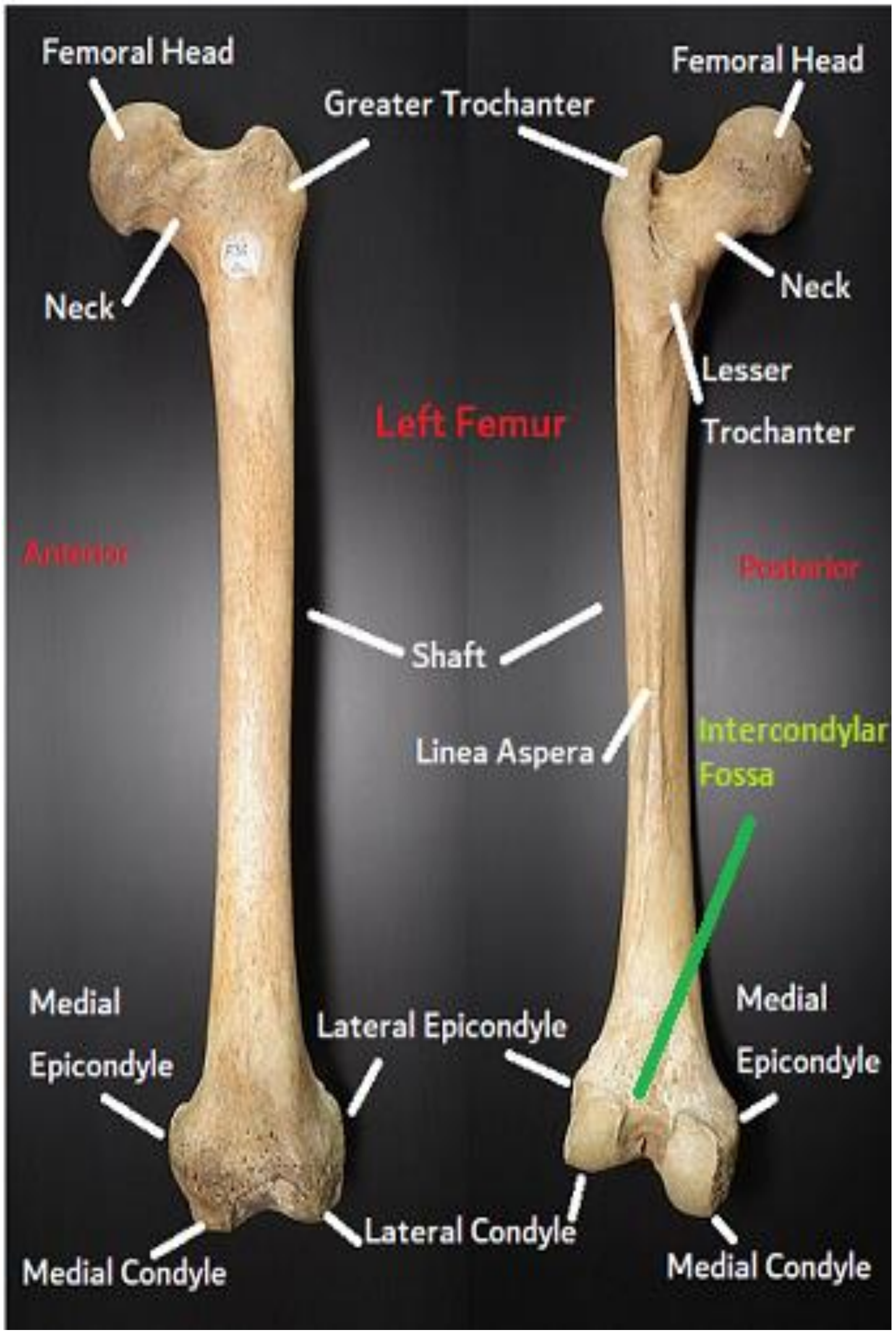


BONY STRUCTURES

Femur (Distal Portion)

The femur is the longest bone in the body, and its distal end is specialized for articulation with the tibia and patella. The two condyles—medial and lateral—are expansive, rounded surfaces that connect with corresponding tibial plateaus. Posteriorly, these condyles are separated by the **intercondylar fossa**, while anteriorly they converge to form the trochlear groove for the patella. Near each condyle is an **epicondyle** (medial and lateral), which serve as attachment sites for various ligaments and portions of the knee capsule.

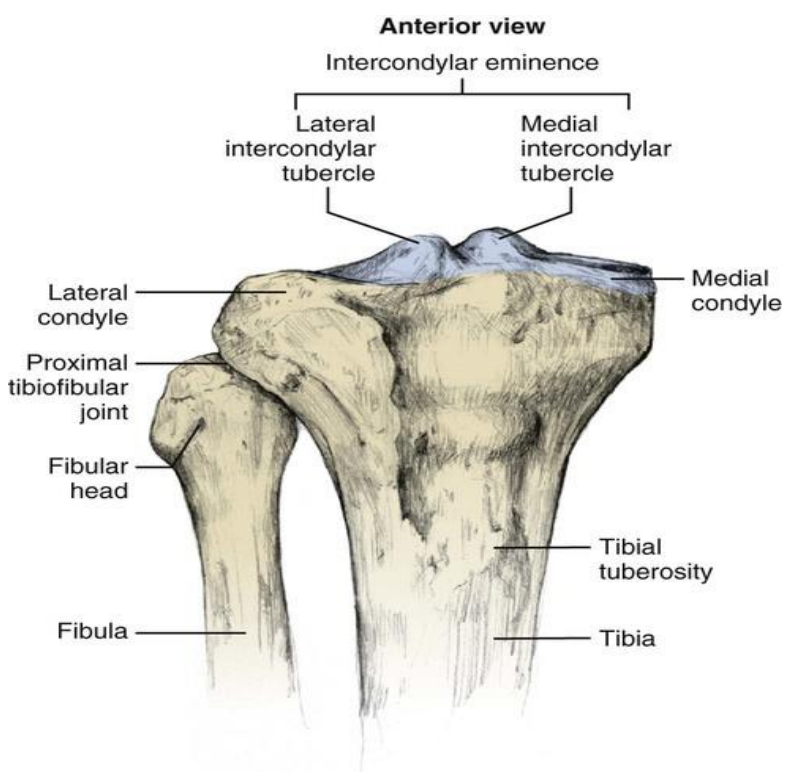
Figure 2: Distal femur, showing the medial and lateral condyles, epicondyles, and the intercondylar fossa.



Tibia (Proximal Portion)

The tibia, the larger of the two lower leg bones, has two relatively flat regions on its proximal end called the **medial** and **lateral tibial plateaus**. These plateaus articulate with the femoral condyles and are covered by a layer of hyaline cartilage. Between them lies the **intercondylar eminence**, a raised feature that helps anchor the cruciate ligaments. The **tibial tuberosity**, located on the anterior side, is the site where the patellar ligament attaches.

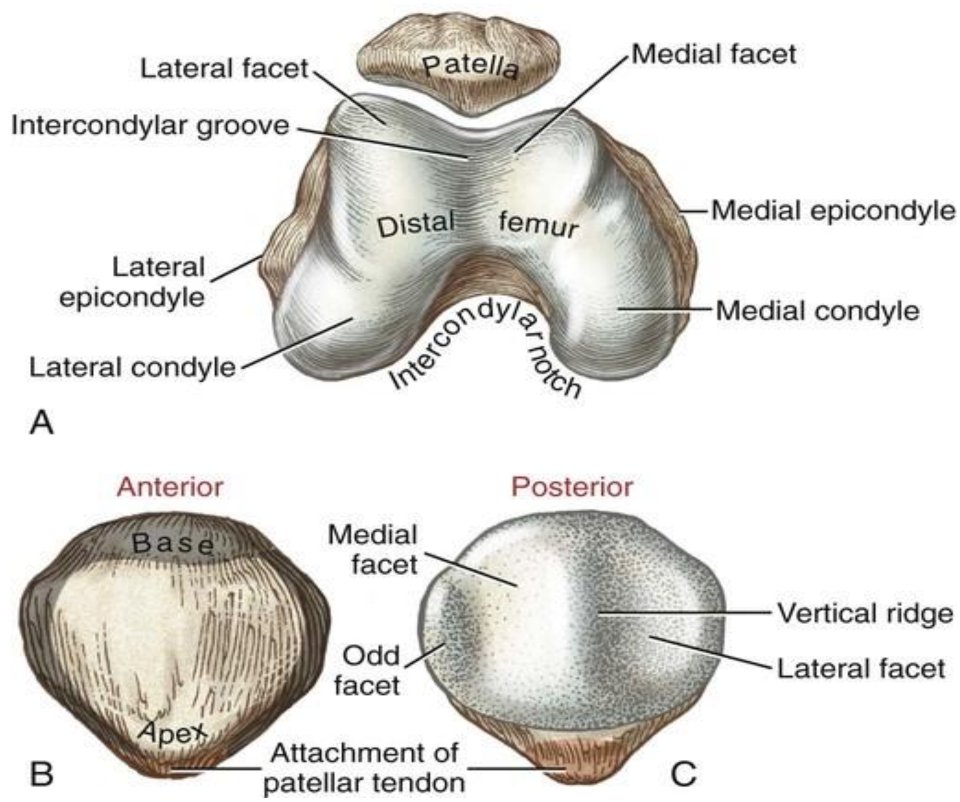
Figure 3: Proximal tibia, highlighting the medial and lateral plateaus, intercondylar eminence, and tibial tuberosity.



Patella

The patella is a sesamoid bone embedded within the quadriceps tendon. Shaped like a triangle, it has a broad base at the top and a pointed apex at the bottom. Its posterior surface is lined with thick articular cartilage, divided into medial and lateral facets (with some individuals also having a smaller "odd" facet). Functionally, the patella augments the leverage of the quadriceps muscle by acting as a pulley, improving the efficiency of knee extension.

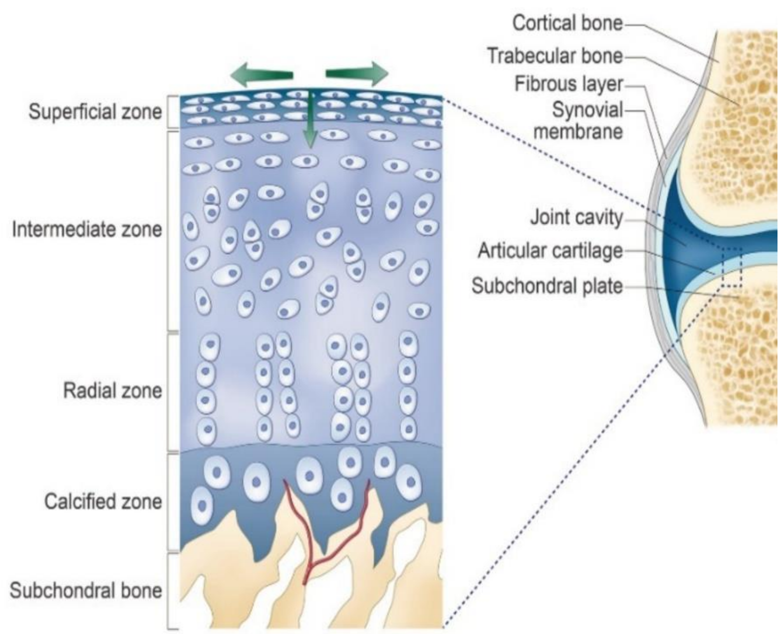
Figure 4: Posterior view of the patella, highlighting its facets and cartilage surfaces.



ARTICULAR CARTILAGE AND JOINT SURFACES

All articulating surfaces in the knee (distal femur, proximal tibia, and posterior patella) are lined by hyaline cartilage. This specialized tissue consists of chondrocytes within a matrix composed chiefly of type II collagen and proteoglycans (e.g., aggrecan). In healthy states, this cartilage effectively disperses compressive loads. However, in osteoarthritis, this tissue progressively deteriorates, leading to roughening and fissuring. Eventually, this destruction reveals the underlying subchondral bone and contributes significantly to pain and joint dysfunction.

Figure 5: Microscopic depiction of healthy knee joint cartilage, illustrating chondrocytes and collagen organization.

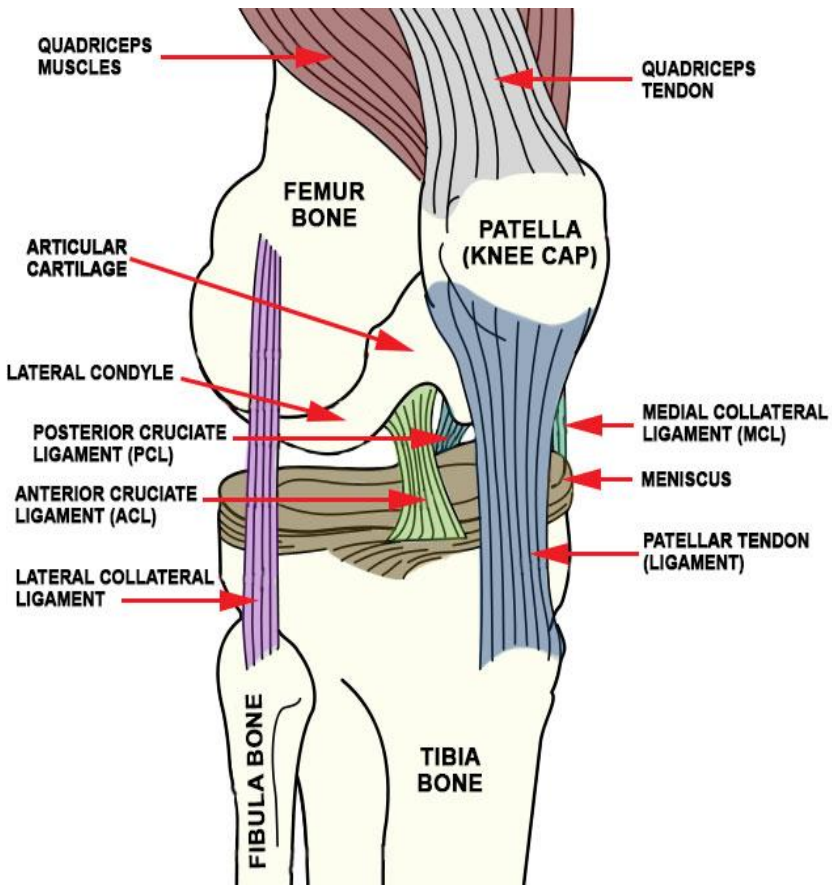


JOINT CAPSULE AND SYNOVIAL MEMBRANE

Fibrous Capsule

A robust fibrous layer envelops the knee, connecting around the edges of the femoral and tibial articular surfaces. An opening in the anterior portion accommodates the patella, and a posterolateral aperture allows passage of the popliteus tendon. This fibrous membrane is supported by expansions from the quadriceps tendon and by specific ligaments, enhancing overall stability.

Figure 6: Anatomy of the knee joint capsule, showing main points of attachment and the spaces for the patella and popliteus tendon.



Synovial Membrane

On the inner aspect of the fibrous capsule lies the synovial membrane, which secretes synovial fluid. This fluid lubricates the joint surfaces and delivers nutrients to the avascular cartilage. In the context of OA, the synovial membrane can become inflamed, known as synovitis, thereby accelerating cartilage degradation through inflammatory mediators.

Bursae

Several bursae (fluid-filled sacs) reduce friction at sites where tendons, ligaments, or skin move over bony areas. Key bursae around the knee include:

- **Suprapatellar bursa** (above the patella, beneath the quadriceps tendon)
- **Prepatellar bursa** (over the patella, just beneath the skin)
- **Infrapatellar bursae** (deep and superficial to the patellar ligament)

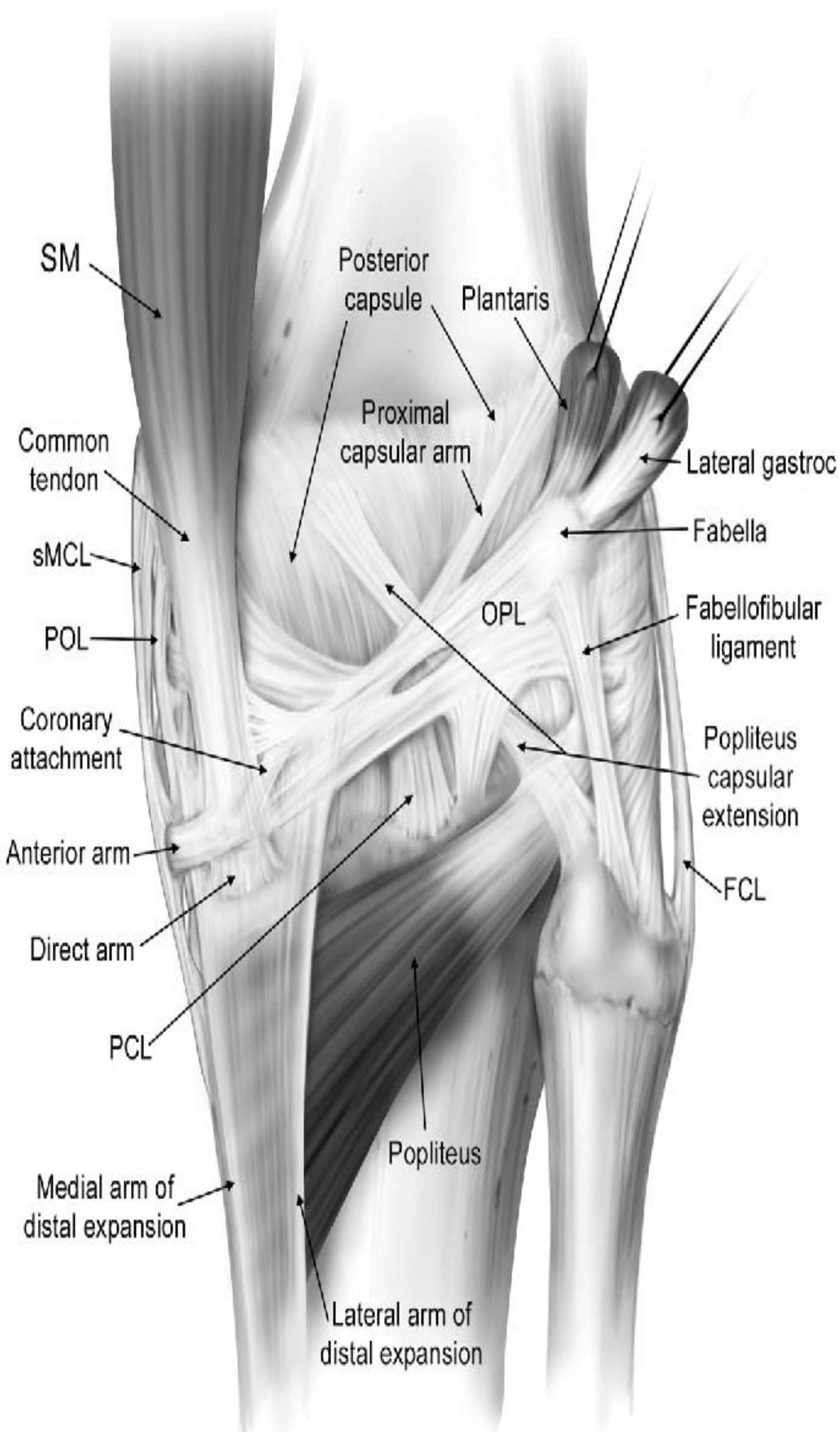
Bursitis, an inflammatory condition of these sacs, can cause pain and swelling.

LIGAMENTS AND MENISCI

Extracapsular Ligaments

1. **Patellar Ligament**: Continuation of the quadriceps tendon, linking the patellar apex to the tibial tuberosity. It is a key stabilizer of the patellofemoral interface.
2. **Lateral (Fibular) Collateral Ligament (LCL)**: Extends from the lateral epicondyle of the femur to the head of the fibula. It resists varus forces (medial to lateral).
3. **Medial (Tibial) Collateral Ligament**: Connects the medial epicondyle of the femur to the medial surface of the tibia. It resists valgus forces (lateral to medial).
4. **Oblique Popliteal Ligament**: Formed from an expansion of the semimembranosus tendon, reinforcing the posterior capsule.
5. **Arcuate Popliteal Ligament**: Emerges from the fibular head and sweeps upward, reinforcing the posterolateral area of the joint capsule.

Figure 7: Posterior aspect of the knee, demonstrating oblique and arcuate popliteal ligaments.

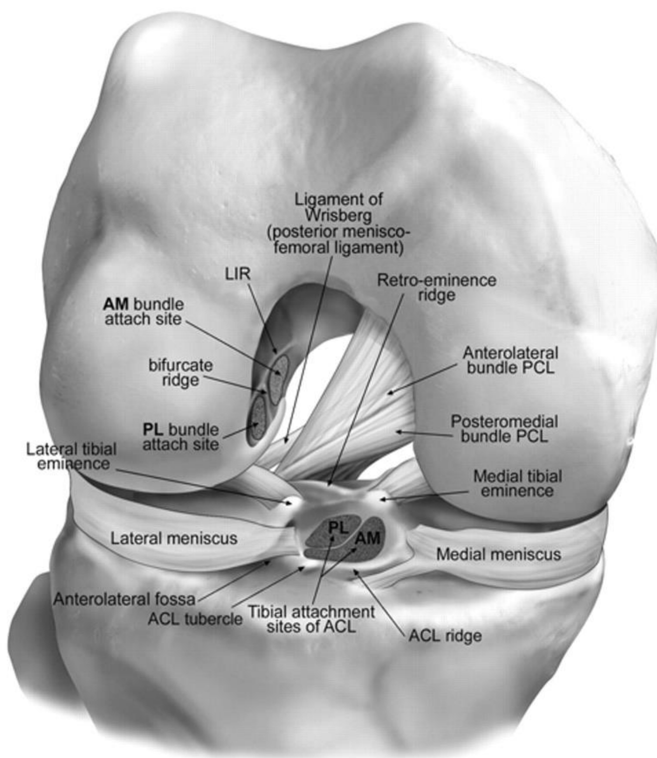


Intracapsular Ligaments

1. **Anterior Cruciate Ligament (ACL)**: Originates from the anterior intercondylar region of the tibia and travels upward and backward to attach to the lateral femoral condyle. It prevents anterior translation of the tibia relative to the femur and restricts hyperextension.

2. **Posterior Cruciate Ligament (PCL)**: Begins in the posterior intercondylar region of the tibia and proceeds upward and forward to the medial femoral condyle. It prevents posterior translation of the tibia and limits hyperflexion.

Figure 8: Superior view of the tibial plateau, showing the positions of the ACL and PCL relative to each other.



Menisci

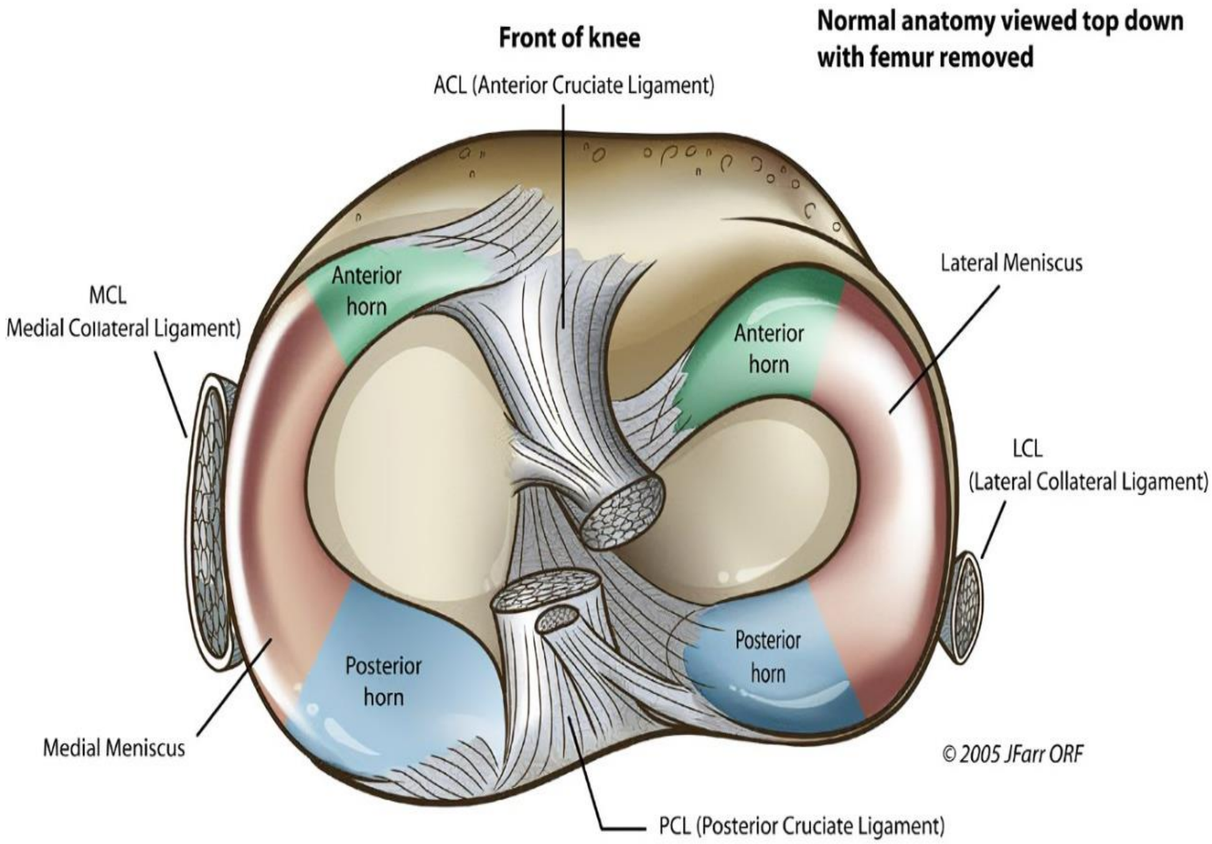
Two crescent-shaped menisci (medial and lateral) rest between the tibial plateaus and the femoral condyles:

- **Medial Meniscus**: C-shaped and less mobile because it has firmer attachments to the joint capsule and the MCL. This reduced mobility makes it more prone to injury.
- **Lateral Meniscus**: Almost circular in shape, with looser attachments that allow more movement.

Functions of the menisci include:

- Distributing axial loads to minimize stress on the articular cartilage
- Stabilizing the knee by deepening the tibial articular surfaces
- Enhancing lubrication by circulating synovial fluid

Figure 9: Top-down view of the knee joint, highlighting the medial and lateral menisci, along with the attachments of meniscofemoral and transverse ligaments.



NEUROVASCULAR STRUCTURES

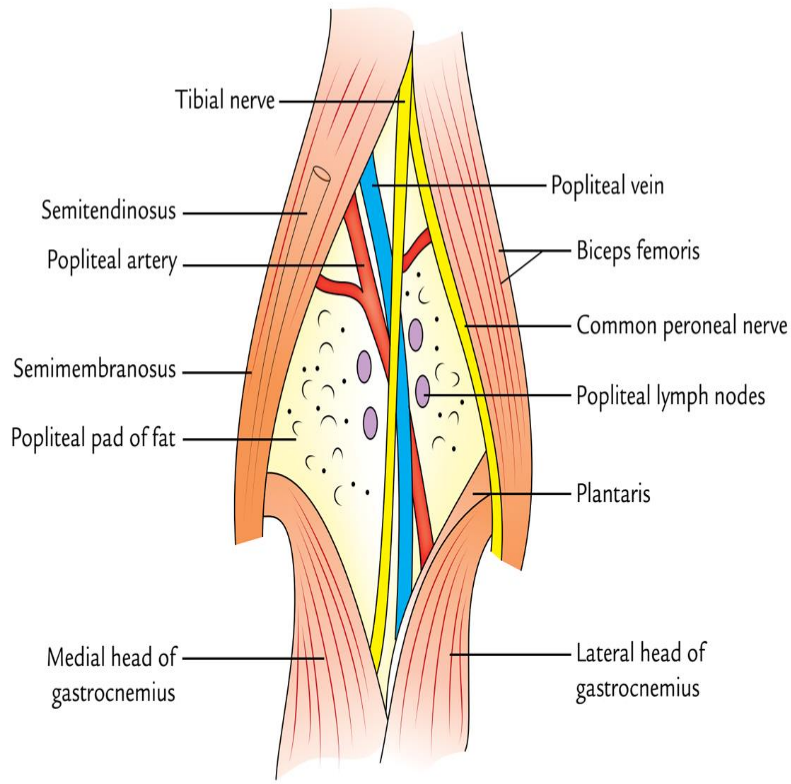
Nerve Supply

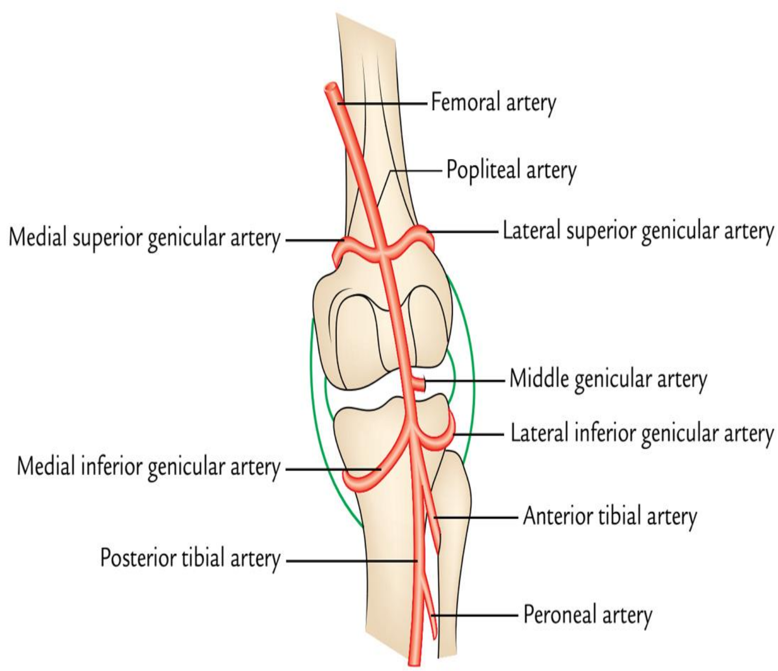
The knee joint's innervation is provided by several nerves, which carry both sensory (pain, proprioception) and motor signals:

- **Femoral Nerve**: Through its saphenous branch and other articular twigs, innervates the anterior knee region.
- **Tibial and Common Fibular (Peroneal) Nerves**: Both contribute articular branches in the posterior and lateral areas.
- **Obturator Nerve**: Its posterior division gives articular branches to parts of the knee.

In OA, joint degeneration can lead to nociceptive impulses traveling via these nerves, often manifesting as pain or discomfort.

Figure 10: Posterior view of the knee (popliteal fossa), showing branches of the tibial nerve, common fibular nerve, and their articular branches.





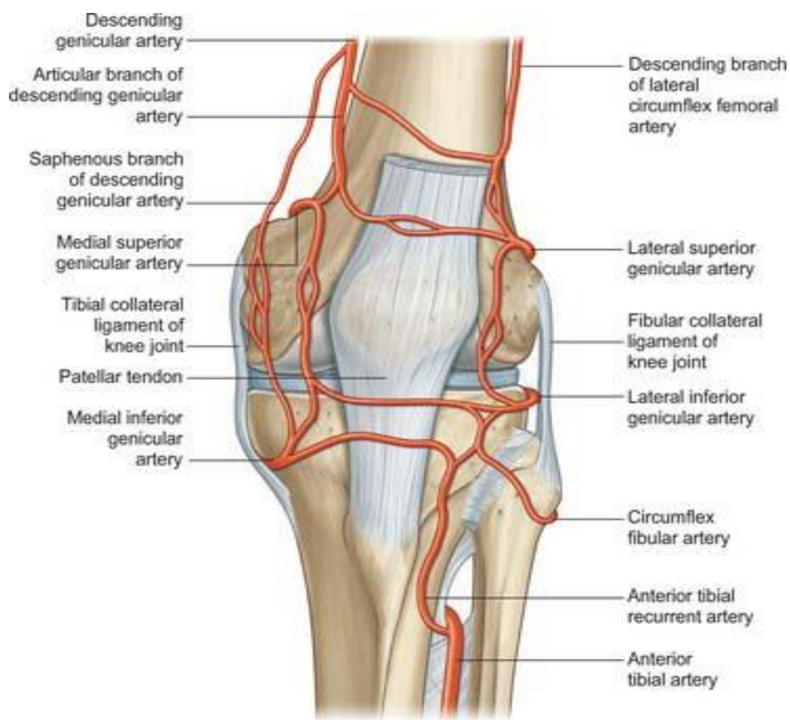
Vascular Supply

Blood flow to the knee is maintained by a network of vessels known as the **genicular anastomosis**, primarily involving:

1. **Popliteal Artery Branches**:
    - Medial and lateral superior genicular arteries
    - Medial and lateral inferior genicular arteries
    - Middle genicular artery (penetrates posterior capsule)
2. **Femoral Artery Contributions**:
    - Descending genicular artery
3. **Anterior Tibial Artery**:
    - Anterior tibial recurrent artery
4. **Posterior Tibial Artery**:
    - Circumflex fibular branch

These interconnected arteries ensure adequate blood flow during knee flexion and extension when certain vessels may be compressed.

Figure 11: Schematic diagram showing the arterial network of the knee, including the genicular anastomoses around the femoral condyles and tibial plateaus.



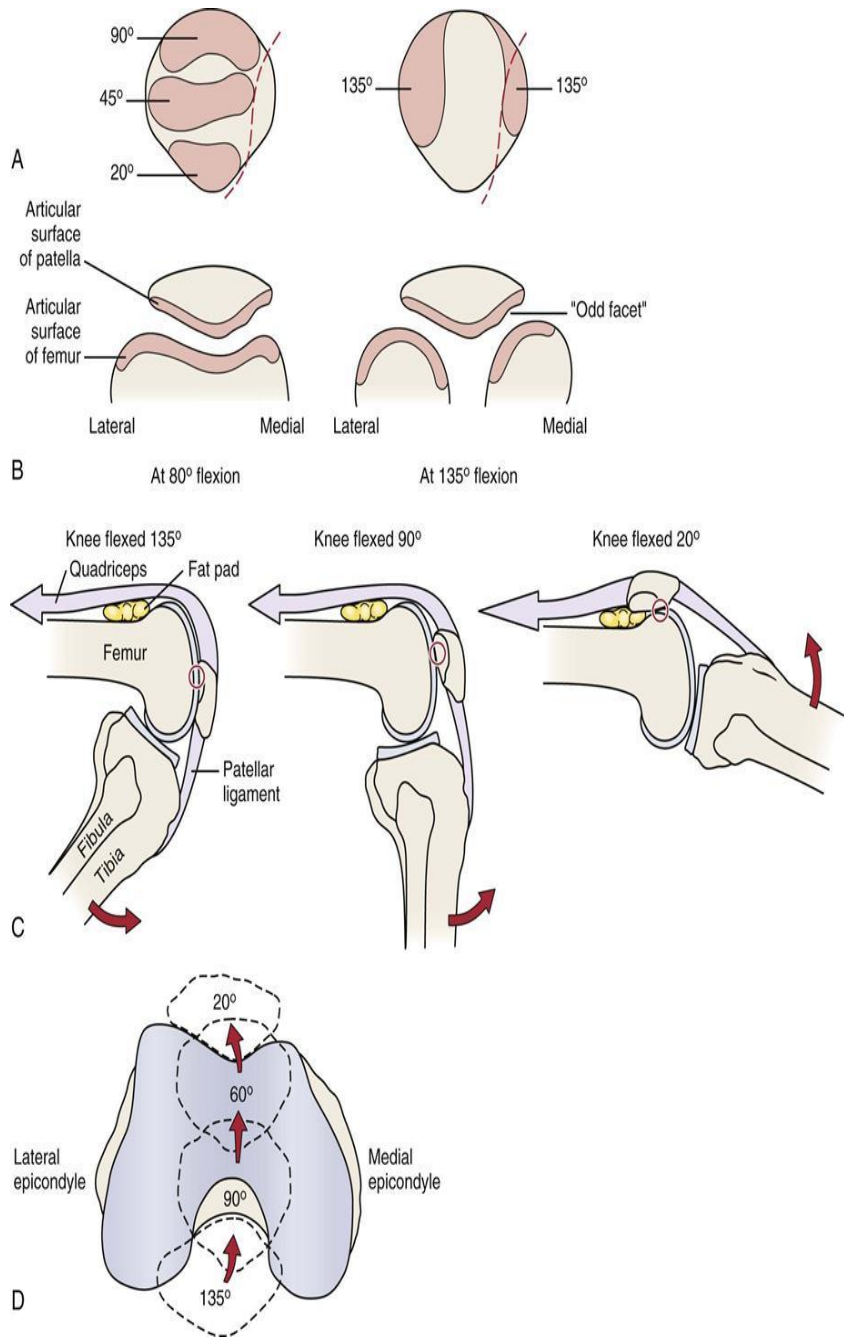
KEY BIOMECHANICS OF THE KNEE

Primary Movements

The knee is classified as a modified hinge joint. Its main actions are:

- **Flexion**: Moving the lower leg posteriorly, typically up to ~135° when the hip is flexed.
- **Extension**: Straightening the leg, returning it to ~0°.
- **Rotation**: Limited internal (medial) and external (lateral) rotation occurs when the knee is flexed. In full extension, rotation is minimal due to ligamentous and bony constraints.

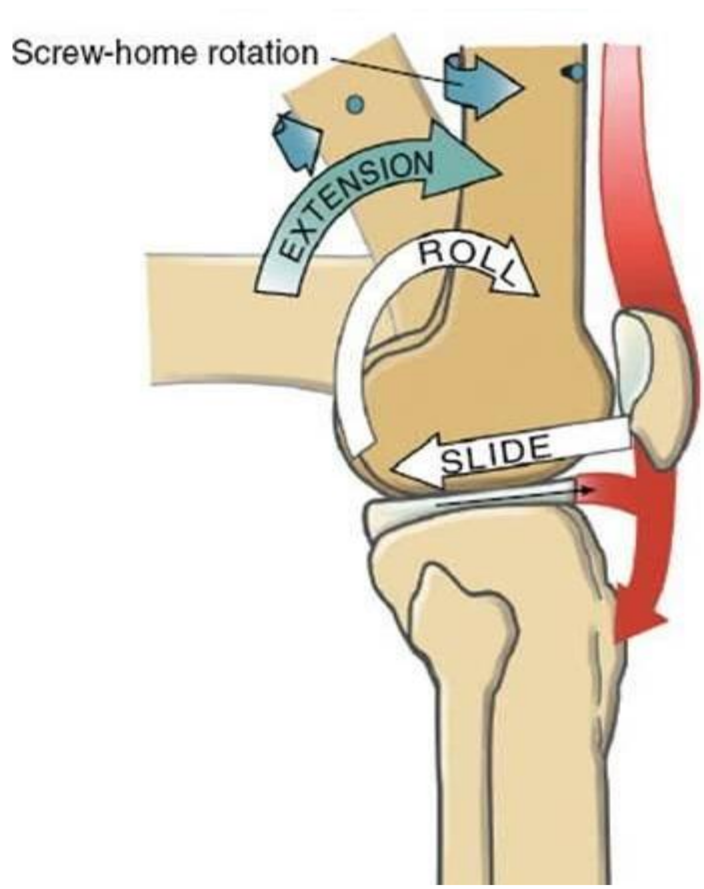
Figure 12: Illustration of knee flexion and extension arcs, indicating the approximate ranges of motion.



The Screw-Home Mechanism

As the knee extends fully (last 15–20°), the tibia externally rotates (if the foot is free) or the femur internally rotates (if the tibia is fixed). This phenomenon is known as the **screw-home mechanism**, which effectively "locks" the knee in stable extension, reducing energy expenditure during standing. To "unlock," the **popliteus** muscle initiates a reverse rotation, allowing the joint to flex again.

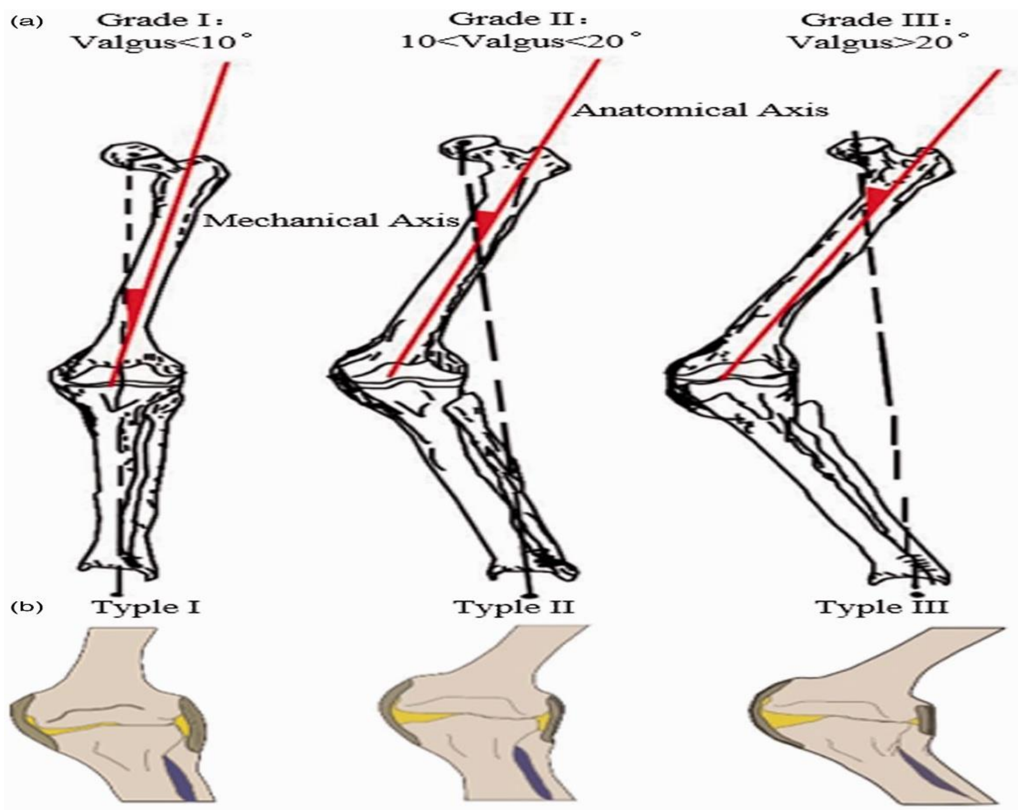
Figure 13: Depiction of the screw-home mechanism, showing slight external rotation of the tibia during terminal extension.



Load Distribution

The menisci play a large role in distributing compressive loads. With normal alignment, weight-bearing forces pass centrally through the femoral condyles and tibial plateaus. Malalignment, such as a varus or valgus deformity, can overload one compartment, hastening cartilage breakdown. During osteoarthritis, progressive wear in one compartment can lead to a vicious cycle of worsening alignment and further cartilage loss.

Figure 14: Frontal section of the knee in varus and valgus postures, demonstrating uneven load distribution.



MUSCLES ACTING ON THE KNEE

Extensor Group

- **Quadriceps Femoris**: Consisting of rectus femoris, vastus medialis, vastus lateralis, and vastus intermedius. These muscles insert at the patella, continuing as the patellar ligament to the tibial tuberosity. This group is the main knee extensor, crucial for activities such as walking, standing up from a chair, and climbing stairs.

Flexor Group

- **Hamstrings**: Biceps femoris, semitendinosus, and semimembranosus primarily flex the knee, with biceps femoris also contributing to external (lateral) rotation, and semitendinosus/semimembranosus contributing to internal (medial) rotation.

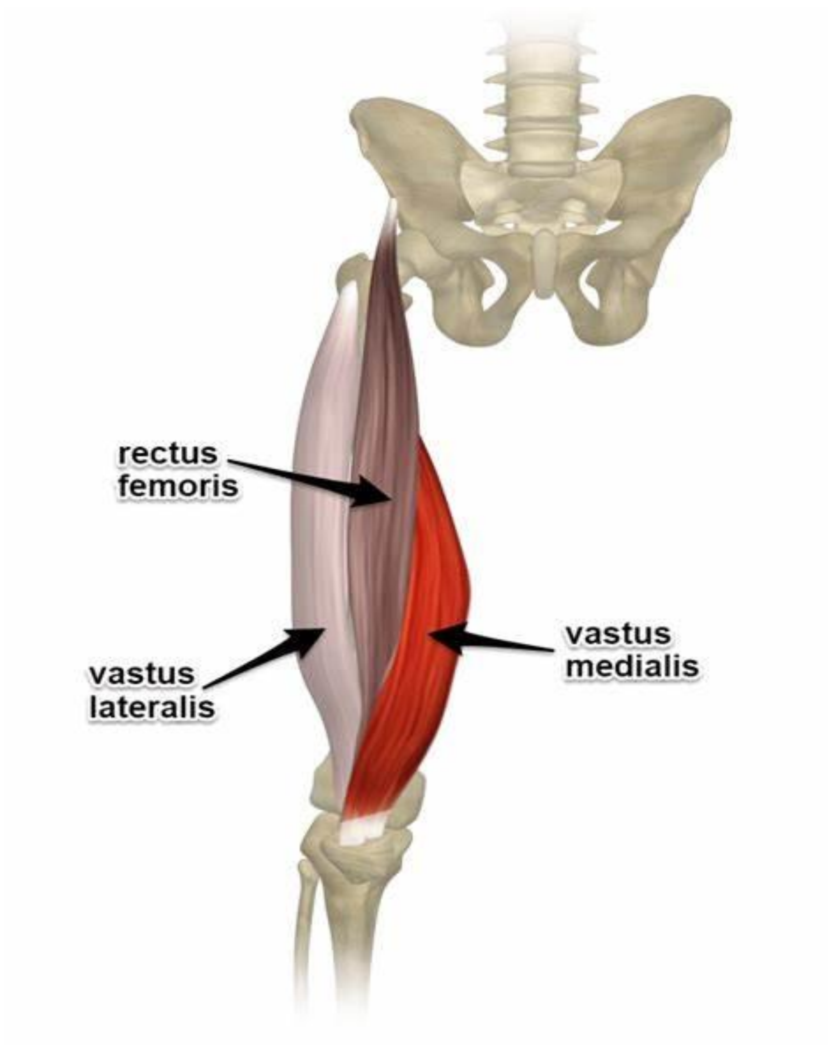
- **Popliteus**: Initiates unlocking of an extended knee by medially rotating the tibia (or externally rotating the femur).

- **Gastrocnemius**: Though known for plantarflexion at the ankle, it also crosses the knee and assists with flexion.

Rotators

- **Internal (Medial) Rotation**: Popliteus, semimembranosus, semitendinosus (also sartorius and gracilis to a smaller extent).
- **External (Lateral) Rotation**: Biceps femoris is the primary lateral rotator when the knee is flexed.

Figure 15: Anterior view of the thigh highlighting the quadriceps muscle group and their common tendon inserting onto the patella.



ANATOMICAL BASIS OF OSTEOARTHRITIS

Knee OA is commonly associated with:

1. **Articular Cartilage Breakdown**: Progressive deterioration leads to reduced joint space, fissuring, and exposure of subchondral bone.
2. **Meniscal Degeneration**: Tears and fraying in fibrocartilage reduce load distribution.
3. **Synovial Inflammation**: The presence of pro-inflammatory factors exacerbates cartilage loss.
4. **Osteophytes**: New bone outgrowths around margins of the joint, often visible on imaging.

Structural abnormalities and mechanical overload, whether due to obesity or prior injury, can accelerate this degenerative cycle. Clinically, this can manifest as pain, stiffness, and functional limitations, often prompting measures like intra-articular injections (PRP or corticosteroids), physical therapy, and in advanced cases, surgical interventions.

PLATELET-RICH PLASMA (PRP)

What is PRP?

Platelet-Rich Plasma is an autologous (patient-derived) concentrate of platelets suspended in a small volume of plasma. Since platelets contain numerous **growth factors** (e.g., platelet-derived growth factor [PDGF], transforming growth factor-beta [TGF-β], vascular endothelial growth factor [VEGF], and others), PRP injections aim to harness the body's natural healing processes.

How PRP Is Made

1. **Blood-Drawn**

   A small volume of venous blood (often 15–60 mL) is drawn from the patient's arm.

2. **Centrifugation**

   - The blood sample is placed in a special centrifuge tube.
   - It undergoes **centrifugation** (sometimes in two spins: a "soft spin" to separate plasma from red blood cells, and a "hard spin" to concentrate platelets).
   - This process separates the blood into layers: red blood cells (bottom), platelet-poor plasma (top), and a "buffy coat" layer enriched with platelets and white blood cells (middle).

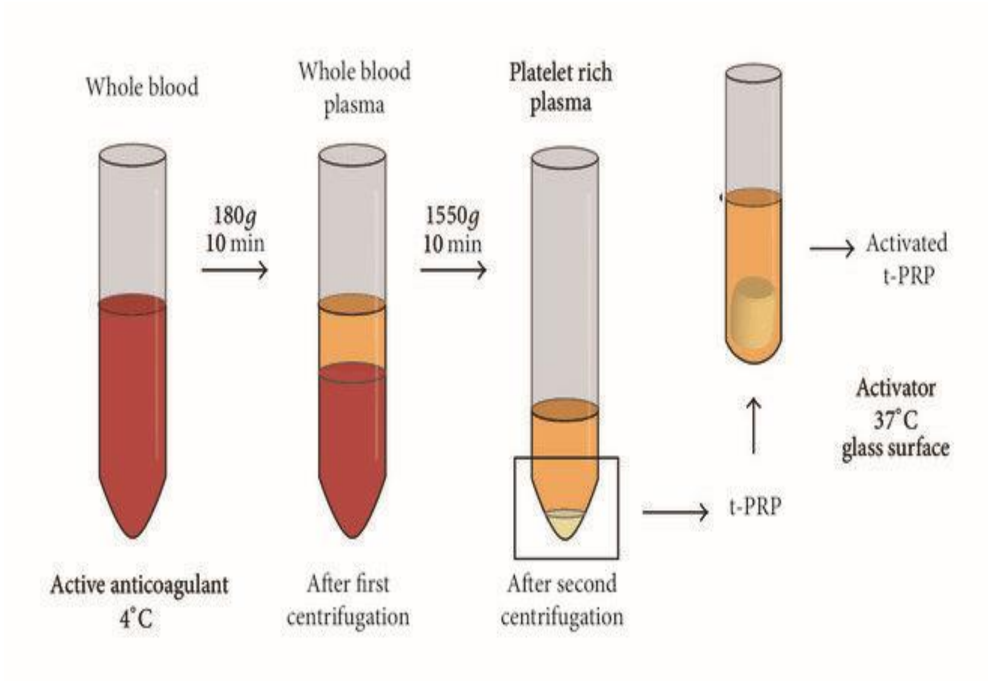
3. **Extraction of the Platelet-Rich Layer**

- The platelet-rich layer (the buffy coat and adjacent plasma) is carefully extracted into a syringe.
- Depending on the protocol, clinicians may adjust the final platelet concentration by discarding platelet-poor plasma or by resuspending platelets in a specified plasma volume.

4. **Injection**

- The final PRP product is injected into the knee joint under sterile conditions, often guided by ultrasound for precise placement.

Figure 16: *Schematic representation of PRP preparation steps.*



Mechanism of Action of PRP

- **Growth Factors and Cytokines**: Platelets release a cocktail of growth factors that:
  - Stimulate **chondrocytes** to synthesize extracellular matrix components like collagen and proteoglycans.
  - Promote **angiogenesis** (formation of new blood vessels) and tissue remodeling.
  - Recruit reparative cells to the site of injury, possibly aiding in cartilage repair or at least slowing cartilage degeneration.

- **Anti-inflammatory Effects**:
    - Certain growth factors and cytokines in PRP can **modulate inflammatory cascades**, reducing the production of pro-inflammatory molecules that are elevated in OA.
    - PRP may counteract some catabolic pathways in the synovium and cartilage.
- **Synovial Fluid Improvement**:
    - PRP might **enhance the lubricating properties** of synovial fluid by stimulating increased hyaluronic acid production.

Clinical-Impact:

While PRP is not a cure for advanced OA, it is believed to **promote a more favorable environment** in the knee joint for tissue homeostasis. Patients often report **reduced pain**, **improved function**, and **delayed progression** when used in conjunction with physical therapy and other conservative measures.

CORTICOSTEROIDS (STEROIDS)

What Are Corticosteroids?

Corticosteroids (e.g., triamcinolone, methylprednisolone) are potent **anti-inflammatory** agents. They mimic the actions of cortisol, a naturally occurring hormone produced by the adrenal glands.

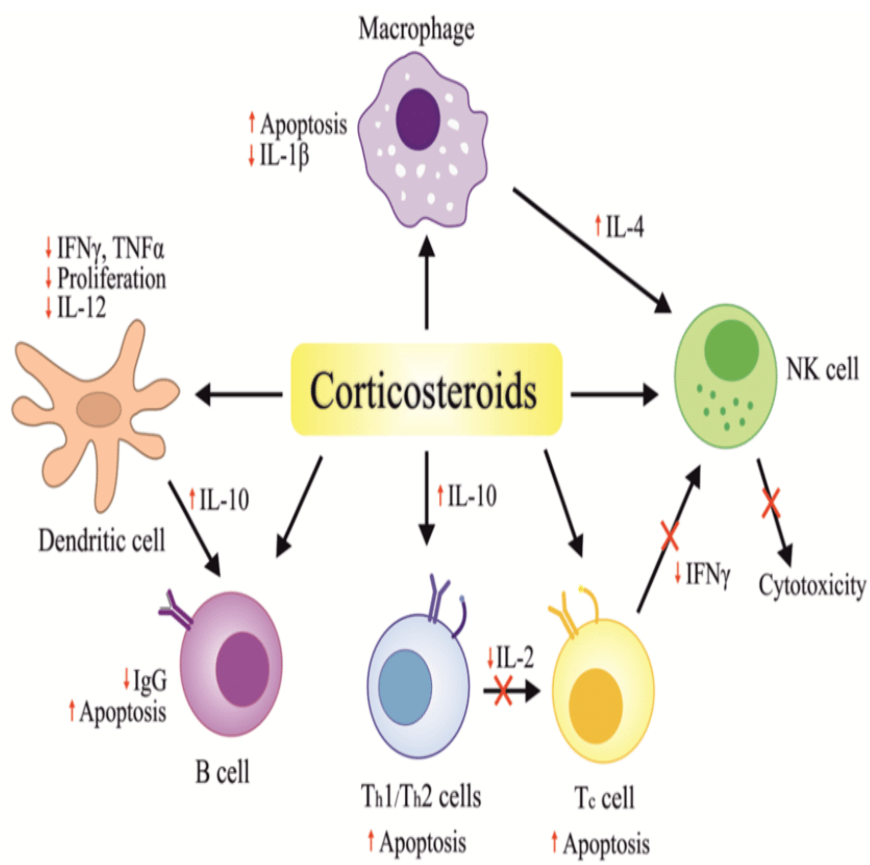
Mechanism of Action of Corticosteroids

1. **Genomic Pathway**
   - Corticosteroids diffuse through the cell membrane and bind to **glucocorticoid receptors** in the cytoplasm.
   - This receptor-hormone complex translocates to the nucleus, where it **modulates gene transcription**—upregulating anti-inflammatory proteins (e.g., lipocortin-1) and downregulating pro-inflammatory cytokines (e.g., IL-1, TNF-α, IL-6).
2. **Non-Genomic Pathway** (Rapid Effects)
   - Corticosteroids can also exert **fast actions** by interacting with membrane-bound receptors, leading to a reduction in inflammatory mediator release.

3. **Overall Anti-inflammatory and Immunosuppressive Effects**

- **Decreased Synovial Inflammation**: Reduces the activity of immune cells (e.g., neutrophils, macrophages) and diminishes synovitis.
- **Reduced Pain**: Inhibits the production of prostaglandins and inflammatory mediators that sensitize nociceptors around the joint.

Figure 17: *Molecular pathway of corticosteroid anti-inflammatory action.*



Clinical Impact of Steroid Injections

- **Rapid Symptom Relief**: Corticosteroid injections can provide **quick and effective pain relief**, often noticeable within days.
- **Short-Term Benefit**: Although they help reduce acute inflammation, the effect may wear off over weeks to months.
- **Frequency Considerations**: Repeated frequent steroid injections have raised concerns about **possible cartilage damage** and systemic effects, so clinicians typically limit how often they are given.

The knee's complex interplay of bones, articular surfaces, synovial structures, ligaments, and muscles underlies both its functional versatility and vulnerability to disorders. Osteoarthritis, the prototypical degenerative joint disease, illustrates how disruptions in cartilage health, meniscal integrity, and biomechanical forces culminate in pain and disability. Detailed anatomical knowledge is instrumental in tailoring and evaluating various treatments, including intra-articular injections of PRP or corticosteroids. By understanding how each component contributes to knee stability and motion, clinicians and researchers can more effectively address the underlying pathology and optimize patient outcomes.

AIMS AND OBJECTIVES

AIM

To compare the efficacy of intra-articular platelet-rich plasma (PRP) with intra-articular corticosteroids in managing mild to moderate knee osteoarthritis.

OBJECTIVES

1. Evaluate and compare pain relief and functional improvement following PRP and corticosteroid injections.
2. Assess and contrast any adverse effects or complications associated with both treatments.
3. Determine patient-reported satisfaction levels and overall quality of life improvements after each intervention.
4. Investigate the duration of therapeutic benefits and potential need for repeat interventions between the two treatment modalities.

REVIEW OF LITERATURE

1. Sánchez et al. (2008): Sánchez and colleagues conducted a retrospective investigation to evaluate an autologous growth-factor–enriched preparation in individuals with knee osteoarthritis (OA). They recruited 60 participants experiencing mild to moderate OA symptoms, administering intra-articular injections of this specialized plasma product once a week for three successive weeks. The researchers monitored pain using a Visual Analog Scale (VAS) and functional capacity using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). By the three-month review, average pain scores decreased by close to 50%, and the composite WOMAC measures improved by about 40%. At the six-month assessment, more than two-thirds of the participants maintained substantial relief, indicating roughly a 45% reduction in VAS pain from initial values. Although radiographic data did not show overt cartilage restoration during this interval, symptomatic improvements persisted for most patients. Only a small portion of individuals reported minor adverse responses, such as brief joint discomfort. The authors attributed these positive outcomes to the abundance of growth factors—including platelet-derived growth factor (PDGF) and transforming growth factor-beta (TGF-β)—which might enhance local cell processes and regulate inflammation within the joint. They concluded that delivering autologous preparations packed with growth factors via intra-articular routes could offer a promising, minimally invasive treatment approach for patients with degenerative joint disease, setting an early stage for subsequent research into biologically based OA therapies [26].

2. Bannuru et al. (2009): Bannuru and associates carried out a systematic review and meta-analysis comparing the clinical performance of hyaluronic acid (HA) and corticosteroid (CS) injections in knee OA. Seven randomized controlled trials were pooled, covering 606 total subjects—303 assigned to receive HA and 303 receiving CS. The primary endpoints centered on pain relief (using the VAS scale) and functionality (often measured by the WOMAC index). Findings revealed that CS offered more immediate pain alleviation, particularly in the initial four weeks, cutting average VAS scores by up to 40–50% during that period. However, HA's effects appeared more sustained, as improvements continued beyond the two-month mark. By about 24 weeks, patients given HA frequently showed better preservation of pain reduction and functional gains compared to those on corticosteroids. The risk of minor side effects was slightly higher in the HA group, with a small percentage encountering joint swelling or injection-site irritation, but overall tolerability was deemed acceptable in both interventions. On balance, Bannuru et al. suggested that CS might be preferred for rapid, short-term symptom relief, whereas HA could be selected for longer-term management. Their conclusions underscored the importance of tailoring OA treatment according to both the patient's immediate pain intensity and the need for extended functional improvement [27].

3. Matthews and Hunter (2011): Matthews and Hunter presented a comprehensive synopsis of newly emerging pharmacological and biologic treatments focused on osteoarthritis (OA), emphasizing interventions designed to modify disease progression rather than simply control pain. Their review encompassed experimental agents such as aggrecanase inhibitors, targeted nitric oxide synthase blockers, and novel growth-factor–based formulations. Preliminary research—drawn from studies totaling roughly 400–800 participants—indicated modest yet encouraging outcomes, with improvements in pain of 20–30% on average and some evidence of delayed joint-space narrowing over 6–12 months. Additionally, the authors highlighted emerging cell-based therapies, including mesenchymal stem cells and platelet-rich plasma, which showed a potential 15% gain in cartilage thickness in some pilot investigations. Nonetheless, they pointed out that high costs, regulatory complexities, and broad variability in research designs continue to hamper definitive conclusions regarding these new treatments. They also stressed that these cutting-edge therapies should work alongside, rather than replace, established, non-surgical options such as exercise, weight loss, and standard analgesics. Ultimately, Matthews and Hunter advocated for well-powered, long-term randomized controlled trials to substantiate the safety and efficacy of these promising agents before integrating them widely into clinical practice for knee OA [28].

4. Cerza et al. (2012): Cerza and co-researchers examined how platelet-rich plasma (PRP) compared to hyaluronic acid (HA) for alleviating knee OA symptoms in a cohort of 120 patients. Participants were randomized into two groups, with one group receiving three weekly HA injections, while the other underwent two PRP injections administered over three weeks. Pain levels were tracked with a VAS scale, and function was measured using the WOMAC index. After six months, the PRP group reported roughly a 56% decrease in VAS pain scores, surpassing the 40% drop observed in the HA group. The disparity extended to function: WOMAC scores revealed that PRP recipients achieved an improvement of about 52%, compared to 33% among HA-treated patients. Further follow-up at 12 months showed that 65% of the PRP group still experienced pain relief of at least 40%, whereas the HA group exhibited a gradual decline in symptom control over time. Adverse events remained minimal, typically limited to mild and short-lived swelling in the treated joint. The authors hypothesized that PRP may promote a more biologically active environment within the knee, possibly enhancing tissue repair processes beyond what viscosupplementation provides. Their work underscored PRP's potential superiority in both pain relief and function over an extended period [29].

5. Hochberg et al. (2012): In 2012, Hochberg and collaborators outlined updated recommendations from the American College of Rheumatology (ACR) regarding interventions for osteoarthritis in the hand, hip, and knee. Their summary drew upon over 50 clinical trials, collectively assessing more than 4,000 OA cases. They placed strong emphasis on nonpharmacologic strategies—such as reducing body weight, performing targeted exercises, and ensuring comprehensive patient education—to bolster pain management and facilitate daily activities. In the realm of pharmacologic treatments, the guidelines addressed oral nonsteroidal anti-inflammatory drugs (NSAIDs), topical agents, and intra-articular therapies including corticosteroids (CS) and hyaluronic acid (HA). While CS provided rapid pain attenuation, with up to a 40% decline in VAS scores within the first month for acute flares, HA was noted to confer longer-term advantages, sometimes preserving functional improvements for three to six months. Adverse impacts—like potential cartilage damage with frequent CS usage—received particular mention. Additionally, the authors advocated for structured self-management programs, suggesting these initiatives might add an extra 15% benefit to standard care. Ultimately, Hochberg et al. advocated an individualized, multi-step strategy that integrates lifestyle optimizations with the thoughtful use of medications or injections, moving on to surgical options only if conservative measures fail [30].

6. Khoshbin et al. (2013): Khoshbin and colleagues performed a systematic review and quantitative meta-analysis to explore the role of platelet-rich plasma (PRP) in the non-surgical treatment of symptomatic knee OA. Their inclusion criteria spanned nine randomized controlled trials and five observational studies, totaling roughly 1,000 participants. The review found that PRP-treated patients typically saw about a 50% decrease in pain ratings on the VAS at six months, notably surpassing the approximate 35% reduction reported with hyaluronic acid or placebo. WOMAC function scores showed parallel improvements, with a 48% enhancement under PRP conditions versus about 30% in comparator arms. A small proportion (2–3%) of individuals experienced minor adverse events such as injection-site irritation or brief swelling. The investigators observed that inconsistent PRP preparation practices might partially explain any variability in results, as formulations could differ regarding platelet concentration and leukocyte content. Despite these discrepancies, they concluded that PRP emerges as a viable, relatively safe therapy offering both pain relief and improved function. Khoshbin et al. ultimately called for standardized PRP protocols and expanded research to pinpoint optimal dosage and evaluate whether the observed gains persist over the long term [31].

7. Neogi (2013): Neogi's work centered on the epidemiological aspects of pain in osteoarthritis (OA) and how it influences everyday life. Drawing on data from large cohorts—sometimes exceeding 5,000 participants—the review indicated that knee OA affects about 10–25% of adults older than 60. Notably, pain severity does not always align with the degree of radiographic changes; up to 30% of individuals show disproportionately high pain relative to x-ray findings, pointing to neurological or central sensitization processes. Neogi further highlighted that body weight is a crucial contributing factor, as obesity correlates with up to a 50% higher incidence of knee OA in certain populations. The financial toll of OA was also emphasized, with direct and indirect healthcare costs forming a substantial economic burden. The article underlined the importance of multimodal interventions—addressing not just cartilage integrity, but also inflammation, biomechanics, and psychosocial factors—to effectively manage pain and safeguard joint function. Consequently, Neogi concluded that future research and therapy models should look beyond structural changes, giving equal weight to mechanistic and lifestyle determinants in OA care [32].

8. Patel et al. (2013): Patel and colleagues compared the impact of platelet-rich plasma (PRP) injections against placebo on knee OA in a randomized, double-blind clinical trial. They enrolled 78 patients, all diagnosed with mild-to-moderate knee OA, dividing them evenly between two injections of PRP (spaced by three weeks) or placebo (saline). By the six-month mark, the PRP cohort displayed approximately a 56% drop in WOMAC pain scores, considerably higher than the 20% decrease in the placebo group. Additionally, WOMAC function subscale improvements reached nearly 48% for PRP recipients compared to 16% in placebo participants. VAS pain ratings mirrored these tendencies, indicating a more profound and lasting analgesic effect with PRP. Only around 5% of participants encountered minor adverse outcomes, generally short-lived joint discomfort. The authors speculated that PRP's efficacy might result from its capacity to reduce inflammation and possibly spur early regenerative processes within the joint environment. They concluded that PRP could be a compelling alternative when conventional measures, such as standard injections or oral medications, prove insufficient, and called for studies with broader populations and longer observation to reinforce these promising findings [33].

9. Camurcu et al. (2018): Camurcu and co-researchers explored whether administering a single corticosteroid injection before platelet-rich plasma (PRP) therapy would yield superior outcomes in knee OA. They assigned 60 patients into two equal groups: one received a CS injection followed by PRP a week later, and the other received PRP alone.

Evaluations continued for six months using VAS for pain and WOMAC for function. At the final assessment, the combination group recorded about a 55% reduction in pain scores, notably outperforming the 40% reduction in those treated exclusively with PRP. Functional improvements similarly favored the combination approach, showing a 50% gain in WOMAC stiffness against 35% for PRP alone. Additionally, only 10% of the combination group reported mild post-injection swelling, whereas the PRP-only group registered a rate of 20%. The study team proposed that the preemptive steroid injection could calm acute inflammation, potentially amplifying PRP's reparative mechanisms. Although encouraging, they acknowledged that sample size and limited follow-up required more extensive trials to confirm whether this dual-phase injection sequence offers substantial advantages over PRP or steroids alone [34].

10. Ismaiel (2018): Ismaiel carried out a comparative study examining platelet-rich plasma (PRP) versus corticosteroids (CS) for advanced knee OA, where most participants had Kellgren-Lawrence grades III–IV. Fifty-four patients, average age roughly 64, were split into two equal groups: one receiving two PRP injections spaced two weeks apart, and the other a single CS injection. Assessment at three months revealed a 45% drop in VAS pain for PRP recipients, exceeding the 30% decline in the CS group. Functionally, the WOMAC total score improved by about 40% with PRP versus roughly 25% under CS. Even among individuals with the most advanced OA, PRP demonstrated a consistent advantage. By the six-month checkpoint, around 65% of the PRP group retained substantial symptom relief, whereas the CS group's improvement diminished to nearly 15% of the initial pain reduction. Adverse events were modest, typically low-intensity knee soreness after injection. The researcher concluded that while CS might deliver quicker early relief, PRP provided more enduring benefits even in severe OA. Nevertheless, the study noted that imaging-based parameters were not explored in depth, thus leaving open questions about long-term structural changes [35].

11. Nabi et al. (2018): Nabi and colleagues compared ultrasound-guided injections of platelet-rich plasma (PRP) and corticosteroids (CS) for alleviating knee OA symptoms. They randomly assigned 70 patients into two equally sized arms, each receiving two injections over two weeks. VAS pain scores and WOMAC functional assessments were tracked over six months. At the three-month point, the CS group achieved around a 50% decline in VAS scores, compared to 44% in the PRP group. However, at six months, PRP maintained a 40% reduction, whereas CS slipped to 28%. Functionally, PRP demonstrated nearly a 35% WOMAC improvement at six months, surpassing the CS group's 20%. Sonographic evaluation also displayed reduced synovial membrane thickness in the PRP arm, signifying lesser joint inflammation. Only around 10% of PRP participants noted mild local discomfort post-injection, while no severe complications arose in either group. Nabi et al. proposed that PRP confers better durability, whereas CS is more beneficial in the short term. They underscored the significance of ultrasound guidance to optimize placement accuracy, which might bolster clinical outcomes for both PRP and CS injections [36].

12. Guillibert et al. (2019): In a prospective clinical study, Guillibert and coauthors assessed the efficacy of a single high-volume (8–10 mL) injection of autologous pure PRP in knee OA. They followed 123 individuals, whose mean age was around 60, predominantly with moderate OA (Kellgren-Lawrence II–III). Pain was measured via VAS, while function was evaluated using WOMAC. One month after injection, nearly 70% of patients reported a pain decrease of at least 30%. At three months, WOMAC pain indices fell by an average of 45%, with functional improvements hovering around 40%. These benefits continued into the six-month mark, retained by about two-thirds of the participants. Adverse effects were infrequent, limited primarily to mild swelling in 5% of cases that resolved spontaneously. Although radiographs did not confirm cartilage restoration, improvements in daily activities and reduced discomfort suggested a favorable clinical outcome. The authors posited that administering a higher PRP volume might saturate the synovial space with beneficial growth factors, promoting more robust tissue support. They recommended further randomized studies to determine whether this single high-volume approach is superior to multiple lower-volume injections in sustaining long-term relief [37].

13. Sánchez et al. (2019): Sánchez et al. explored an integrated approach for severe knee OA, combining intra-osseous and intra-articular PRP infiltrations. They enrolled 50 individuals diagnosed with advanced OA (grades III–IV) and administered one injection into the subchondral bone and one into the joint space. By six months, participants demonstrated around a 55% decrease in VAS pain and a 50% rise in WOMAC functional scores, retaining close to 40% improvement at one year. Radiographically, approximately 30% of the group displayed stabilization of their joint space width, although convincing evidence of cartilage regrowth remained elusive. Around 15% of patients reported brief bone pain soon after subchondral injections, which subsided within a week. The authors postulated that addressing subchondral pathology in tandem with intra-articular inflammation could provide a more holistic effect, potentially slowing OA's progression while improving pain and mobility. They concluded that a dual-injection methodology might represent an advanced strategy for managing end-stage OA, warranting further large-scale trials to clarify its efficacy and refine technical specifics such as injection timing and volume [38].

14. Ahmed et al. (2020): Ahmed and collaborators embarked on a comparative assessment of platelet-rich plasma (PRP) versus corticosteroids (CS) for knee OA, enrolling 60 subjects with Kellgren-Lawrence grades I–III. Thirty individuals received a single PRP injection, while another 30 were given a single CS injection. All participants engaged in an 11-week follow-up, with reviews at two-week intervals, employing VAS for pain and WOMAC for function. By the third week, CS showed a quicker effect, driving roughly a 40% drop in VAS pain, compared to about 30% for PRP. However, from week seven onward, PRP demonstrated more robust and lasting improvement, culminating in a roughly 50% pain reduction, while CS tapered around 35%. WOMAC scores reflected a similar pattern, with PRP exceeding 40% improvement in function at the final measurement. Both groups tolerated the therapies well, with minor swelling or stiffness being the most common complaint. The study suggested CS is ideal for fast short-term relief, whereas PRP offers sustained benefits. Ahmed et al. recommended personalized selection of injection therapy, aligning with patients' functional demands and recovery timelines [39].

15. Arjun et al. (2020): In a North Indian tertiary care hospital, Arjun et al. compared the therapeutic merits of autologous platelet-rich plasma (PRP) and corticosteroids (CS) among 80 knee OA patients. Each arm received two injections, spaced three weeks apart. After six months, the PRP cohort reported a 48% decrease in VAS pain, significantly outpacing the CS group's 34% reduction. Similarly, WOMAC stiffness and function improved by roughly 42% in the PRP recipients, compared to 25% in the CS arm. Laboratory checks indicated a larger decrease in C-reactive protein (CRP) levels in the PRP group, hinting at stronger anti-inflammatory effects. Though both interventions were fairly safe, with minor, transient local discomfort, the CS group's pain relief notably diminished after three months. The authors inferred that PRP confers greater long-range advantages, especially for individuals desiring extended symptom management. They underscored the need for expanded trials to standardize PRP protocols and investigate whether additional injections could elevate these benefits even further [40].

16. Elksniņš-Finogejevs et al. (2020a): Conducting a single-center, prospective RCT with 40 participants, Elksniņš-Finogejevs et al. evaluated the comparative effectiveness of platelet-rich plasma (PRP) versus corticosteroids (CS) in moderate knee OA (Kellgren-Lawrence II–III). One group received 8 mL of PRP (n=20), and the other got triamcinolone acetonide plus lidocaine (n=20). Pain and functional status were measured through VAS, IKDC, and Knee Society Score (KSS) over a 1-year period. Both interventions brought about significant relief at one week (~30% VAS reduction). However, PRP surpassed CS at 15 weeks, yielding an approximate 60% dip in VAS as opposed to 45% under CS. By 12 months, about 70% of PRP recipients, maintained half or more of their initial pain relief, unlike the CS group, which stabilized at around 35%. Although 75% of PRP patients reported mild knee swelling in the first week, it subsided on its own. The study concluded PRP might supply greater longevity of benefit, emphasizing that it possibly modulates the intra-articular environment more effectively than steroids alone [41].

17. Elksniņš-Finogejevs et al. (2020b): In another publication detailing similar protocols, Elksniņš-Finogejevs et al. elaborated on the same cohort's long-term outcomes, reiterating the comparison of PRP and corticosteroids. With 40 patients randomly split between a single 8 mL PRP dose or 1 mL of triamcinolone plus 5 mL lidocaine, the authors homed in on 1-year follow-up data. At six months, PRP delivered around a 65% reduction in VAS pain, declining slightly to 60% at one year, whereas the CS group decreased from 50% at six months to 30% by 12 months. IKDC and KSS scores echoed these patterns, with consistently higher performance in PRP-treated knees. Most notably, mild synovitis affected about three-quarters of the PRP participants early on but resolved spontaneously. The investigators emphasized that pre-existing synovitis seemed to respond faster to corticosteroids initially, yet it showed less stable gains over time. Consequently, they posited that PRP may be preferable for those requiring lasting symptom management, reinforcing the notion that biologic treatments could better sustain joint homeostasis [42].

18. Tang et al. (2020): Tang and collaborators carried out a meta-analysis contrasting platelet-rich plasma (PRP) with hyaluronic acid (HA) for knee OA management. Ten randomized controlled trials, accounting for roughly 1,200 patients, were included. Both pain intensity (via VAS) and function (often assessed by WOMAC) were evaluated at six months. On average, PRP led to a 52% reduction in VAS scores, whereas HA hovered around 35%. In terms of WOMAC, PRP recipients achieved a 46% improvement in function, significantly outdoing the 30% gain of HA users. Although the incidence of adverse events was minimal under both methods—around 5% overall—mild joint irritation and swelling emerged slightly more in the PRP subset. Tang et al. observed that variables such as platelet concentration and the presence or absence of leukocytes might influence results, stressing the need for uniform manufacturing protocols. Ultimately, the data proposed that PRP could be more effective than HA, but the researchers recommended larger, standardized trials to confirm these benefits and delineate the optimum injection schedules [43].

19. Vold (2020): In an unpublished manuscript, Vold investigated how corticosteroid (CS) injections stack up against platelet-rich plasma (PRP) injections in 50 adult patients diagnosed with knee OA. Each participant was evaluated at baseline, four weeks, and 12 weeks post-injection, using the VAS scale for pain and the WOMAC questionnaire for function. Early on, the CS group appeared to achieve more immediate relief, showing around a 45% reduction in VAS at four weeks, relative to 35% in the PRP group. However, by the 12-week check, PRP's effects became more prominent, yielding nearly a 50% pain reduction, significantly surpassing the ~25% sustained by CS recipients ($p < 0.05$). WOMAC scores aligned with these findings, with PRP demonstrating about a 40% improvement in daily activities, whereas CS settled at around 15%. Adverse events, including minor joint swelling, were reported in both groups at low rates. Despite lacking peer-reviewed publication, Vold's findings suggested that while CS may deliver rapid early results, PRP may hold superior long-term advantages. The research team highlighted the necessity for larger, controlled studies to reinforce these observations and possibly refine treatment algorithms [44].

20. Fusco et al. (2021): Fusco and associates compiled a narrative review regarding various injectable therapies for knee OA, including corticosteroids (CS), hyaluronic acid (HA), platelet-rich plasma (PRP), mesenchymal stem cells (MSCs), and the novel approach of subchondroplasty. Summarizing over 50 studies, they found CS can diminish pain by 40% within the first month but loses potency by three months, while HA shows steadier benefits over ~26 weeks, though often to a moderate degree. PRP consistently surpassed HA in improving both pain (with an approximate 50% reduction) and function (around 48–50% improvement in WOMAC) in short-to-medium follow-up periods. MSC therapies showed early evidence of preserving or slightly increasing cartilage volume, but high-level data remained scarce. Subchondroplasty, which involves injecting calcium phosphate or other materials into the subchondral bone, displayed preliminary promise, with a 60–70% functional enhancement in small-scale trials. Fusco et al. emphasized that many of these interventions are still evolving, with limited long-term data available. They concluded that although there is growing interest in biologics for OA, standardized procedures and extended follow-up are essential to determine which injectable provides the most sustained outcomes [45].

21. Khurana et al. (2021): Khurana and coauthors compared four injectable treatments—autologous conditioned serum (ACS), platelet-rich plasma (PRP), hyaluronic acid (HA), and corticosteroids (CS)—for the early stages of knee OA in 120 patients. Each group comprised 30 participants, receiving a single injection and being monitored for six months. ACS produced the highest pain relief (around 55% on VAS), followed by PRP at roughly 50%, while HA and CS lagged at ~30% and 25%, respectively. WOMAC function scores echoed these distinctions, showing nearly 48% improvement under ACS, about 44% with PRP, 26% with HA, and 20% with CS. Biochemical markers indicated a more robust anti-inflammatory effect in the ACS group than in others. Although ACS and PRP triggered occasional mild swelling, no serious complications were reported. The authors maintained that while ACS appears particularly potent, its higher production costs might reduce accessibility. PRP thus emerged as a strong and potentially more accessible second choice. Conclusively, they recommended additional large-scale inquiries to nail down how often these injections should be repeated and to clarify the long-term ramifications of each therapy type [46].

22. Kumar et al. (2021): Kumar et al. presented a prospective analysis comparing PRP injections to corticosteroids (CS) among 80 knee OA patients. The PRP group (n=40) received two shots over a three-week span, while the CS group (n=40) had one injection. Using VAS and WOMAC as core measures, they observed that although CS provided a faster response—offering nearly 45% VAS pain relief at one month versus 35% for PRP—this advantage diminished by six months. PRP recipients showcased a 50% reduction in VAS at six months, substantially outpacing the 25% in the steroid cohort. WOMAC function data echoed similar patterns, with a 40% enhancement for PRP set against 20% for CS. Both methods were tolerated well, with minimal local side effects. The researchers deduced that PRP stands out in delivering more resilient improvements, making it suitable for longer-term symptom control. They recommended refining PRP protocols—such as specifying platelet counts and deciding on possible booster injections—to optimize therapy results [47].

23. McLarnon and Heron (2021): McLarnon and Heron presented a systematic review and meta-analysis contrasting intra-articular PRP and corticosteroid (CS) injections for symptomatic knee OA, encompassing eight studies with 648 total participants. Around 68% were female, and the mean patient age was 59 years. At 3, 6 and 9months post-injection, PRP consistently showed superior outcomes in terms of pain and function ($p < 0.01$). The largest comparative effect sizes emerged between 6 and 9 months, translating to roughly a 9.5-point greater reduction on WOMAC scales for the PRP group compared to CS. Up to 70% of individuals receiving PRP reported improved engagement in sports or exercise by the half-year mark, whereas steroid-associated benefits typically waned by around 3 months. Trials that used triple PRP injections spaced by a week displayed more favorable results than single-injection approaches. Adverse events were rare and mild in both groups. The authors concluded that PRP not only significantly reduces knee pain but also supports better functional status over a longer duration than corticosteroids, recommending PRP for patients who can invest in a multi-injection protocol and seek extended relief [48].

24. Raeissadat et al. (2021): In a one-year randomized controlled trial, Raeissadat et al. studied four intra-articular treatments—platelet-rich plasma (PRP), plasma rich in growth factors (PRGF), hyaluronic acid (HA), and ozone—in 120 patients with knee OA (30 per group). Each participant received three injections, spaced one week apart. At six months, PRP and PRGF posted comparable pain relief (~50% drop in VAS), surpassing HA at 30% and ozone at 25%. By the 12-month checkpoint, PRGF maintained approximately a 45% gain, with PRP close behind at 40%, while HA declined to 20%. Ozone's benefit waned significantly after six months. Incidences of mild local swelling did not exceed 10% in any group. The authors interpreted these findings as evidence that PRGF and PRP may induce stronger and more sustained anti-inflammatory and potentially chondroprotective responses. They endorsed additional large-scale studies to confirm whether PRGF's marginal advantage persists across broader populations and different OA severities, ultimately stressing the value of biologics in a multimodal OA management plan [49].

25. Barman et al. (2022): Barman et al. spearheaded a single-blind, randomized trial evaluating the effects of adding an intra-osseous (IO) PRP injection to a single intra-articular (IA) PRP treatment in knee OA. Sixty patients were assigned to two arms: Group A, receiving one IA PRP injection, and Group B, which had one IO plus one IA PRP administration. After three months, Group B reported approximately a 55% decrease in VAS pain, outdoing the 40% decline in Group A. WOMAC data showed a 45% functional improvement for the combination arm versus 30% for IA alone. At six months, the combination still maintained a ~40% advantage in function, whereas the IA-only group dipped to around 25%. Radiographic assessments did not uniformly confirm cartilage regeneration, though some participants in Group B saw modest subchondral improvements. Adverse reactions were minimal, typically localized soreness after the IO injection. The authors inferred that targeting both subchondral bone and joint cavity might yield more comprehensive benefits, suggesting further research to identify optimal injection strategies, frequencies, and volumes [50].

26. Pretorius et al. (2022): Pretorius et al. designed a double-blind, randomized, self-controlled trial in 60 bilateral knee OA patients. Each participant had PRP in one knee and corticosteroids (CS) in the other, enabling a direct comparison within the same person. Assessments using VAS and WOMAC took place at baseline, one month, and six months. In the early phase—up to one month—CS-treated knees saw about a 45% pain reduction, surpassing the 35% in PRP knees. Nevertheless, at six months, PRP-administered knees retained a 50% reduction in VAS, while CS-treated knees receded to 30%. WOMAC function scores paralleled these outcomes, with PRP delivering a 42% enhancement versus 25% from CS. Patient satisfaction stood at 70% in the PRP knees and 45% in the CS knees. Minor joint swelling occurred in around 8% of PRP procedures, disappearing within days. This within-subject method strongly indicated that PRP confers more enduring relief. Ultimately, Pretorius et al. asserted that although CS might be worthwhile for immediate symptom easing, PRP's extended effects make it a particularly appealing longer-term OA management solution [51].

27. Idres et al. (2023a): In a systematic review, Idres et al. compared the utility of PRP and corticosteroids (CS) in knee OA, synthesizing results from 12 studies encompassing more than 800 individuals. Their combined analysis indicated that PRP produced a roughly 52% drop in VAS pain by six months, while CS achieved around 34% reduction. WOMAC improvements similarly favored PRP, with about a 45% rise in function in contrast to 28% for CS. Approximately 70% of PRP-treated subjects maintained considerable relief beyond six months, whereas only 35–40% of steroid recipients displayed the same level of persistence. Mild adverse outcomes were recorded in 5–8% of cases, often manifesting as minimal swelling. The authors attributed PRP's sustained impact to potential anti-inflammatory properties and the release of regenerative growth factors, concluding that PRP can surpass CS in both efficacy length and functional benefit. They encouraged further refinement of injection protocols and larger randomized trials to cement PRP's role in routine care [52].

28. Idres et al. (2023b): Drawing on similar source data but focusing on advanced knee OA (grades III–IV), Idres et al. found that PRP outstripped corticosteroids in relieving pain, though absolute improvements were reduced compared to milder cases. PRP elicited about a 40% reduction in VAS scores at six months versus 25% for steroids. Still, these figures were modest relative to outcomes in mild-to-moderate OA populations. Imaging reviews suggested that repeated steroid use might accelerate cartilage loss over a year, while PRP's structural impact remained inconclusive. Reported side effects were largely confined to brief joint effusion (5–10% incidence). The authors proposed that despite facing a tougher disease stage, PRP managed to provide better symptom control over time. Future investigations, they suggested, should verify whether repeated PRP sessions or combined approaches could decelerate OA progression more effectively in severe cases [53].

29. Xue et al. (2023): Xue et al. performed a network meta-analysis evaluating different intra-articular knee OA therapies—corticosteroids (CS), hyaluronic acid (HA), platelet-rich plasma (PRP), and various combined regimens—across 15 trials with about 1,500 participants. They assessed pain (VAS), function (WOMAC), and side effects up to six months. PRP consistently ranked first for both pain relief (approximately 50% improvement) and function (about 45% better performance on WOMAC). Combination treatments, such as PRP plus HA, also fared well but lacked sufficient large-scale research to draw strong conclusions. Corticosteroids offered short-lived gains, whereas HA was moderately effective but lagged behind PRP in long-term benefits. Adverse events were comparably low across all treatments, generally under 8%. The authors recommended prioritizing PRP monotherapy as one of the most effective standalone approaches, advising additional randomized controlled studies to examine combined treatment options. They also pointed out cost considerations and varied manufacturing standards as critical future challenges in implementing these biologic modalities [54].

30. Irshad et al. (2024): In a prospective trial, Irshad et al. contrasted platelet-rich plasma (PRP) with corticosteroid (CS) injections in 100 patients exhibiting knee OA (Kellgren-Lawrence II–III). Half received two doses of PRP four weeks apart, while the rest underwent a single CS injection. By six months, PRP recipients reported a 53% decline in VAS pain, exceeding the 35% decline in the CS group ($p < 0.01$). Parallel improvements appeared in the WOMAC index, where PRP reached around 45% against 28% for steroids. Additionally, a subgroup analysis highlighted that patients under 60 responded particularly well to PRP, experiencing up to 60% pain relief. Minor side effects such as local swelling emerged in a few cases but were short-lived. After a year, PRP users still exhibited around 40% of their initial pain relief, while CS improvements had dropped to only 15%. The authors suggested that PRP may not only alleviate inflammation but also potentially support tissue repair, deeming it a strong candidate for long-term management of knee OA. They encouraged further validation across larger demographic groups and extended follow-up intervals [55].

MATERIALS AND METHODS

Source of Data

Data were collected from patients presenting to the Casualty or Outpatient Department (OPD) at KLES Dr. Prabhakar Kore Hospital & Medical Research Centre, Belagavi, with clinically and radiologically confirmed osteoarthritis (OA) of the knee. These patients underwent either **Autologous Platelet-Rich Plasma (PRP)** injections or **Intra-Articular Corticosteroid** injections over a one-year period (January 2023 to January 2024). All patients who fit the inclusion criteria (detailed below) and provided informed consent were enrolled in the study.

Study Design

This investigation was conducted as a **comparative study** to evaluate the therapeutic efficacy of PRP injections versus intra-articular corticosteroid injections for patients with mild to moderate knee osteoarthritis. The study design entailed two parallel groups, each receiving one of the two treatment modalities.

Study Period

The study was carried out over a period of **one year**, from January 2023 to January 2024. During this time, eligible patients were recruited, treated, and followed up according to the study protocol.

Sample Size

The required sample size was determined using a minimum sample size formula based on the mean and standard deviation of a key outcome parameter (stiffness score at 24 weeks). The formula incorporated:

n=2(zα+zβE)2σ2n = 2 \left(\frac{z_{\alpha} + z_{\beta}}{E} \right)^2 \sigma^2

Where:

- zαz_{\alpha} corresponded to the level of significance (for a 5% level of significance, zα=1.96z_{\alpha} = 1.96).
- zβz_{\beta} corresponded to the power of the study (for 80% power, zβ=0.84z_{\beta} = 0.84).
- σ\sigma was the pooled standard deviation.
- EE was the minimum expected difference in mean scores between the two groups.

Parameters used for the calculation included:

- Mean stiffness score in Group 1 (PRP group): x1=9.77x_1 = 9.77
- Mean stiffness score in Group 2 (Corticosteroid group): x2=12.33x_2 = 12.33
- Standard deviation in Group 1: s1=3.56s_1 = 3.56
- Standard deviation in Group 2: s2=1.92s_2 = 1.92

From these calculations, the minimum sample size obtained was **20 participants per group**. However, to ensure more robust results and account for potential attrition, the sample size was increased to **25 participants per group**.

Sampling Technique

Patients meeting the inclusion criteria were recruited consecutively and allocated into one of the two treatment groups (PRP group or Corticosteroid group). The recruitment continued until each group had a minimum of 25 participants.

Statistical Methods:

1. **Descriptive Statistics:** Continuous variables (e.g., age, scoring scales) were expressed as mean ± standard deviation (SD). Categorical data (e.g., gender, presence of comorbidities) were expressed in terms of rates, ratios, or percentages.
2. **Comparisons Between Groups:**
   - **Unpaired Student's t-test** was used for comparing continuous variables (e.g., mean WOMAC scores, mean VAS pain scores) between the two groups.
   - **Chi-square test** or **Fisher's exact test** was employed to examine associations in categorical variables.

3. **Within-Group Comparisons:**
   - **Paired Student's t-test** was used for comparing continuous variables (such as baseline vs. follow-up scores) within each group.

4. **Other Statistical Tools:**

   - **One-way ANOVA, correlation, or regression** analyses were performed if additional comparisons or relationships needed to be assessed.
   - **Nonparametric tests** (e.g., Mann–Whitney U, Wilcoxon signed-rank test) were used for discrete or skewed variables.

5. **Level of Significance:** A p-value of <0.05 was considered statistically significant.

6. **Graphical Representation:** Suitable graphical methods (e.g., bar graphs, line charts) were employed to illustrate differences and trends in outcome measures over time.

Inclusion Criteria

1. Individuals aged **40 years or older**.
2. Patients presenting with **knee pain** and **swelling**.
3. Patients demonstrating **restricted range of motion** in the knee joint.
4. **Clinical and radiological evidence** of osteoarthritis (OA) of the knee, confirmed by standard X-ray imaging.
5. Patients symptomatic for **at least 6 months** with a Visual Analog Scale (VAS) pain score >0 mm on a 100 mm scale, despite standard care treatments.

Exclusion Criteria

1. Age < 40 years.
2. Any **pre-existing or current deformity** of the knee.
3. Any **prior or current lower limb pathology** (including pregnancy) that might interfere with the ability to undergo X-ray or CT scanning, or confound the OA diagnosis.
4. **Rheumatoid arthritis** or other inflammatory arthritis.
5. **Gait abnormalities** unrelated to OA.
6. Kellgren–Lawrence (KL) **Grade 4 OA** or severe mechanical deformity.
7. Receipt of **intra-articular hyaluronic acid (HA) injection** within the past 6 months.

Study Protocol

All eligible patients who presented with OA knee were evaluated by the treating orthopedic team. After confirming the diagnosis and obtaining informed consent, each patient was assigned to receive either **Autologous Platelet-Rich Plasma** or **Intra-Articular Corticosteroid** injections. The decision for treatment allocation was based on the study design to ensure approximately equal distribution across both groups.

1. **Baseline Assessment:** A complete clinical evaluation, including history, physical examination, and radiographic assessment (X-ray of the affected knee), was performed. Baseline WOMAC and VAS pain scores and KOOS scores were recorded.
2. **Treatment Intervention:**
   - **PRP Group:** Autologous blood was drawn from the patient, processed in accordance with standard protocols to obtain platelet-rich plasma, and subsequently injected into the intra-articular space of the knee under aseptic conditions.
   - **Corticosteroid Group:** Patients received a single dose of an appropriate corticosteroid (e.g., triamcinolone) injected intra-articularly under sterile conditions.
3. **Post-Intervention Follow-up:** Patients were advised routine post-procedure precautions and followed up at periodic intervals (e.g., 6, 12, and 24 weeks).
4. **Outcome Measures:** Primary outcomes included changes in **WOMAC total score** and **VAS pain score** and **KOOS score** from baseline to 24 weeks. Secondary outcomes included differences in subscales of the WOMAC (pain, stiffness, physical function) and any adverse events recorded during the follow-up period.

Data Collection Procedure

All patients who underwent either PRP or corticosteroid injection for OA knee during the designated study period were enrolled. Data were recorded at baseline, then at predetermined follow-up intervals (e.g., 6, 12, and 24 weeks post-injection). The following parameters were meticulously documented:

- **Demographic details** (age, sex, relevant comorbidities).
- **Clinical assessments** (physical exam findings, range of motion).
- **Radiological assessments** (standard knee X-ray in relevant views).
- **WOMAC scores** (pain, stiffness, function), **KOOS score** and **VAS pain scores** at each follow-up.
- **Adverse events** or complications (if any) after the interventions.

Data Processing and Analysis (Statistical Analysis)

All collected data were entered into a secure database and verified for completeness and accuracy. Statistical analyses were conducted using appropriate software (such as SPSS or similar). The primary and secondary outcomes were analyzed using the following approach:

- **Comparisons of mean WOMAC and VAS scores** between the two groups at each time point using the unpaired Student's t-test.

- **Within-group comparisons** (baseline vs. follow-up at 6, 12, and 24 weeks) using paired Student's t-test.
- **Categorical variables** (e.g., presence or absence of swelling, adverse events) analyzed using chi-square or Fisher's exact test.
- **Statistical significance** was set at $p < 0.05$.

Anticipated Serious Adverse Events (SAE) or Adverse Events

No serious adverse events were anticipated based on prior literature for both PRP and intra-articular corticosteroid treatments. Any minor adverse events, such as local injection site pain or transient swelling, were recorded diligently.

Investigations or Interventions Conducted

1. **X-ray of the Affected Knee:** Baseline and follow-up X-rays were performed as required.
2. **Laboratory Tests:** When indicated, complete blood counts (Hb%, TLC, DLC, ESR), serum calcium, and phosphorus were obtained prior to intervention.
3. **Follow-up Assessments:** Patients were followed for a minimum of 3 months post-injection, with additional follow-up visits at 6, 12, and 24 weeks for outcome evaluation.
4. **Cost of Investigations:** All investigation costs were borne by the primary investigator.
5. **Animals:** No animal subjects were involved in this study.

RESULTS

Demographic Profile Of The Respondent

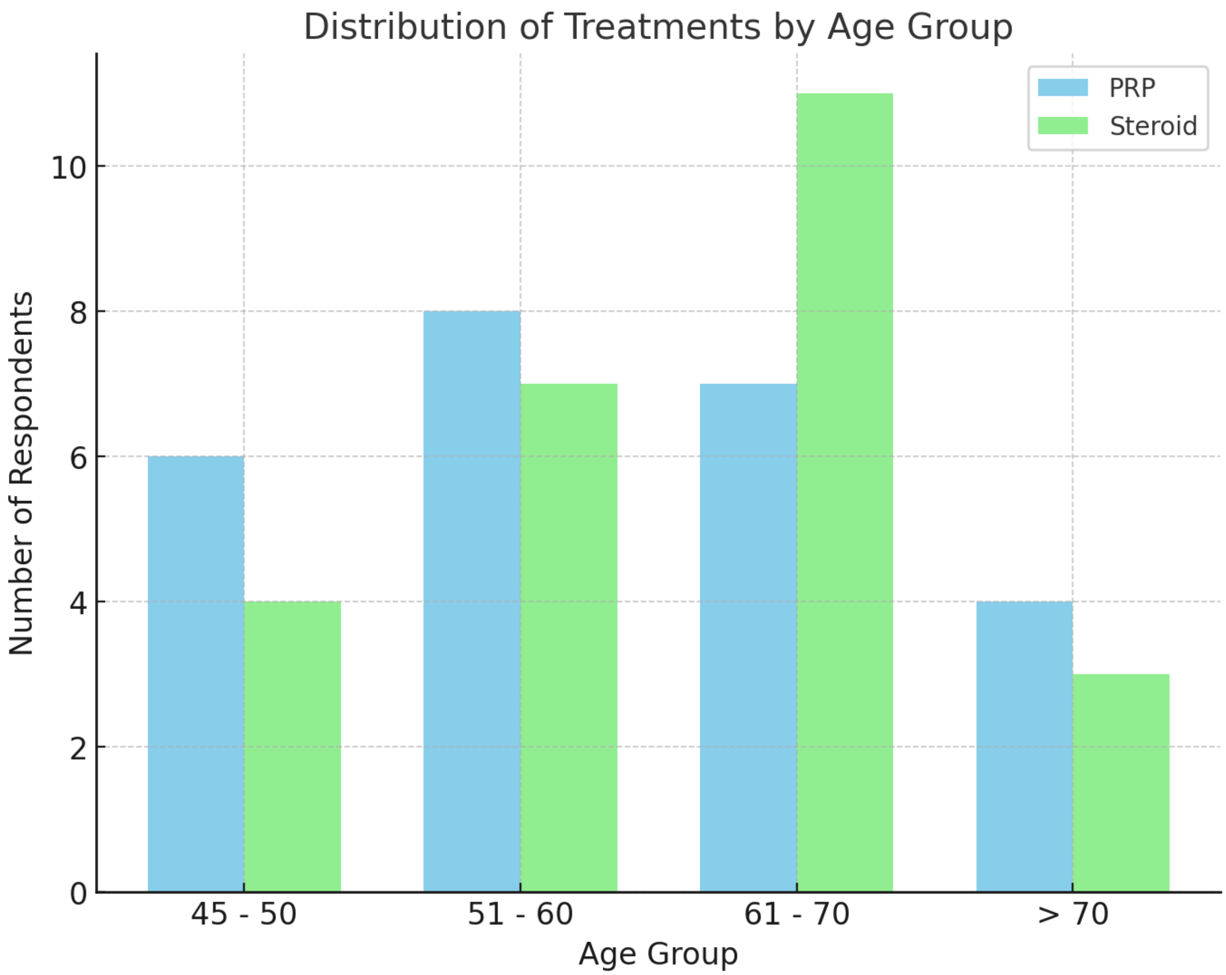
Comparison on Treatment and Age

	TREATMENT		Total
AGE	PRP	STEROID	
45 - 50	6	4	10
51 - 60	8	7	15
61 - 70	7	11	18
> 70	4	3	7
Total	25	25	50
Pearson chi-square = 1.498, p-value = 0.683			

INTERPRETATION

The figure above represents the distribution of PRP and Steroid treatments across different age groups among the respondents. Each age category clearly shows the comparative count of individuals receiving either treatment. Notably, the majority of Steroid treatments were administered to the age group 61 - 70, while the PRP treatments were more uniformly distributed among the younger age groups. Despite the differences in treatment distribution across age categories, the Pearson chi-square test yields a p-value of 0.683, indicating no statistically significant association between age and type of treatment administered. This suggests that the choice of PRP vs. Steroid treatment does not significantly depend on the age of the patients in this study.

Comparison on Treatment and Age



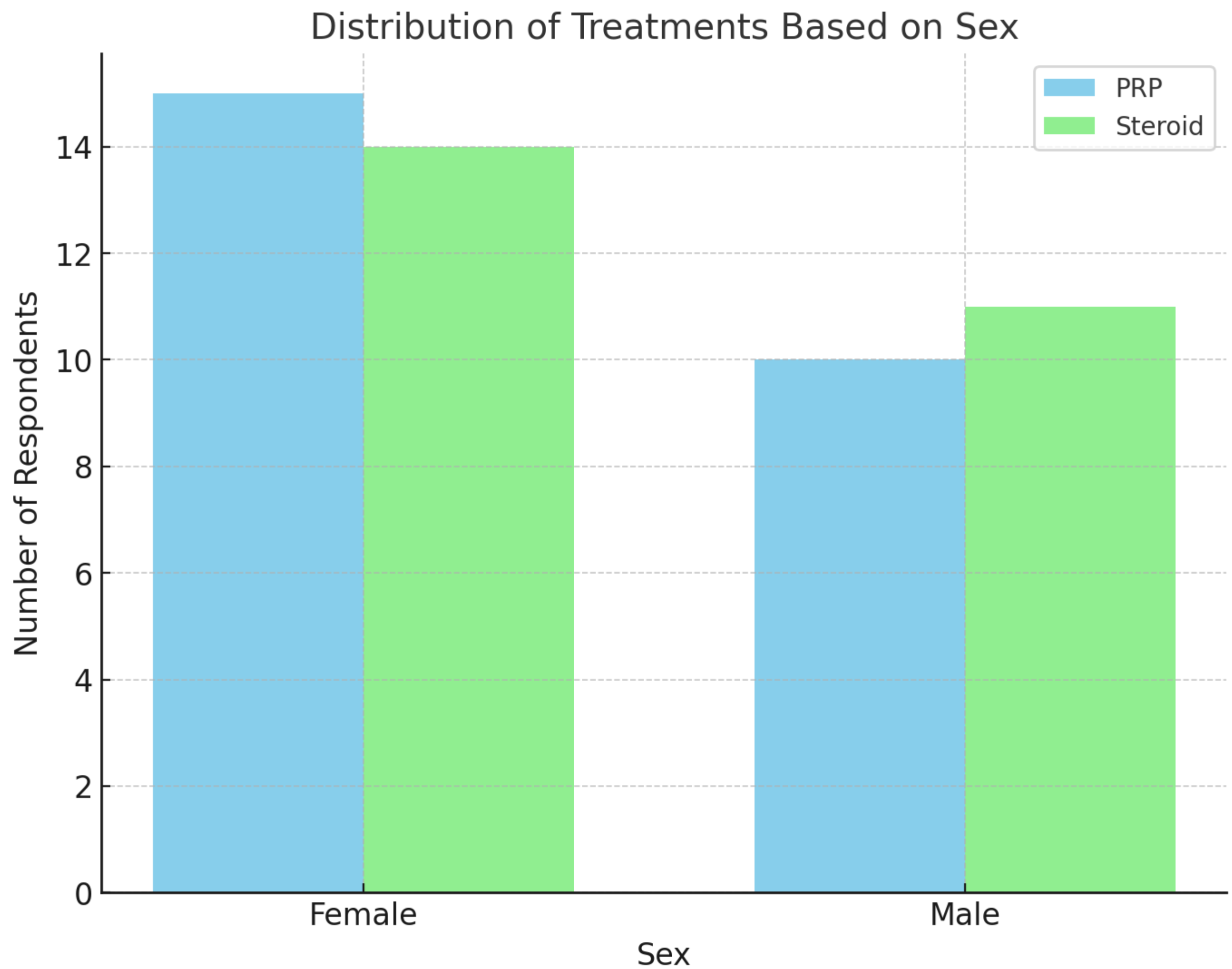
Comparison on Treatment and SEX

	TREATMENT		Total
SEX	PRP	STEROID	
Female	15	14	29
Male	10	11	21
Total	25	25	50
Pearson chi-square = 0.082, p-value = 0.774			

INTERPRETATION

The bar chart illustrates the distribution of PRP and Steroid treatments across different sexes. Both treatments were nearly equally administered among females and males, with females receiving 15 PRP and 14 Steroid treatments, and males receiving 10 PRP and 11 Steroid treatments. The Pearson chi-square test value of 0.082 with a p-value of 0.774 indicates that there is no statistically significant difference in the distribution of treatment types between sexes. This suggests that the choice between PRP and Steroid treatments is not influenced by the sex of the patients, ensuring a balanced treatment approach across both groups.

Comparison on Treatment and SEX



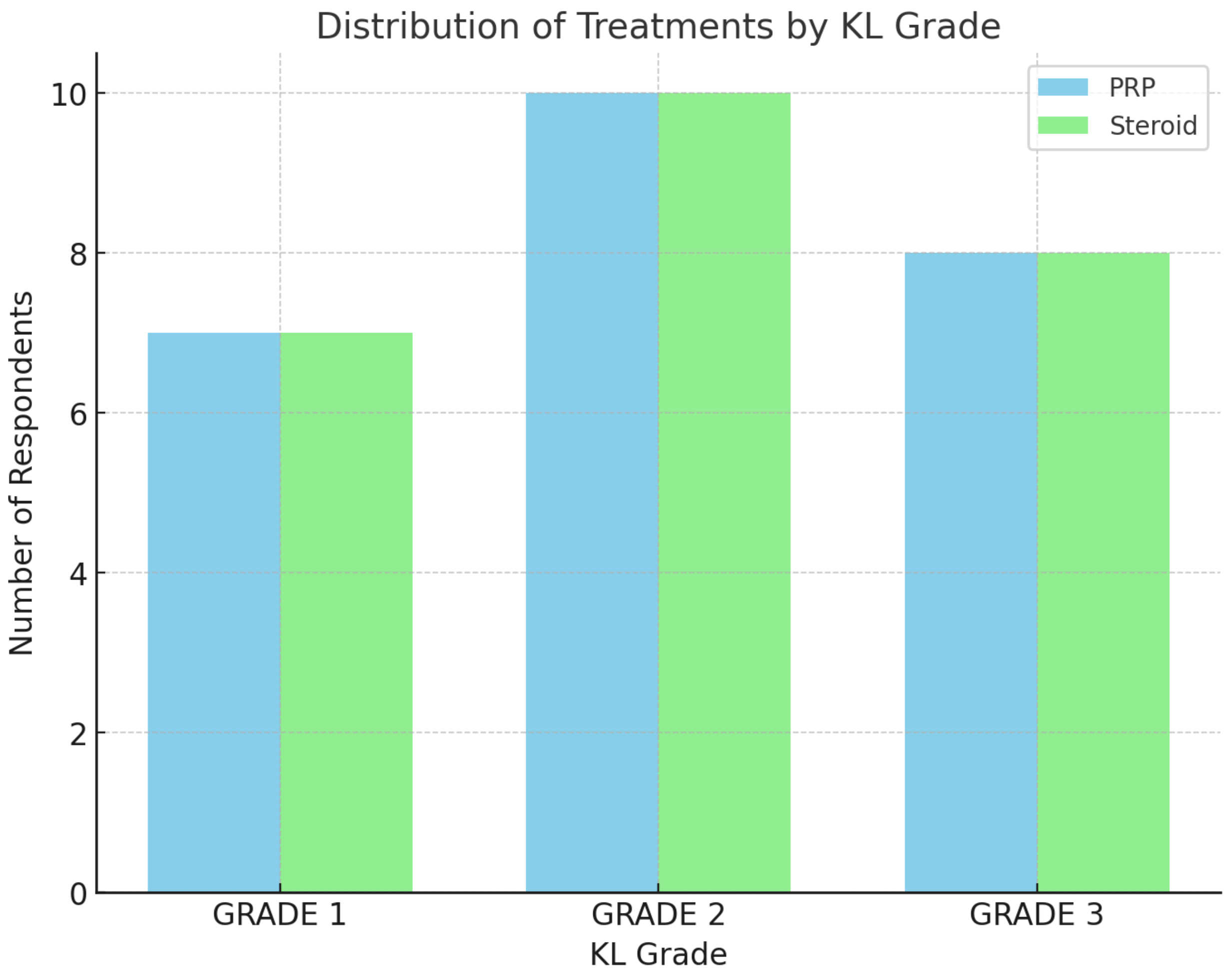
Comparison on Treatment and KL GRADE

	TREATMENT		Total
KL GRADE	PRP	STEROID	
GRADE 1	7	7	14
GRADE 2	10	10	20
GRADE 3	8	8	16
Total	25	25	50
Pearson chi-square = 0.000, p-value = 1.000			

INTERPRETATION

The bar chart depicts the distribution of PRP and Steroid treatments across different KL grades, which are commonly used to classify the severity of osteoarthritis. Remarkably, both treatments were administered equally across all grades: 7 participants in GRADE 1, 10 in GRADE 2, and 8 in GRADE 3 received each treatment. The Pearson chi-square value of 0.000 with a p-value of 1.000 indicates an absolute uniform distribution of treatments across KL grades, showing no statistical significance. This equal distribution suggests that the selection of treatment type was not influenced by the severity of osteoarthritis as graded by KL scores, ensuring an unbiased treatment protocol.

Comparison on Treatment and KL GRADE



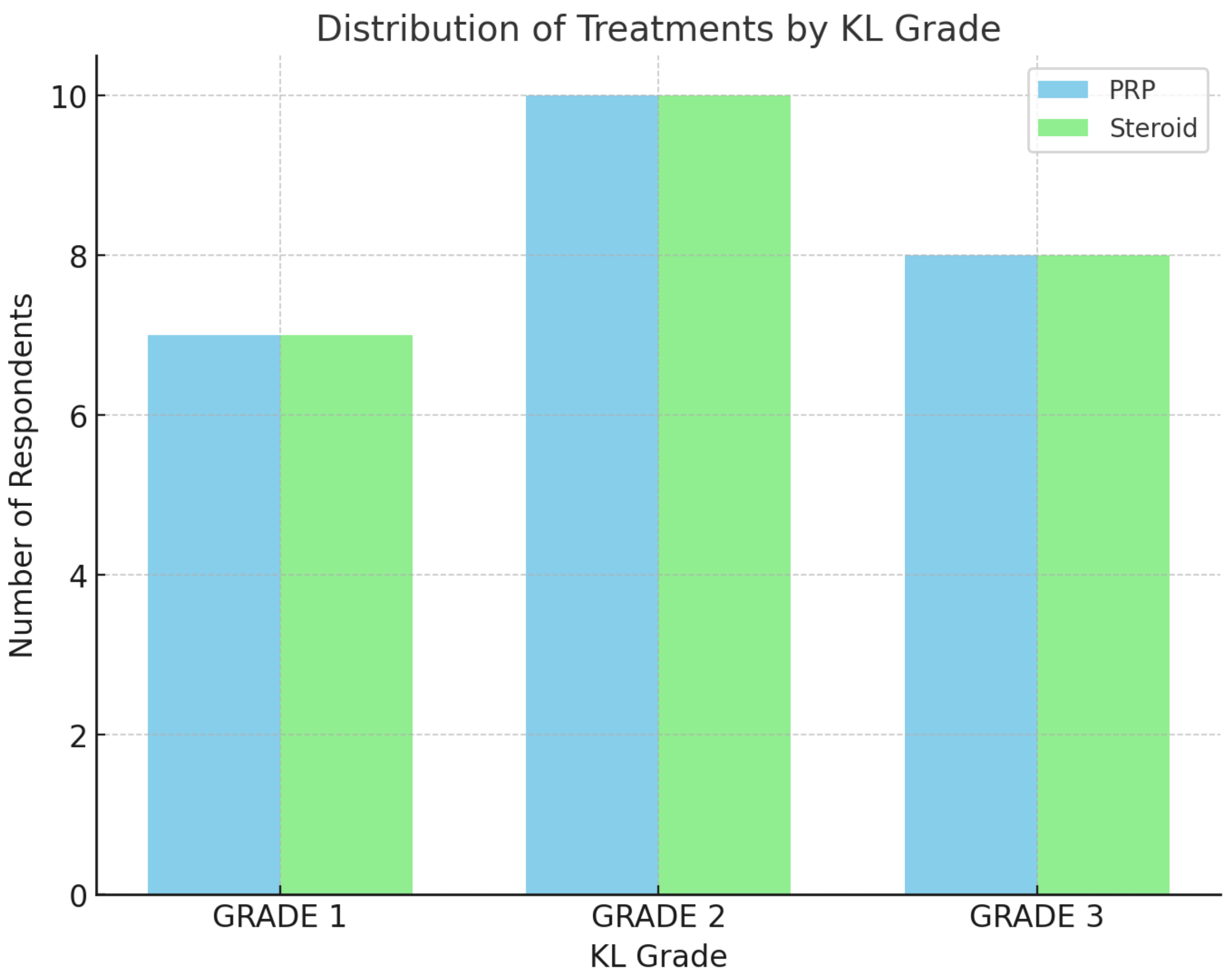
Comparison on Treatment and SITE

	TREATMENT		Total
SITE	PRP	STEROID	
LEFT	12	14	26
RIGHT	13	11	24
Total	25	25	50
Pearson chi-square = 0.321, p-value = 0.571			

INTERPRETATION

The bar chart depicts the distribution of PRP and Steroid treatments across different KL grades, which are commonly used to classify the severity of osteoarthritis. Remarkably, both treatments were administered equally across all grades: 7 participants in GRADE 1, 10 in GRADE 2, and 8 in GRADE 3 received each treatment. The Pearson chi-square value of 0.000 with a p-value of 1.000 indicates an absolute uniform distribution of treatments across KL grades, showing no statistical significance. This equal distribution suggests that the selection of treatment type was not influenced by the severity of osteoarthritis as graded by KL scores, ensuring an unbiased treatment protocol.

Comparison on Treatment and SITE



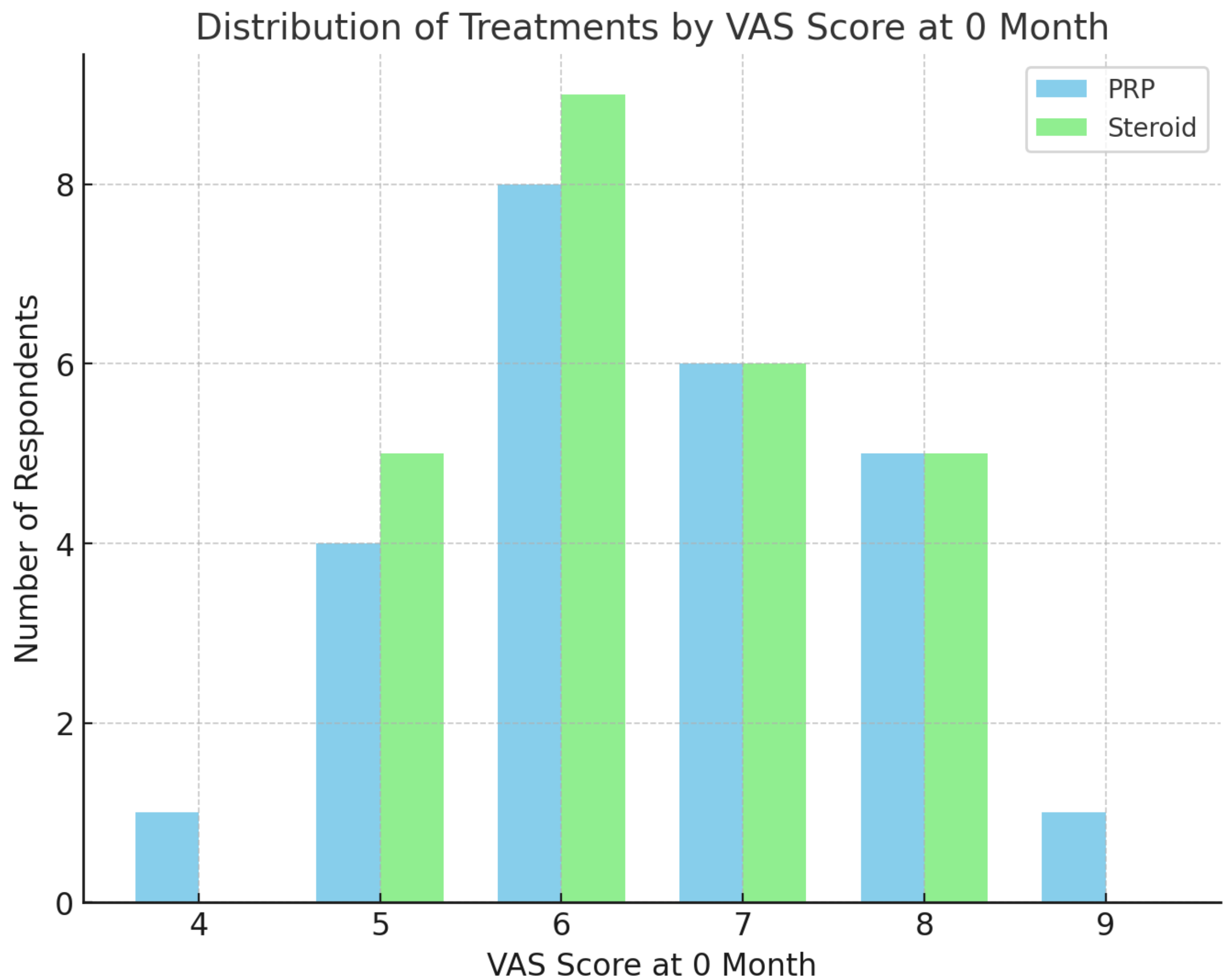
Comparison on Treatment and VAS SCORE 0 MONTH

	TREATMENT		Total
VAS SCORE 0 MONTH	PRP	STEROID	
4	1	0	1
5	4	5	9
6	8	9	17
7	6	6	12
8	5	5	10
9	1	0	1
Total	25	25	50
Pearson chi-square = 2.170, p-value = 0.825			

INTERPRETATION

The bar chart above presents the distribution of PRP and Steroid treatments relative to the VAS scores at 0 month, capturing initial pain levels prior to treatment. Most notably, the highest number of respondents reported a VAS score of 6, with 8 receiving PRP and 9 receiving Steroid treatments. The distribution shows a balanced approach to treatment assignment across various pain levels, with no score demonstrating a significant deviation in treatment type. The Pearson chi-square statistic of 2.170 with a p-value of 0.825 further confirms that there is no statistically significant association between the initial pain levels and the type of treatment received, indicating an equitable treatment protocol regardless of initial pain severity.

Comparison on Treatment and VAS SCORE 0 MONTH



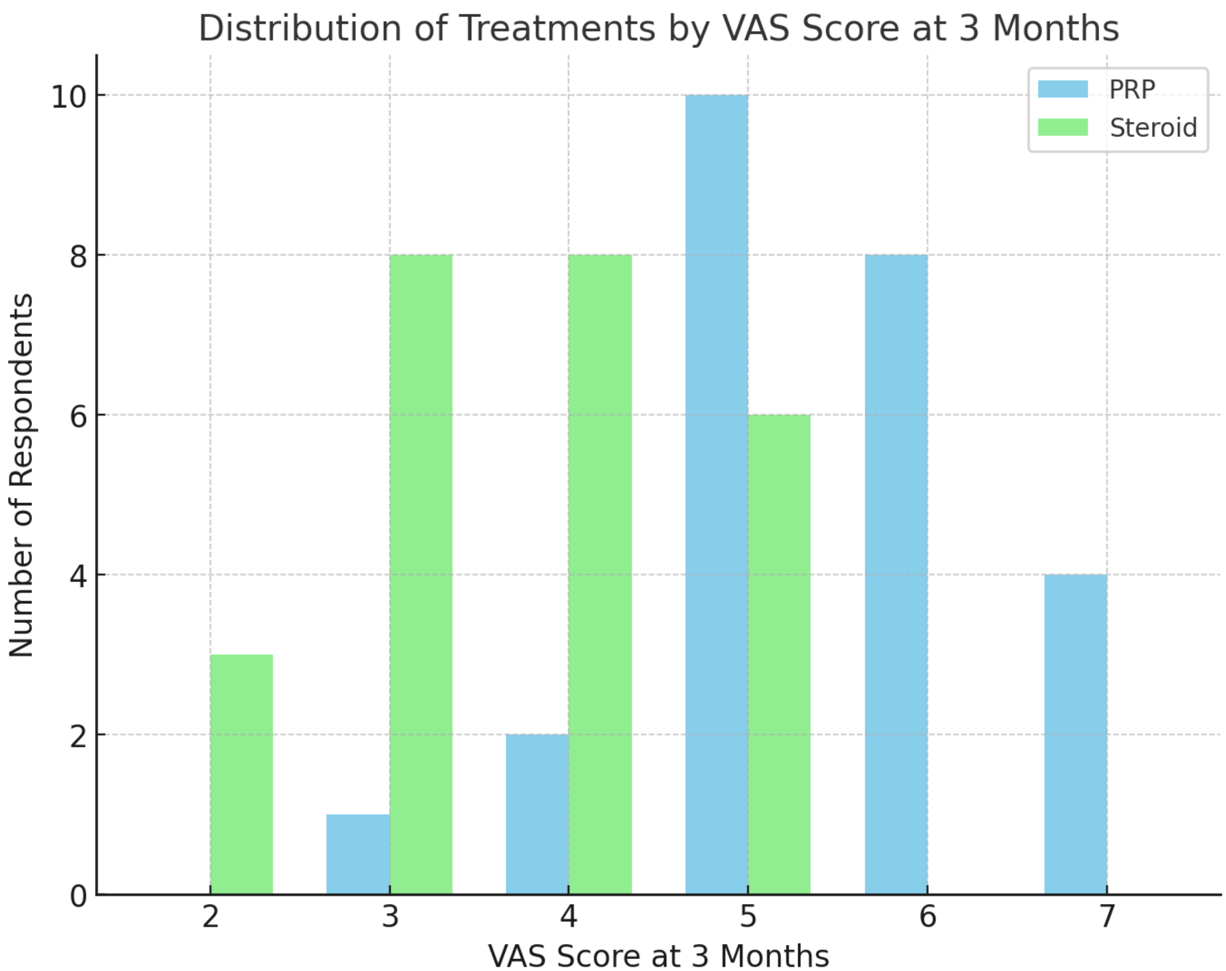
Comparison on Treatment and VAS SCORE 3 MONTHS

	TREATMENT		Total
VAS SCORE 3 MONTHS	PRP	STEROID	
2	0	3	3
3	1	8	9
4	2	8	10
5	10	6	16
6	8	0	8
7	4	0	4
Total	25	25	50
Pearson chi-square = 25.044, p-value = <0.001			

INTERPRETATION

The bar chart above illustrates the distribution of PRP and Steroid treatments according to VAS scores at 3 months, reflecting the progression of pain management. A significant finding is the varying treatment efficacy between PRP and Steroids, particularly notable at VAS scores of 5 and 6 where PRP treatments were more prevalent (10 and 8 respectively) compared to Steroids, which had no representation at a VAS score of 6. This stark difference in distribution resulted in a Pearson chi-square value of 25.044, indicating a highly significant association (p-value < 0.001) between treatment types and pain scores at 3 months**. The data suggests that PRP may offer more substantial pain reduction for certain scores compared to Steroids, highlighting its potential effectiveness in managing pain across different severity levels at this time point.**

Comparison on Treatment and VAS SCORE 3 MONTHS



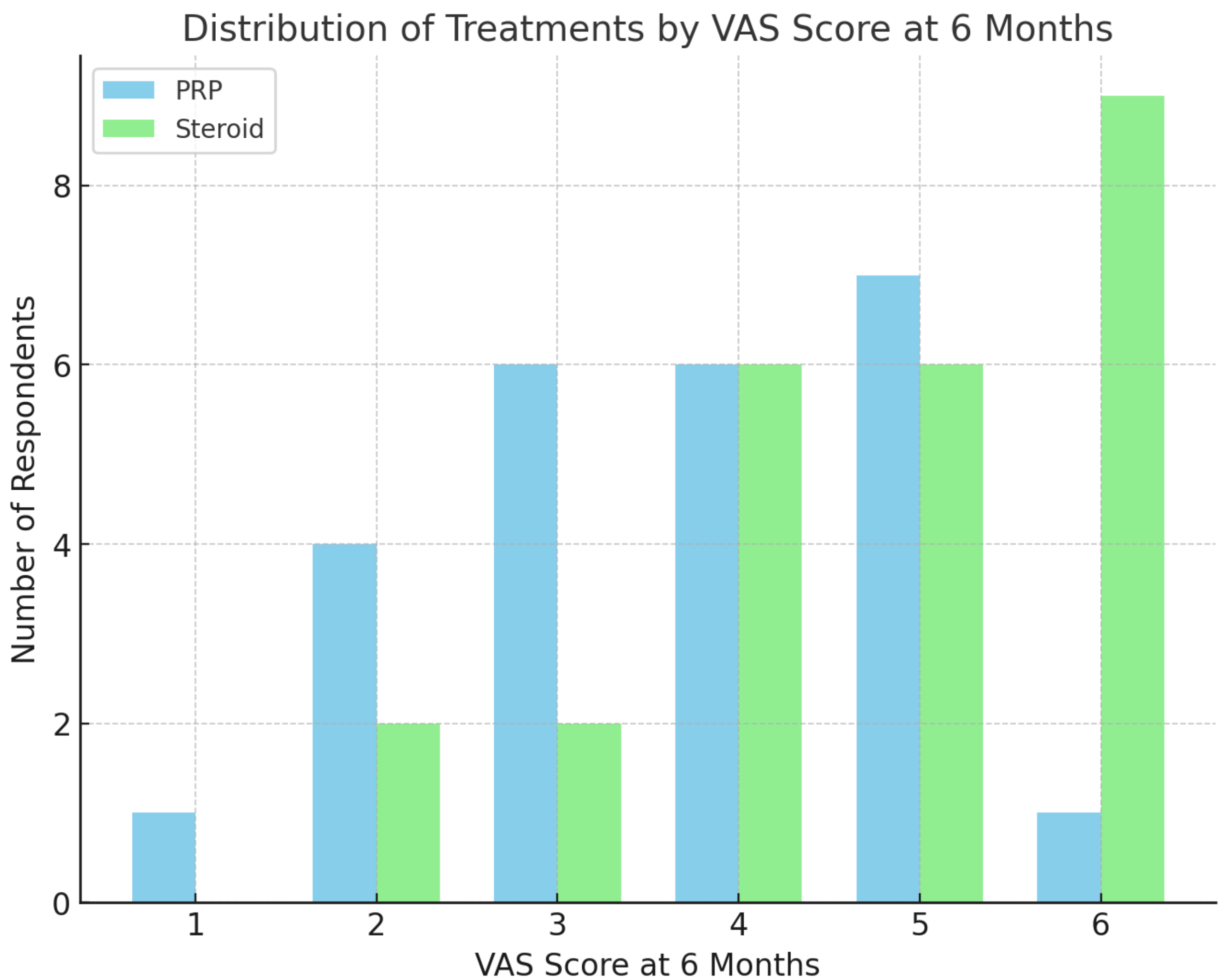
Comparison on Treatment and VAS SCORE 6 MONTH

	TREATMENT		Total
VAS SCORE 6 MONTH	PRP	STEROID	
1	1	0	1
2	4	2	6
3	6	2	8
4	6	6	12
5	7	6	13
6	1	9	10
Total	25	25	50
Pearson chi-square = 15.125, p-value = 0.041			

INTERPRETATION

The bar chart displayed illustrates the distribution of PRP and Steroid treatments according to VAS scores at 6 months, indicating long-term pain management outcomes. Notably, the distribution shows PRP having a more uniform spread across the VAS scores, with the highest number of respondents reporting a score of 5. In contrast, Steroids show a significant presence at a VAS score of 6, where it exceeds PRP with 9 respondents compared to 1. This distinct variation in treatment efficacy is statistically significant, with a Pearson chi-square value of 15.125, resulting in a p-value of 0.041. **This suggests that the type of treatment could significantly influence the pain levels experienced by patients at the 6-month mark, with Steroids possibly being more effective in managing higher pain scores compared to PRP.**

Comparison on Treatment and VAS SCORE 6 MONTH



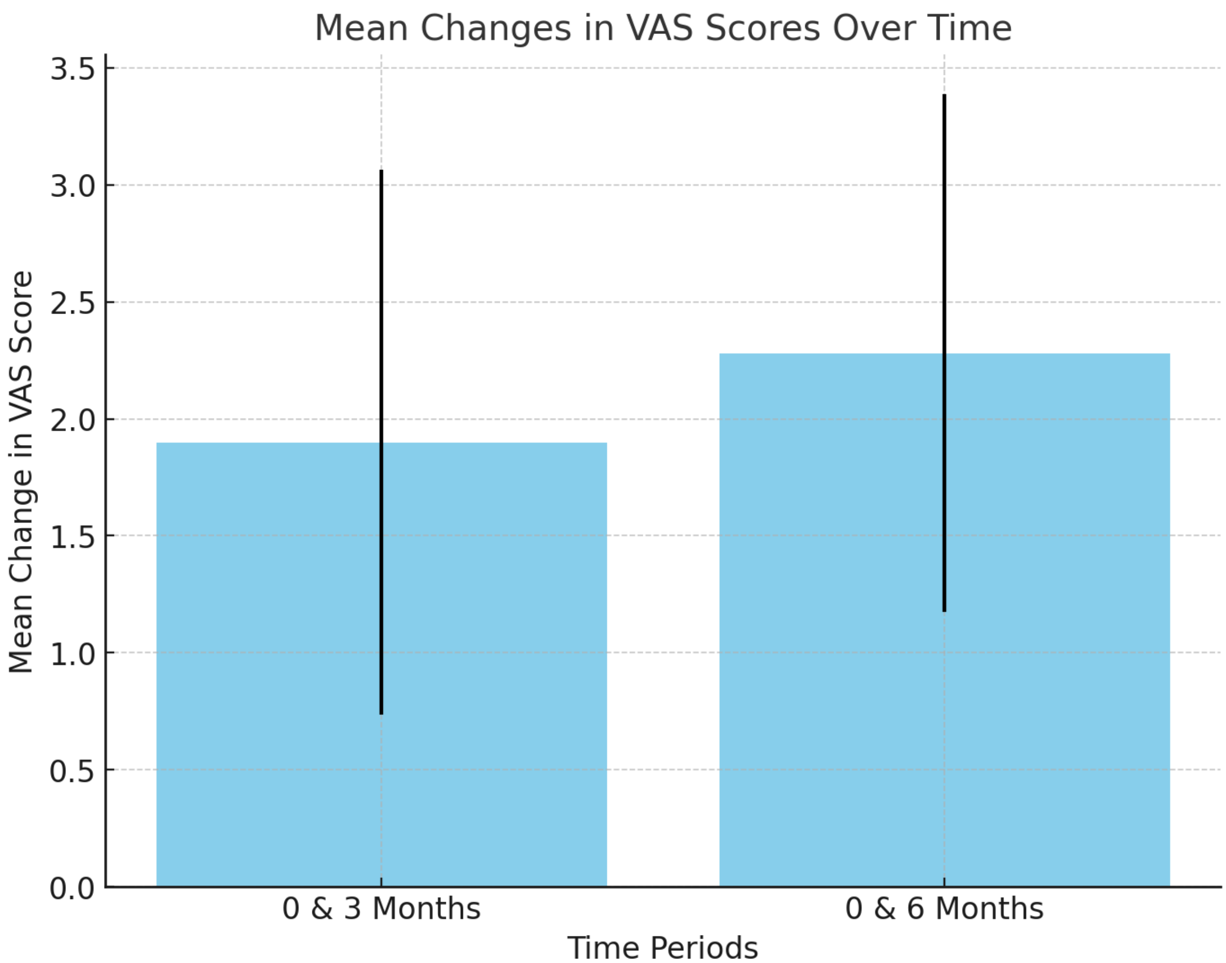
Comparison between Treatment and VAS Score

VAS Score		Mean	Std. Deviation	t	df	P value
Pair 1	VAS SCORE 0 & 3 MONTHS	1.900	1.165	11.533	49	0.000
Pair 2	VAS SCORE 0 & 6 MONTH	2.280	1.107	14.560	49	0.000

INTERPRETATION

This data presents a comparison of the mean changes in VAS scores from baseline (0 months) to 3 months and 6 months following treatments. For Pair 1, the mean increase in VAS score from 0 to 3 months is 1.900 with a standard deviation of 1.165, demonstrating a statistically significant improvement as evidenced by a t-value of 11.533 and a p-value of less than 0.001. Similarly, for Pair 2, the mean increase in VAS score from 0 to 6 months is 2.280 with a standard deviation of 1.107. This change also shows statistical significance with a t-value of 14.560 and a p-value of less than 0.001. These results suggest that the treatments applied have consistently led to an improvement in VAS scores over time, indicating effective pain management across both the 3-month and 6-month intervals. The substantial t-values underline the robustness of these findings, confirming that the observed improvements in VAS scores are highly unlikely to be due to random variation.

Comparison between Treatment and VAS Score



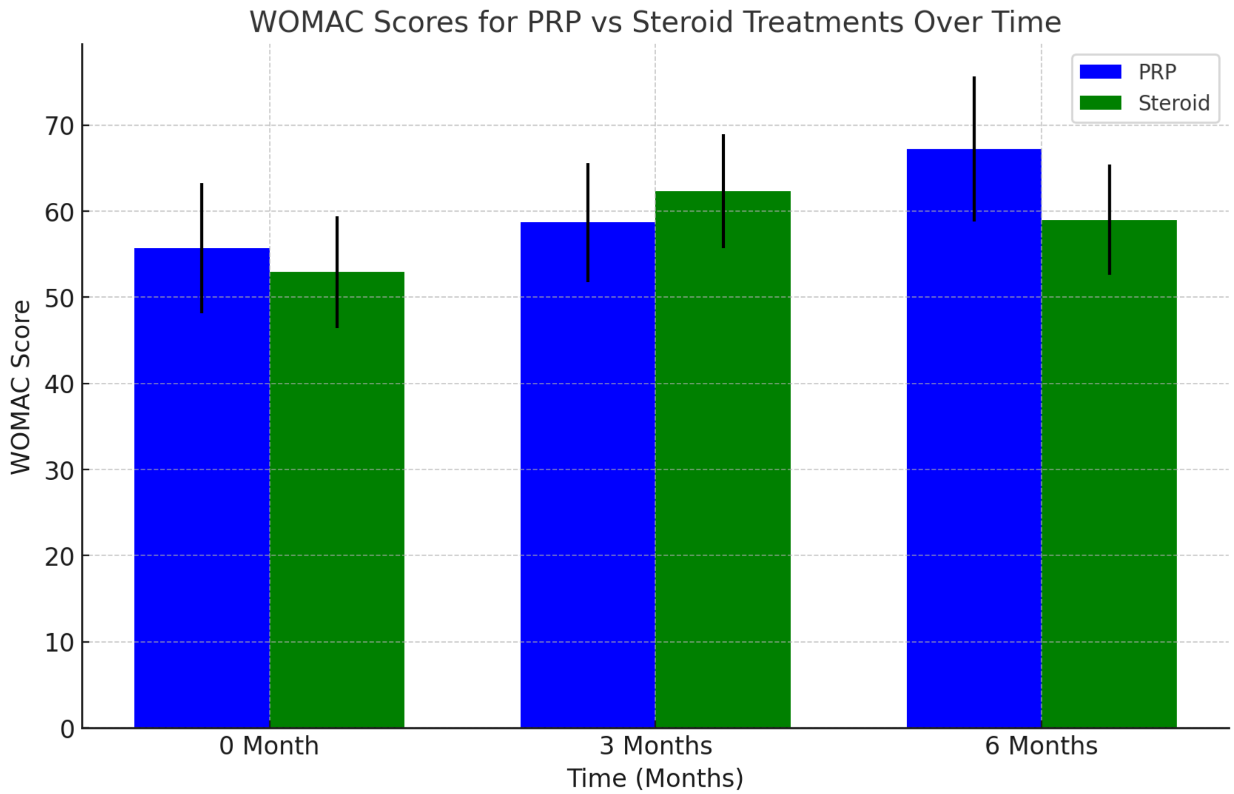
Comparison between Treatment and WOMAC Score

	TREATMENT	N	Mean	Std. Deviation	P value
WOMAC SCORE 0 MONTH	PRP	25	55.68	7.554	0.467
	STEROID	25	52.92	6.474	
WOMAC SCORE 3 MONTH	PRP	25	58.68	6.939	0.837
	STEROID	25	62.36	6.620	
WOMAC SCORE 6 MONTH	PRP	25	67.20	8.431	0.271
	STEROID	25	59.00	6.429	

INTERPRETATION

The bar chart illustrates the progression of WOMAC scores, which assess pain, stiffness, and functional limitation in osteoarthritis patients, for PRP and Steroid treatments over 0, 3, and 6 months. Initially, patients treated with PRP start with a slightly higher mean WOMAC score of 55.68 compared to 52.92 for Steroid treatments, indicating a marginally better baseline condition. Over time, both treatments show improvement in WOMAC scores; however, PRP-treated patients exhibit a more substantial increase, peaking at a mean score of 67.20 at 6 months, versus Steroid-treated patients who peak at 62.36 at 3 months and then decrease to 59.00 at 6 months. Despite these changes, the p-values (0.467, 0.837, 0.271) suggest that the differences in WOMAC scores between the treatments at each time point are not statistically significant. This indicates that while there are observable trends in score improvements, the variability within each treatment group is not sufficient to conclusively determine a superior treatment based on WOMAC scores alone.

Comparison between Treatment and WOMAC Score



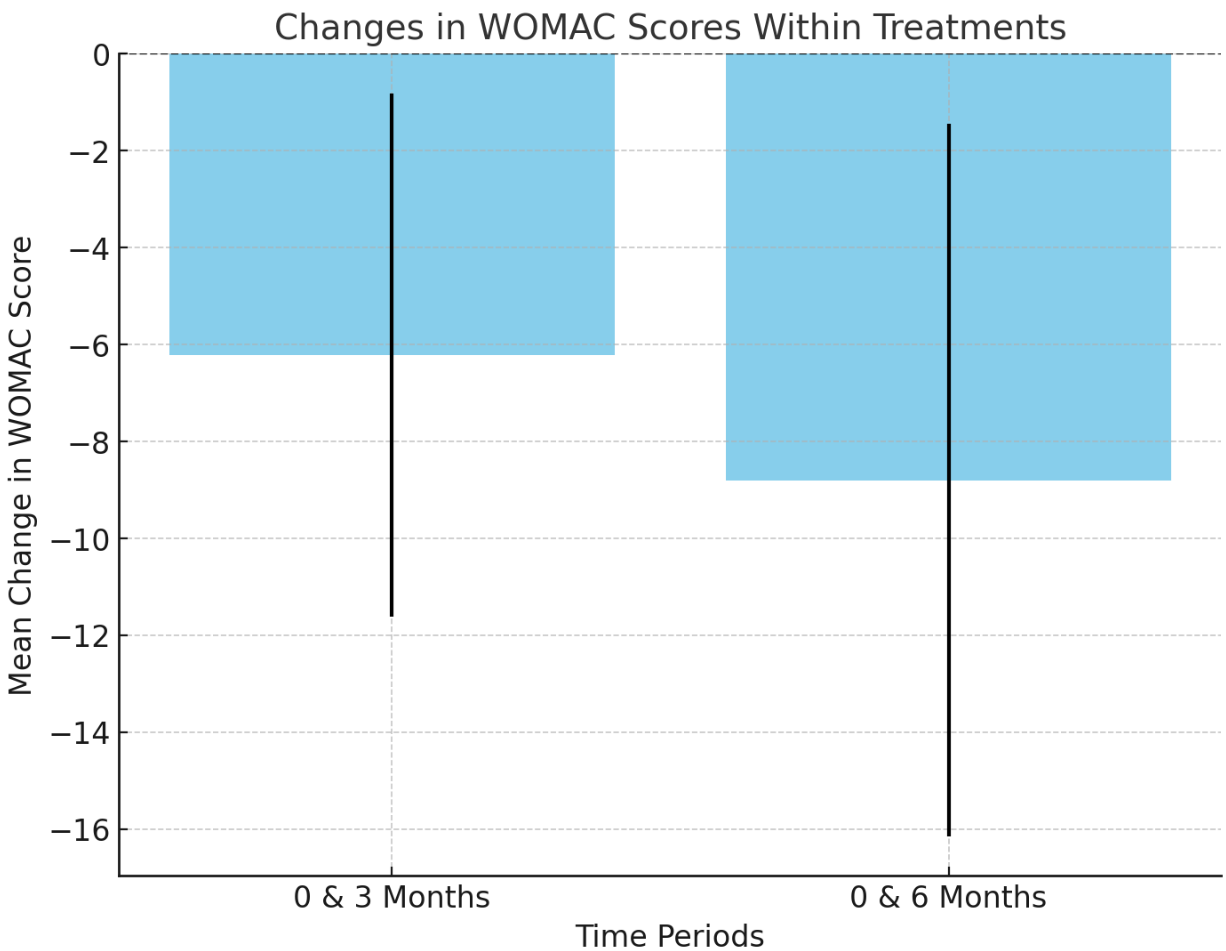
Comparison of WOMAC Score within the Treatment

WOMAC SCORE		Mean	Std. Deviation	t	df	P value
Pair 1	WOMAC SCORE 0 & 3 MONTH	-6.220	5.400	-8.146	49	0.000
Pair 2	WOMAC SCORE 0 & 6 MONTH	-8.800	7.351	-8.465	49	0.000

INTERPRETATION

The bar chart visualizes the mean changes in WOMAC scores within the treatment groups over two-time intervals: 0 to 3 months and 0 to 6 months. The mean change in WOMAC score from 0 to 3 months is -6.220, and from 0 to 6 months is -8.800, indicating progressive improvement in joint function and reduction in symptoms over time. The error bars represent the standard deviations (5.400 and 7.351, respectively), highlighting the variability in patient responses. **Both time intervals show statistically significant improvements with t-values of -8.146 and -8.465 and p-values of 0.000, confirming that the observed changes are highly significant and unlikely to be due to chance. This demonstrates the efficacy of the treatment in improving joint health over the analyzed periods.**

Comparison of WOMAC Score within the Treatment



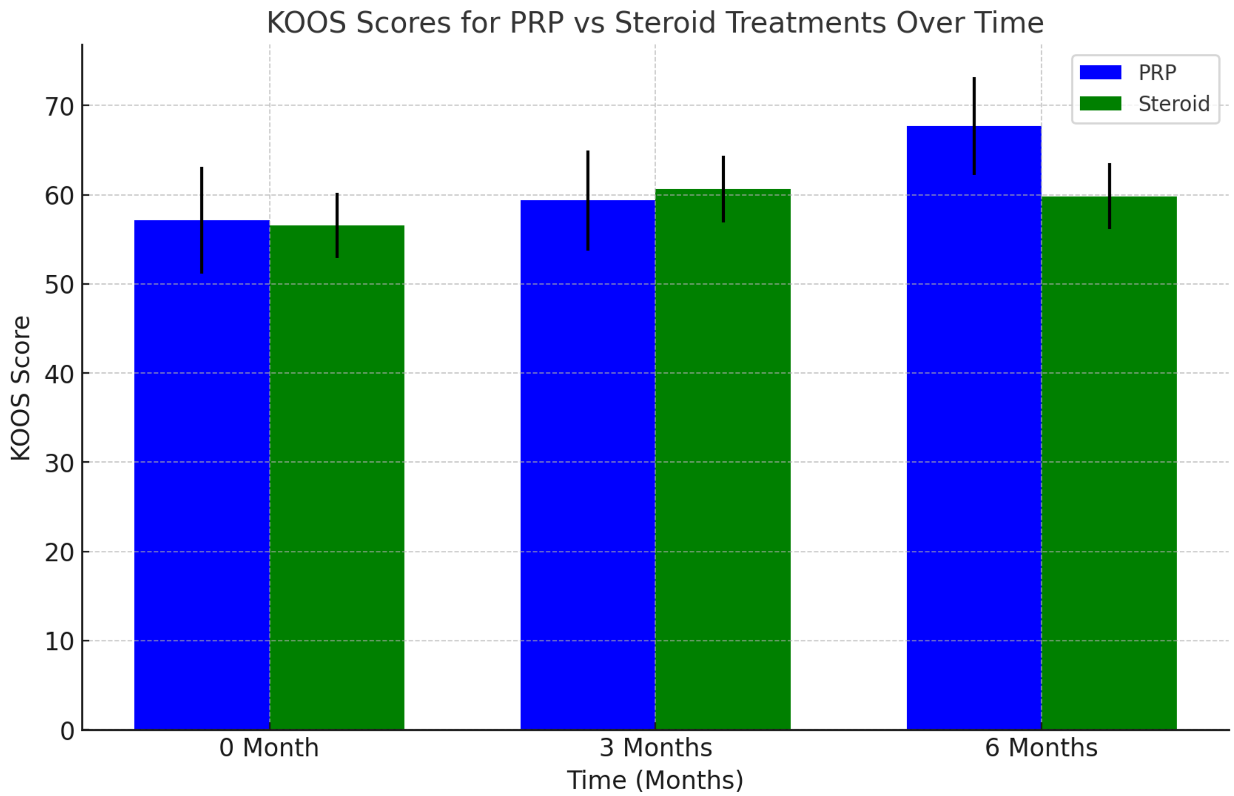
Comparison between Treatment and KOOS Score

	TREATMENT	N	Mean	Std. Deviation	P value
KOOS SCORE 0 MONTH	PRP	25	57.12	6.002	0.015
	STEROID	25	56.56	3.698	
KOOS SCORE 3 MONTHS	PRP	25	59.36	5.612	0.044
	STEROID	25	60.64	3.707	
KOOS SCORE 6 MONTH	PRP	25	67.68	5.498	0.043
	STEROID	25	59.84	3.727	

INTERPRETATION

The bar chart demonstrates the progression of KOOS scores, which assess knee-specific outcomes, for PRP and Steroid treatments over 0, 3, and 6 months. Initially, the KOOS scores are comparable between the two groups, with PRP at 57.12 and Steroid at 56.56. By 3 months, Steroid treatments slightly surpass PRP (60.64 vs. 59.36). **However, at 6 months, PRP shows a significant improvement, reaching a mean score of 67.68 compared to 59.84 for Steroid treatments. The p-values (0.015, 0.044, and 0.043) suggest statistical significance in the differences between treatments across all time points, particularly highlighting the long-term efficacy of PRP in improving knee function and reducing symptoms**.

Comparison between Treatment and KOOS Score



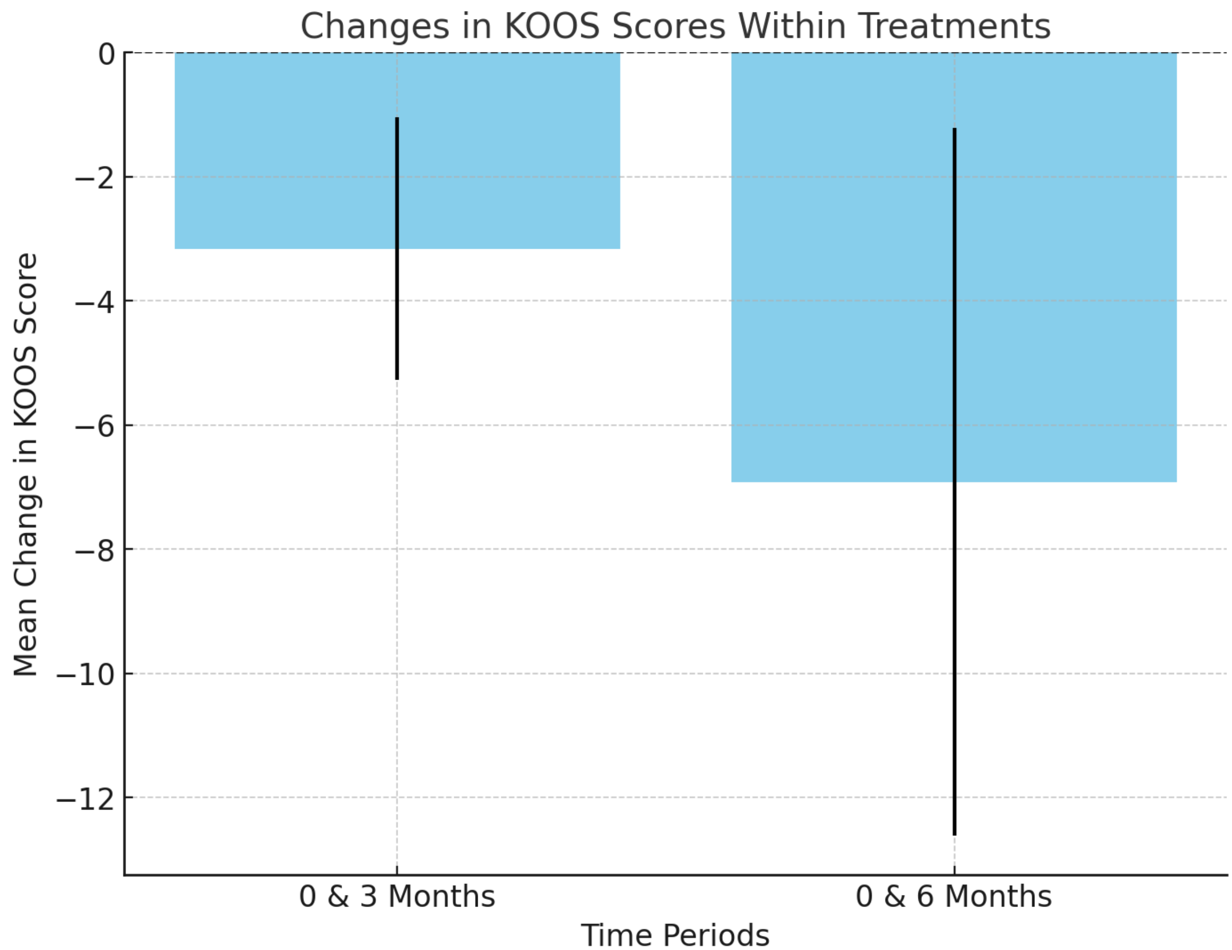
Comparison of KOOS Score within the Treatment

KOOS SCORE		Mean	Std. Deviation	t	df	P value
Pair 1	KOOS SCORE 0 & 3 MONTHS	-3.160	2.113	-10.576	49	0.000
Pair 2	KOOS SCORE 0 & 6 MONTH	-6.920	5.699	-8.585	49	0.000

INTERPRETATION

The bar chart illustrates the changes in KOOS scores within the treatment groups over two time intervals: 0 to 3 months and 0 to 6 months. The mean decrease in KOOS scores from 0 to 3 months is -3.160, while from 0 to 6 months, it is -6.920, indicating progressive improvement in knee function and symptoms. The standard deviations (2.113 and 5.699, respectively) are depicted as error bars, showing variability in responses among participants. **Both changes are statistically significant, as indicated by t-values of -10.576 and -8.585, with p-values of 0.000 for both intervals. These results highlight the treatment's effectiveness in improving knee-specific outcomes over time, with greater improvement observed at the 6-month mark.**

Comparison of KOOS Score within the Treatment



DISCUSSION

Osteoarthritis of the knee is one of the more common degenerative joint diseases, characterized by progressive cartilage loss, synovial inflammation, and subchondral bone remodeling that commonly result in chronic pain and loss of function [56]. In view of the increasing trend in elderly populations around the globe and the increasing morbidity load of knee OA, minimum invasiveness and effectiveness of therapeutic interventions have become increasingly important. Intra-articular corticosteroid injections have been used for decades for symptomatic benefit, primarily by dampening the local inflammatory responses [57]. Concerns have, however remained over decreasing effectiveness over time, possible adverse outcomes such as changes to articular cartilage, and consequences of chronic steroid dosing [58]. Such considerations have spurred growing interest in other or adjunctive therapies that might provide longer-lasting benefit with an improved safety profile.

Of these, platelet-rich plasma has emerged as the most popular source of autologous platelets and associated growth factors, such as platelet-derived growth factor and transforming growth factor-beta, thought to be involved in healing tissue and inflammation modulation [59]. In the last ten years, several randomized controlled trials have been published comparing PRP to conventional treatments such as corticosteroids and hyaluronic acid, and most studies report promising outcomes for PRP at mid-term follow-up times [60]. Advocates point out that, by releasing a wider range of growth factors, PRP could offer more sustained gains in pain and function with fewer concerns for cartilage damage than repeated steroid use [61]. But not everyone was swept up in the excitement. Critics also point out the heterogeneity of PRP preparation methods, including single-spin vs. double-spin techniques, platelet concentration thresholds, and injection protocols, as well as the potential cost barriers that could limit its routine adoption [62].

In the present hospital-based comparative study, the efficacy of intra-articular PRP was juxtaposed with corticosteroid injections in individuals with knee OA. The study population encompassed a broad age range and included both sexes; participants were evaluated at baseline, three months, and six months using validated instruments such as the Visual Analog Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Knee injury and Osteoarthritis Outcome Score (KOOS) [63]. Results revealed no significant relationships between age or sex and the choice of PRP vs. corticosteroid, which aligns with the concept that physicians often select injectables based on clinical severity and comorbidities rather than exclusively on demographic factors [64]. Although older patients may exhibit reduced regenerative potential, there is mounting evidence that they, too, can benefit from PRP, particularly if OA is mild to moderate in severity [65]. Similarly, an approximately equal distribution of treatments between males and females in this study bolsters other findings suggesting that sex alone does not reliably predict better outcomes with one therapy over another [66].

Radiographic severity, as classified by the Kellgren–Lawrence (KL) grading system, was also evenly distributed across treatments, indicating that clinicians in this setting did not strictly use KL grade to guide therapeutic decisions [67]. This underscores a broader trend: while imaging findings can be valuable, they do not invariably supersede functional assessments and patient preferences when selecting between PRP and corticosteroids. Furthermore, lateralization (left vs. right knee) was balanced, reflecting that side of involvement carries minimal influence on treatment effectiveness.

Pain measurement via VAS provided a revealing look at the temporal patterns of symptom relief. At baseline, those with a VAS score of 6 were nearly equally split between the two treatment arms, suggesting that initial pain severity did not strongly dictate which injection was administered. By three months, steroids often resulted in conspicuous early pain control, whereas PRP's effect—tied to its mechanism of slow-releasing growth factors—tended to manifest more gradually [68]. Although some authors report that PRP can produce significant benefits even in the shorter term, the variability in PRP formulations and patient characteristics may account for differing timelines of improvement [69]. At six months, a notable shift emerged in favor of PRP. Corticosteroid-induced analgesia appeared to wane, whereas PRP recipients often continued to experience meaningful pain relief [70]. These findings, consistent with prior investigations, suggest that while corticosteroids excel for prompt symptom reduction, PRP may better sustain or extend that relief.

Both groups achieved overall pain reductions between baseline and subsequent follow-ups, affirming that intra-articular injections, whether PRP or steroid, can be beneficial [71]. Nevertheless, the relative short duration of steroid-induced relief may necessitate repeated injections to maintain benefits, sparking debates about the cumulative effects on cartilage and systemic health [72].

Functional outcomes, assessed through WOMAC, yielded significant improvements in both arms of the study at three and six months [73]. This indicates that each approach—PRP or steroid—can enhance activities of daily living and decrease stiffness in many patients with knee OA. However, while group differences in WOMAC did not always reach strict statistical significance, the PRP cohort often displayed a trend of better or more sustained function by six months. Parallel results have been noted elsewhere, hinting that PRP's benefits may be most apparent in the mid-term, perhaps due to ongoing modification of the intra-articular environment via growth factor release [74]. Some researchers propose that multiple PRP injections amplify these benefits, although cost, convenience, and a lack of standardized protocols remain pivotal challenges [75].

Similarly, KOOS data revealed a pronounced yet evolving pattern. Corticosteroids conferred a slight edge at three months, likely reflecting their potent short-term anti-inflammatory impact, but the PRP group demonstrated greater KOOS improvements at six months [76]. This delayed superiority further implies a regenerative or biologically mediated advantage, aligning with the theory that PRP can stimulate local tissues to a degree unattainable by corticosteroids alone [77]. Nonetheless, not all studies converge on PRP's long-term primacy, and repeated corticosteroid injections at set intervals may still help certain subsets of patients manage symptoms effectively.

In synthesizing these outcomes with existing literature, it appears that PRP and corticosteroids each have distinct strengths. Corticosteroids remain an affordable, readily accessible, and clinically recognized modality for acute pain relief, yet repeated use raises caution regarding potential cartilage damage [78]. PRP, conversely, boasts a favorable risk profile and possible regenerative influence, though patient heterogeneity and preparation inconsistencies can blur its overall efficacy estimates [79]. Many investigations, including the present one, lean toward PRP's more durable benefits at mid-term follow-up, specifically in reducing pain and preserving function. However, large discrepancies in effect size across different studies highlight the need for standardized PRP techniques and a clearer understanding of which patient populations stand to gain the most.

Despite these promising findings, the present study is not without limitations. The six-month follow-up, while adequate for capturing mid-range outcomes, does not clarify whether PRP's advantages persist or expand beyond that timeframe. Longer follow-ups extending to one year or more could help determine how frequently patients might require repeat injections and whether PRP has protective or even reparative effects on joint structures [80]. Additionally, the sample size may limit detection of subtle but clinically important differences in subgroups (e.g., older vs. younger patients, varying KL grades). Advanced imaging modalities such as MRI could further elucidate whether structural changes accompany symptomatic improvements, offering critical insight into PRP's potential as a disease-modifying intervention. Finally, while both PRP and corticosteroids yielded meaningful symptom relief, personalizing treatment remains essential. Factors like obesity, diabetes, previous surgical history, and lifestyle may condition each patient's therapeutic response and tolerability.

Overall, this study supports the fact that both intra-articular corticosteroids and PRP can reduce symptoms of knee OA and improve patient function over six months, but with different timelines and possibly varying durations of relief. Corticosteroids are likely to provide early analgesic benefits, whereas PRP may offer more sustained improvements that persist at mid-term evaluation. These data agree with a developing body of literature that regenerative strategies can be incorporated into usual OA care, particularly when looking to avoid additional steroid injections. However, recommendations should be made based on shared decision-making, patient-specific needs, and developing evidence. Long-term, high-quality studies will be required to further elucidate the role of PRP in the treatment of knee OA if standardization of PRP preparation improves the reproducibility of its therapeutic benefits.

SUMMARY

This study's findings have provided a comparison of intra-articular autologous platelet-rich plasma injections versus corticosteroid injections in patients suffering from knee OA over a year. A primary assumption was that PRP, rich in growth factors and drawn from the patient's own blood, might deliver sustained symptom relief and functional improvement, whereas corticosteroids often provide prompt but potentially fleeting analgesia. The trajectories of these treatments were assessed by using a set of outcome measures: the VAS for pain, the WOMAC, and the KOOS. Baseline demographic factors including age, sex, KL grade, and knee laterality were documented in detail to investigate whether they influence the choice or efficacy of treatment.

The distribution between age and gender was almost balanced in both cases of PRP and corticosteroid injections. No statistically significant relationships emerged, which indicates that clinicians in this cohort did not use age, sex, or even KL grade as a strict determinant when choosing the type of intra-articular therapy. This is consistent with literature suggesting that treatment choice tends to hinge primarily on a patient’s clinical presentation, pain severity, comorbidities, and preferences. Although prior research has hinted that advanced age can correlate with diminished biologic regenerative capacity, the current data echo other studies that find PRP can still be effective in older adults, particularly when OA remains in mild to moderate stages.

Pain outcomes at three and six months demonstrated a recognizable pattern. The steroid group often showed pronounced early improvement at three months but appeared to lose some of that benefit by six months, especially reflected in the VAS scores. Meanwhile, PRP outcomes tended to gradually improve over time, with many participants reporting stable or further reduced pain severity at six months. This trajectory aligns with the mechanistic rationale behind PRP, where platelet-derived growth factors may have a delayed but more durable effect by modulating local inflammation and potentially aiding soft tissue repair. Not all studies concur on PRP's long-term benefits, partly because of variability in PRP preparation, injection protocols, and patient selection. Nevertheless, the mid-term trends in this study support the notion that PRP may confer sustained improvement in pain and knee function.

When evaluating functional metrics such as WOMAC and KOOS, the results reinforced the differences in the time course of symptomatic relief between PRP and corticosteroids. Although early gains were frequently observed in both cohorts, the PRP group appeared to hold on to their improvements better, especially in the KOOS at the six-month interval. The differences in WOMAC scores between the two groups, however, did not always reach statistical significance, highlighting the complexity of capturing functional improvement in a heterogeneous OA population. Many factors—patient motivation, body mass index, rehabilitation adherence, and comorbidities—may equally shape knee function over time. Yet, the consistent trend toward better or more sustained function in the PRP group is notable and resonates with other clinical trials demonstrating PRP's potential superiority or equivalence to corticosteroids beyond the immediate post-injection phase.

Below is a brief encapsulation of the key takeaways from this one-year hospital-based comparative study:

- **Demographics**: Age, sex, and knee laterality did not significantly predict whether a patient received PRP or corticosteroids, reflecting a balanced approach to treatment allocation.

- **Radiographic Severity**: KL grade distribution was also uniform, suggesting that intra-articular injections were chosen based on overall clinical need rather than radiographic stage alone.
- **Pain Outcomes**: Corticosteroids offered strong but sometimes transient relief, while PRP demonstrated slower onset yet more sustained pain improvement, especially noticeable by the six-month mark.
- **Functional Scores**: Both groups improved significantly in WOMAC and KOOS over time, but PRP showed a particularly favourable trajectory in KOOS at six months, indicating potential long-term benefits.
- **Statistical Significance**: Certain comparisons reached high levels of significance (VAS at 3 and 6 months), whereas others (WOMAC at specified intervals) did not, underscoring the varied responses and the multifactorial nature of OA management.

CONCLUSION

In summary, this comparative study highlights the clinical value of both intra-articular PRP and corticosteroid injections in the treatment of osteoarthritis of the knee, both with their associated strengths and time-dependent activities. The biologically active growth factors may give PRP a more prolonged advantage, while corticosteroids remain the gold standard, cost-effective treatment for immediate symptomatic relief. Although no stark differences were demonstrated in some measures, the results here suggest advantages of PRP for mid and longer-term correction. In our quest to increasingly tailor treatment decisions to individual characteristics, these outcomes highlight the suitability of PRP, especially those seeking continued gain over months while acknowledging corticosteroids place in immediate pain relief. Only by future large-scale, multi-injection or combination-therapy studies, supported by imaging and biomarker analysis will best practices become refined, the optimal dosing regimens will be defined, and the lives of patients having to deal on a daily basis with the effects of knee OA will be bettered.

LIMITATION OF THE STUDY

1.This study compared two groups of 25 patients each in two treatment arms. A large number of sample size would have been more helpful in putting a greater and more powerful conclusion comparing Platelet rich plasma vs Corticosteroid injections.

2.A longer follow up period would have been more helpful in establishing stronger conclusion.

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ANNEXURE 1 : ETHICAL CLEARANCE

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed – to- be- University)
Accredited 'A+' Grade by NAAC in (3rd Cycle) Placed in Category 'A' by MHRD (GoI)

JNMC INSTITUTIONAL ETHICS COMMITTEE
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)

Website: http//www.jnmc.edu
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Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref No.MDC/JNMCIEC/ 123 **Date: 21/03/2023**

To,

BL0122007

BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"INTRA-ARTICULAR AUTOLOGOUS PLATELET RICH PLASMA VS CORTICOSTEROID INJECTION IN OSTEOARTHRITIS OF KNEE : A ONE YEAR HOSPITAL BASED COMPARATIVE STUDY",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

(Dr. Smita Sonoli)
Member Secretary
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi.

(Dr. Harsha Hegde)
Chairman,
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi

ANNEXURE 2 : INFORMED CONSENT

"INTRA-ARTICULAR: AUTOLOGOUS PLATELET RICH PLASMA VS CORTICOSTEROID INJECTION IN OSTEOARTHRITIS OF KNEE: A ONE YEAR HOSPITAL BASED COMPARATIVE STUDY"

Introduction:

I am **BL0122007**, PG Resident, JNMC Belagavi, I am conducting a comparative study on intra-articular: autologous platelet rich plasma vs corticosteroid injection in osteoarthritis of knee. I am going to give you information and invite you to be a part of this research. There may be some words that you may not understand, please contact me for more information as needed.

The second highest weight-bearing joint of the human body is the knee. Osteoarthritis (OA) knee is the most common degenerative joint disease worldwide. The main goals of management are directed to reduce pain, improve function, quality of life, and limit disease progression. Unfortunately, there are no agents currently available that can halt the progression of knee Osteoarthritis. Analgesics and nonsteroidal anti-inflammatory drugs (NSAIDs) have suboptimal effectiveness; surgical treatment can reduce pain and improve joint mobility and function; however, it is associated with significant cost and potential morbidity. Intraarticular (IA) Corticosteroids and Hyaluronic acid (HA) injections provide short-term reduction in pain of Osteoarthritis. Recently, placebo-controlled studies have shown that Intra articular injection of Platelet Rich Plasma (IA PRP) can relieve pain, improving knee function and quality of life. The most likely mechanism by which Platelet rich plasma reduces pain and stiffness of Osteoarthritis is by stimulating the natural healing cascade and tissue regeneration by a "supra-physiological" release of platelet-derived factors directly at the site of treatment. Despite numerous studies and meta-analyses, the efficacy of Intra articular Platelet Rich Plasma in patients with knee Osteoarthritis remains debated and uncertain worldwide

Explanation of procedure: Two groups will be created, one for autologous Platelet Rich Plasma and another for Corticosteroid injection. Patient will be chosen into two groups and given injections according to the groups. 3 month and 6 month follow up will be there to see the improvement of the condition.

Withdrawal from participation in the study: Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will not get any benefits by participating in this study. the data gathered will help population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: you will not receive any payment for participating in this study.

Cost of investigations Done during the course of study will be paid by the **principal investigator / participant.**

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Legal rights: by signing this consent form, we are not waving any of your legal rights.

ANNEXURE 3: PROFORMA

'INTRA-ARTICULAR AUTOLOGOUS PLATELET RICH PLASMA VS CORTICOSTEROID INJECTION IN OSTEOARTHRITIS OF KNEE: A ONE YEAR HOSPITAL BASED COMPARATIVE STUDY'

PATIENT NO. IP NO.

X-RAY NO. SCORES: 1. WOMAC SCORE -

2. VAS PAIN SCORE

-

3. KOOS SCORE-

NAME:

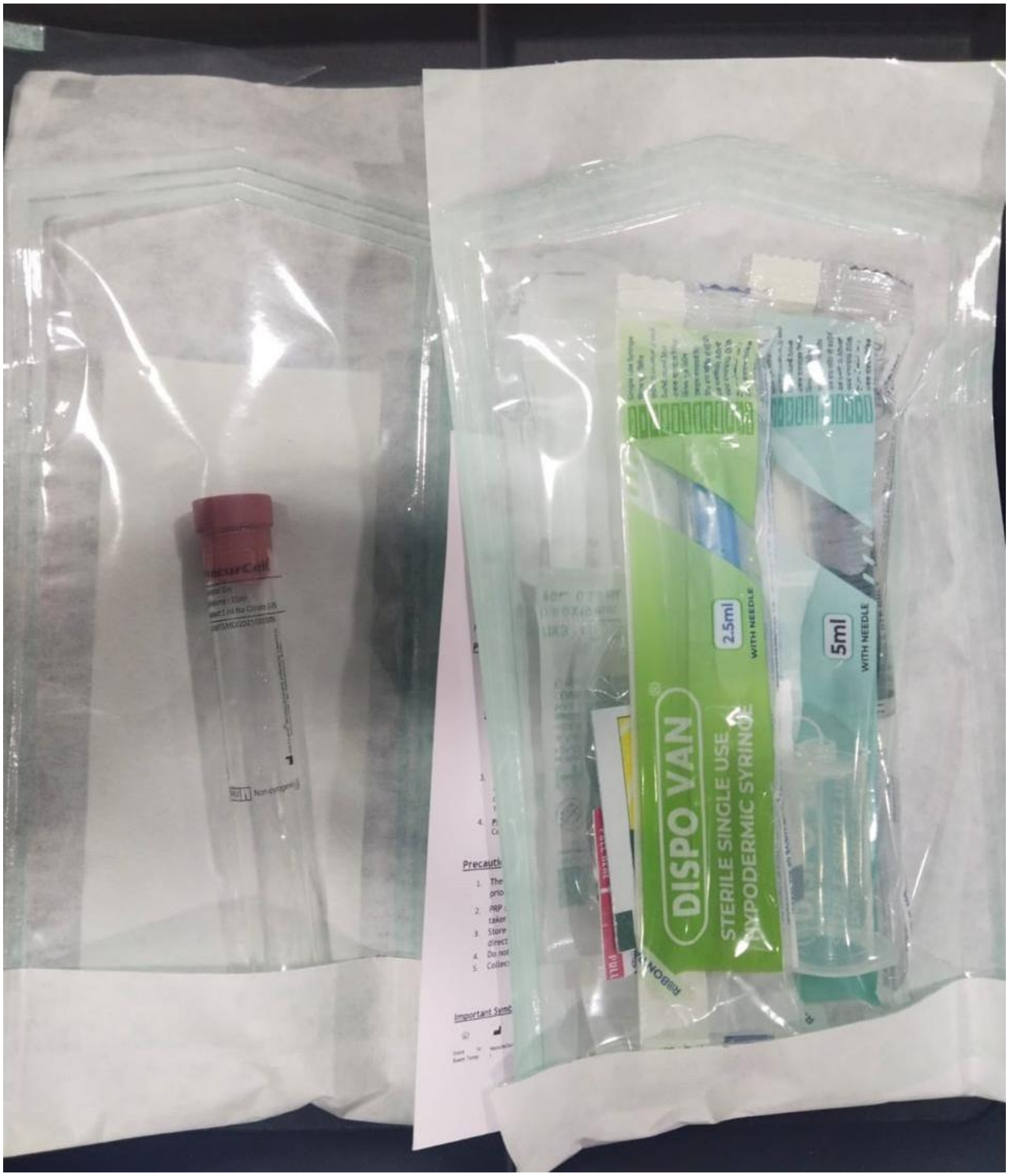
AGE: SEX:

ADDRESS:

OCCUPATION:

DOA: DOI: DOD:

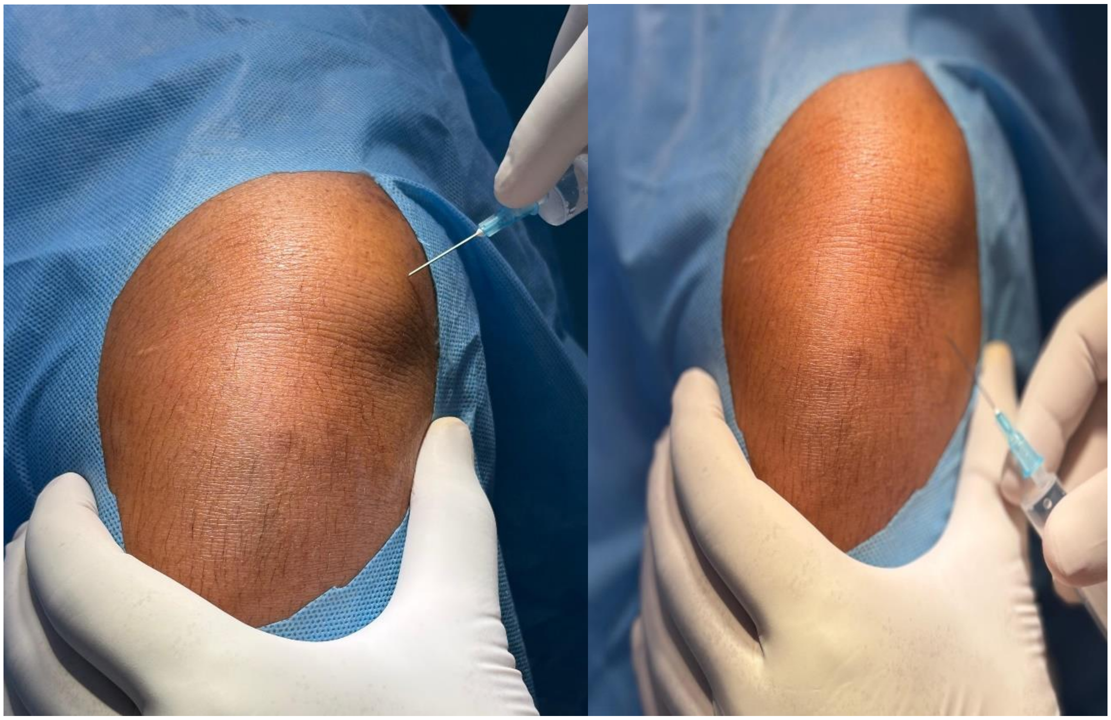
ANNEXURE 4 : CLINICAL PICTURES



PRP KIT

KNEE PREPARATION

FOR INTRA ARTICULAR PRP AND STEROID INJECTION



ANTEROLATERAL APPROACH TO THE KNEE FOR INTRA ARTICULAR PRP AND STEROID INJECTION

CENTRIFUGE MACHINE

FOR PRP PREPARATION

ANNEXURE 5 : MASTERCHART

1	NAME	AGE	SEX	IP NO	KL GRADE	SITE	TREATMEN	VAS SCORE 0 MO	VAS SCORE 3 MONT	VAS SCORE 6 MOI	WOMAC SCORE 0 MC	WOMAC SCORE 3 MONTH	WOMAC SCORE 6 MON	KOOS SCORE 0 MONT	KOOS SCORE 3 MON	KOOS SCORE 6 MON
2	DEEPAK ANANT PAN	52	M	7432896	GRADE 2	RIGHT	PRP	6	5	3	52	54	65	52	55	65
3	VINAYAK MAHADEV	68	M	1E+07	GRADE3	RIGHT	PRP	7	6	4	60	62	68	62	65	70
4	PRAHLAD LAXMANR	74	M	7402273	GRADE2	RIGHT	PRP	6	6	2	65	66	67	64	64	75
5	VINAYAK MAHADEV	68	M	1E+07	GRADE1	LEFT	PRP	5	4	2	52	53	62	55	58	65
6	DEEPAK ANANT PAN	52	M	7432896	GRADE 2	LEFT	PRP	6	6	4	48	50	58	50	52	62
7	PRAHLAD LAXMANR	74	M	7402273	GRADE3	LEFT	PRP	8	7	5	68	70	75	65	65	70
8	AKKATAI BALASAHEI	68	F	1E+07	GRADE2	RIGHT	PRP	7	5	5	55	60	70	58	60	68
9	AKKATAI BALASAHEI	68	F	1E+07	GRADE1	LEFT	PRP	6	5	4	56	60	68	55	58	62
10	RAYAPPA HANJI	58	M	1E+07	GRADE3	LEFT	PRP	8	7	5	54	58	59	52	53	65
11	NANDA PRASANT JH	48	F	1E+07	GRADE2	RIGHT	PRP	8	6	6	68	70	76	65	62	68
12	SIDAVVA	68	F	7432892	GRADE1	LEFT	PRP	5	5	3	52	55	58	55	58	65
13	SIDAVVA	68	F	7432892	GRADE1	RIGHT	PRP	4	4	3	40	48	60	45	48	58
14	RATNA JAGANATH S	62	F	4845258	GRADE1	LEFT	PRP	5	3	2	50	55	72	52	55	60
15	SOBHA KOHLI	57	F	7277156	GRADE2	LEFT	PRP	6	5	3	56	58	74	55	60	65
16	MAHANTESH	48	M	1E+07	GRADE3	RIGHT	PRP	7	5	4	58	60	46	58	65	70
17	MAHANTESH	48	M	1E+07	GRADE3	LEFT	PRP	7	5	3	59	65	65	60	58	75
18	VIDYA PATIL	74	F	1E+07	GRADE2	RIGHT	PRP	8	6	4	52	55	68	55	57	65
19	VIDYA PATIL	74	F	1E+07	GRADE3	LEFT	PRP	9	7	5	72	74	80	70	72	78
20	SHAKUNTALA MUNN/	57	F	1173065	GRADE1	RIGHT	PRP	6	6	2	58	60	65	60	65	68
21	MANJULA SHIVAPPA	48	F	1191110	GRADE2	LEFT	PRP	7	6	5	62	65	75	65	68	65
22	MANJULA SHIVAPPA	48	F	1191110	GRADE1	RIGHT	PRP	5	5	1	60	62	71	62	63	78
23	RAJU ANAPPA MADH	47	M	1178228	GRADE2	LEFT	PRP	6	6	3	52	55	85	58	58	65
24	MANGAL KESARKAR	53	F	4697106	GRADE2	RIGHT	PRP	6	5	4	50	52	72	53	55	78
25	KANCHAN	55	F	77859	GRADE3	RIGHT	PRP	8	7	5	45	48	56	49	52	65
26	NEETA PATNEKAR	54	F	7710424	GRADE3	RIGHT	PRP	7	5	5	48	52	65	53	58	67
27	LALITA KADDIMANI	60	F	1160114	GRADE3	LEFT	STEROID	8	5	6	65	75	70	62	65	63
28	VISHNU KAMBLE	62	M	1155473	GRADE2	RIGHT	STEROID	7	5	6	60	65	62	64	68	62
29	ALLAGOWDA PATIL	66	M	1155674	GRADE3	LEFT	STEROID	7	4	4	49	58	55	52	55	58
30	VISHNU KAMBLE	62	M	1155473	GRADE1	LEFT	STEROID	5	3	3	55	60	58	58	60	57
31	ALLAGOWDA PATIL	66	M	1155674	GRADE2	RIGHT	STEROID	6	5	6	52	55	53	55	58	60
32	SAVITA PATIL	46	F	1153764	GRADE1	RIGHT	STEROID	5	3	4	50	52	55	52	58	54
33	ARUN METI	49	M	1152865	GRADE2	RIGHT	STEROID	6	3	5	45	62	48	55	58	57
34	RENUKA GOUDANIKA	70	F	1158956	GRADE3	LEFT	STEROID	8	4	6	62	65	68	60	65	63
35	JANAKI MALOJI KALE	61	F	1176523	GRADE3	LEFT	STEROID	8	5	5	70	78	75	65	68	62
36	SHARADA BABU ASA	52	F	1179249	GRADE3	LEFT	STEROID	7	4	6	49	60	55	55	58	53
37	AKKA MAHADEVI	72	F	1179248	GRADE2	RIGHT	STEROID	6	3	4	50	65	58	52	58	65
38	AKKA MAHADEVI	72	F	1179565	GRADE2	LEFT	STEROID	6	3	6	51	65	53	55	60	60
39	NAFFESA	63	F	1178545	GRADE1	RIGHT	STEROID	5	3	5	55	65	60	58	60	62
40	FATIMA MULLA	48	F	1124568	GRADE1	LEFT	STEROID	6	2	2	52	60	55	54	58	58
41	FATIMA MULLA	48	F	1125698	GRADE2	RIGHT	STEROID	6	4	4	56	68	65	55	60	62
42	JINENDRA	55	M	1190495	GRADE3	RIGHT	STEROID	8	5	6	45	55	52	50	55	57
43	ULLAVAPPA DEYANN	76	M	1132625	GRADE2	LEFT	STEROID	7	5	5	48	58	55	55	58	59
44	SWATI LONDHE	61	F	1152456	GRADE3	LEFT	STEROID	7	4	4	55	60	59	56	60	58
45	YASHVANT KHANAPU	60	M	1203241	GRADE1	RIGHT	STEROID	6	3	5	42	72	68	58	60	62
46	YASHVANT KHANAPU	60	M	1203241	GRADE2	LEFT	STEROID	7	4	6	59	70	65	60	62	61
47	NAGAVVA KARALING	62	F	7706415	GRADE1	LEFT	STEROID	5	3	4	50	65	58	58	65	60
48	NAGAVVA KARALING	62	F	7706415	GRADE2	RIGHT	STEROID	6	2	3	55	58	56	54	58	55
49	KASHAVVYA	52	F	24946	GRADE1	LEFT	STEROID	5	2	2	50	55	53	55	59	56
50	ARUN TUMARI	62	M	24802	GRADE2	RIGHT	STEROID	6	4	5	50	58	60	58	65	62
51	SHANUL JAMADAR	57	M	24780	GRADE3	LEFT	STEROID	8	4	6	48	55	59	58	65	70