Multidisciplinary Approaches to Managing Osteoarthritis: Integrating Imaging, Laboratory Markers, Pharmacological Interventions, and Physical Therapy for Optimal Patient Outcomes

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Abstract

Background: Osteoarthritis (OA) is a degenerative joint disease that requires comprehensive management to improve patient outcomes. This study investigates the effectiveness of a multidisciplinary approach integrating imaging, laboratory markers, pharmacological interventions, and physical therapy in managing OA progression and improving patient outcomes.

Methods: A retrospective cohort study was conducted in a tertiary hospital, including 250 patients diagnosed with knee or hip OA. Imaging (X-rays, MRI), laboratory markers (CRP, ESR), pharmacological treatments (NSAIDs, corticosteroid injections), and physical therapy were analyzed over 12 months to assess their impact on pain, joint mobility, and functional outcomes.

Results: Imaging showed significant joint space narrowing and cartilage degradation over 12 months. Elevated CRP and ESR were modestly correlated with disease severity. Combination pharmacotherapy (NSAIDs + corticosteroid injections) yielded the highest pain reduction and functional improvement. Physical therapy, when combined with pharmacotherapy, resulted in a 60% improvement in joint mobility and a 45% improvement in WOMAC scores.

Conclusion: A multidisciplinary approach integrating imaging, laboratory markers, pharmacotherapy, and physical therapy significantly improves pain, mobility, and function in OA patients, supporting the need for comprehensive, personalized care.

Keywords: Osteoarthritis, multidisciplinary approach, imaging, laboratory markers, pharmacological interventions, physical therapy, joint space narrowing, functional outcomes.

Introduction

Osteoarthritis (OA) is the most common form of arthritis, affecting millions of individuals worldwide and representing a significant source of disability and reduced quality of life (Wieland et al., 2005). Characterized by the gradual degeneration of joint cartilage and underlying bone, OA predominantly affects weight-bearing joints such as the knees and hips. As a chronic and progressive condition, OA leads to pain,

stiffness, and functional impairment, placing a substantial burden on healthcare systems globally (Safiri et al., 2020).

Traditional management of OA has primarily focused on pharmacological interventions, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroid injections, aimed at alleviating pain and inflammation (McAlindon et al., 2014). However, due to the complex nature of OA progression and its impact on multiple systems, a single-modality approach often fails to address the full spectrum of patient needs. As such, there is growing recognition of the importance of a multidisciplinary approach that incorporates imaging, laboratory markers, pharmacological treatments, and physical therapy to optimize patient outcomes (Wieland et al., 2005).

Imaging techniques, such as X-rays and magnetic resonance imaging (MRI), are essential tools for diagnosing and monitoring OA. They provide valuable information on joint space narrowing, cartilage damage, and the presence of osteophytes (Roemer et al., 2011). In addition to imaging, laboratory markers of inflammation, such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), can provide insights into systemic inflammatory processes that may exacerbate OA symptoms (Spector et al., 1997). Combining these diagnostic tools with pharmacological management and physical therapy offers a comprehensive approach to managing OA progression.

Physical therapy, in particular, plays a pivotal role in improving functional mobility, reducing pain, and preventing further joint deterioration through targeted exercises and manual therapy (Fransen et al., 2015). This holistic management strategy is critical, as pharmacological treatments alone may not address the biomechanical issues underlying OA.

The purpose of this study is to explore how imaging, laboratory markers, pharmacological treatments, and physical therapy can work together to manage OA progression and improve patient outcomes. By understanding the interplay between these modalities, healthcare providers can develop more effective, patient-centered treatment plans that improve function, reduce pain, and enhance quality of life for individuals with OA.

Literature Review

1. Understanding Osteoarthritis

Osteoarthritis (OA) is a degenerative joint disease that affects millions worldwide, particularly older adults. It is characterized by the breakdown of articular cartilage, joint space narrowing, and changes in the subchondral bone (Wieland et al., 2005). As the most common form of arthritis, OA significantly impacts patients ’quality of life by causing pain, stiffness, and reduced joint mobility (Glyn-Jones et al., 2015). The progressive nature of the disease often leads to disability and imposes a heavy burden on healthcare systems due to increased demand for joint replacement surgeries, particularly in the knee and hip joints.

Current guidelines for managing OA emphasize a patient-centered approach, focusing on alleviating symptoms and improving joint function (McAlindon et al., 2014). However, due to the complexity of OA, optimal management requires a combination of pharmacological treatments, physical therapy, and diagnostic tools such as imaging and laboratory markers to monitor disease progression and treatment efficacy.

2. The Role of Imaging in Osteoarthritis

Imaging plays a crucial role in diagnosing and monitoring OA, particularly in assessing joint structural changes.X-rays are the most widely used imaging modality for diagnosing OA, as they reveal key features such as joint space narrowing, subchondral sclerosis, and osteophyte formation (Felson et al., 2000). These radiographic changes are indicative of cartilage loss and bone remodeling, two hallmarks of OA progression.

In addition to conventional X-rays,Magnetic Resonance Imaging (MRI) is becoming increasingly important in OA management due to its ability to visualize soft tissue structures, including cartilage, menisci, and ligaments, which are often affected in OA (Roemer et al., 2011). MRI can detect early OA changes, such as cartilage defects and bone marrow lesions, even before they become visible on X-rays (Hunter and Guermazi, 2012). This makes MRI a valuable tool for detecting early-stage OA and monitoring the efficacy of treatments aimed at slowing disease progression.

Furthermore, a study by Guermazi et al. (2014) highlights that MRI can also identify synovitis and joint effusion, which are associated with increased pain and faster disease progression in OA patients. By combining MRI with conventional radiographic findings, clinicians can gain a comprehensive understanding of OA's structural impact on the joint.

3. Laboratory Markers in Osteoarthritis Management

While OA is not traditionally associated with systemic inflammation, recent studies have shown that low-grade inflammation plays a role in disease progression (Spector et al., 1997).C-reactive protein (CRP) andErythrocyte Sedimentation Rate (ESR) are common laboratory markers used to assess inflammation in OA patients. Elevated CRP levels, even at low levels, have been associated with increased cartilage loss and worsening symptoms in OA (Spector et al., 1997). However, CRP and ESR are not specific to OA and may be elevated due to other inflammatory or infectious conditions, limiting their diagnostic utility.

Despite these limitations, monitoring inflammatory markers in OA patients, especially those with advanced disease or concurrent inflammatory conditions, can provide insight into the systemic inflammatory burden and guide treatment decisions (Attur et al., 2015). While laboratory markers do not directly reflect joint-specific changes, their role in identifying underlying inflammatory processes may contribute to a more targeted and individualized approach to managing OA.

4. Pharmacological Interventions for Osteoarthritis

Pharmacological treatment remains one of the mainstays in managing OA, particularly for pain relief and inflammation control.Nonsteroidal anti-inflammatory drugs (NSAIDs) are widely prescribed for OA due to their effectiveness in reducing pain and inflammation. They act by inhibiting the cyclooxygenase (COX) enzymes responsible for the production of inflammatory prostaglandins (Zhang et al., 2010). However, long-term use of NSAIDs is associated with gastrointestinal, cardiovascular, and renal side effects, necessitating careful monitoring and consideration of alternative therapies in high-risk patients (Hochberg et al., 2012).

Corticosteroid injections are another pharmacological intervention commonly used to manage pain and inflammation in OA patients, particularly in those with moderate to severe symptoms. Intra-articular corticosteroid injections can provide short-term relief from pain and inflammation by reducing synovitis and

effusion (McAlindon et al., 2014). However, repeated use may lead to cartilage degradation and joint damage, limiting their long-term utility.

Emerging pharmacological treatments, such asdisease-modifying osteoarthritis drugs (DMOADs), are being studied for their potential to slow OA progression by targeting the underlying mechanisms of cartilage degradation (Wieland et al., 2005). While these treatments are still under investigation, they offer a promising future for managing OA beyond symptom control.

5. The Role of Physical Therapy in Osteoarthritis Management

Physical therapy is a cornerstone of OA management, with numerous studies supporting its role in improving pain, function, and quality of life for patients (Fransen et al., 2015). Exercise therapy, particularlystrength training andaerobic exercise, has been shown to reduce pain and improve physical function by strengthening the muscles around the joint, reducing joint load, and increasing range of motion (Bennell et al., 2012).

Joint mobilization andmanual therapy techniques are also commonly used by physiotherapists to improve joint function and reduce stiffness in OA patients (Brosseau et al., 2006). These interventions aim to restore the normal biomechanical function of the joint and enhance flexibility, which is crucial for preventing further joint damage.

Studies suggest that individualized exercise programs tailored to the patient's needs and physical limitations are the most effective in managing OA. For instance, a systematic review by Fransen et al. (2015) found that both land-based and water-based exercise programs led to significant improvements in pain and physical function in knee OA patients. Moreover, the benefits of physical therapy are sustained over time, making it a critical component of long-term OA management.

6. Multidisciplinary Approaches in Osteoarthritis Care

The complex and multifaceted nature of OA requires a comprehensive, multidisciplinary approach to management. Combining imaging, laboratory markers, pharmacological interventions, and physical therapy allows for a more holistic view of the disease and provides opportunities for personalized treatment. A multidisciplinary team that includes radiologists, laboratory specialists, physiotherapists, and pharmacologists can develop individualized treatment plans that address both the structural and functional aspects of OA.

By integrating imaging and laboratory markers, clinicians can monitor disease progression and treatment efficacy more effectively. Pharmacological interventions provide symptom relief, while physical therapy improves joint function and delays disease progression. Together, these approaches help optimize patient outcomes and improve the quality of life for individuals with OA.

Methodology

1. Study Design

This study employed a retrospective cohort design to evaluate the effects of multidisciplinary care—incorporating imaging, laboratory markers, pharmacological interventions, and physical therapy—on managing osteoarthritis (OA) in patients attending the orthopedic and rehabilitation clinics at Tertiary Hospital. The study was conducted over a 12-month period, focusing on patients diagnosed with knee or hip OA.

2. Study Setting

The study took place at a tertiary care center with specialized departments for orthopedics, radiology, laboratory diagnostics, physical therapy, and pharmacology. The hospital serves a large population of OA patients receiving multidisciplinary care, including routine imaging, laboratory monitoring, pharmacological management, and tailored physical therapy programs.

3. Participants

The study included 250 adult patients diagnosed with moderate to severe OA of the knee or hip based on clinical and imaging criteria. The participants were selected based on inclusion and exclusion criteria designed to ensure a comprehensive evaluation of OA progression and management.

Inclusion Criteria:

- Adult patients aged 40 years or older.
- Diagnosed with radiographically confirmed knee or hip OA (Kellgren-Lawrence grade 2-4).
- Undergoing regular pharmacological treatment and participating in a prescribed physical therapy program.
- Baseline and follow-up imaging (X-rays, MRI) and laboratory data (CRP, ESR) available in the hospital's electronic medical records.

Exclusion Criteria:

- Patients with inflammatory arthritis (e.g., rheumatoid arthritis, gout).
- Patients who had undergone total knee or hip replacement surgery.
- Patients with incomplete medical records or missing follow-up imaging or laboratory data.
- Pregnant women or patients with contraindications to MRI or NSAID use.

4. Data Collection

Data were extracted retrospectively from the hospital's electronic medical records, capturing patient demographics, clinical characteristics, imaging, laboratory results, and treatment interventions. The data collection process followed standard hospital protocols and was reviewed by two independent researchers to ensure accuracy.

4.1. Imaging Data:

-X-rays: Radiographic data were collected to assess joint space narrowing, osteophyte formation, subchondral sclerosis, and overall Kellgren-Lawrence grade. Baseline X-rays were compared with follow-up images taken after 12 months of treatment.

-MRI: MRI data were used to assess cartilage integrity, meniscal involvement, synovitis, and bone marrow lesions in a subset of 100 patients. MRI was particularly useful for detecting early-stage structural changes not visible on X-rays.

4.2. Laboratory Data:

-C-reactive protein (CRP): Baseline and follow-up CRP levels were recorded to assess systemic inflammation and its correlation with OA progression.

-Erythrocyte Sedimentation Rate (ESR): ESR values were also collected to evaluate the presence of chronic inflammation. Laboratory tests were performed at baseline and every 6 months.

4.3. Pharmacological Data:
-Medications: Information was collected on the type of pharmacological treatment, including NSAIDs, corticosteroid injections, and any disease-modifying osteoarthritis drugs (DMOADs) prescribed. Dosages, treatment duration, and patient adherence were recorded.
-Pharmacist interventions: Documentation of any pharmacist-led interventions, such as medication reviews, dose adjustments, and management of side effects, was included.

4.4. Physical Therapy Data:
-Interventions: Data on the physical therapy modalities employed, including strength training, joint mobilization, and aerobic exercise, were recorded. The frequency and duration of physical therapy sessions were also tracked.
-Patient-reported outcomes: Functional outcomes, including pain levels (measured using a Visual Analog Scale), joint mobility, and overall physical function, were assessed through patient questionnaires at baseline, 6 months, and 12 months.

4.5. Clinical Outcomes:
-Primary Outcome: The primary outcome was the change in joint space width on X-rays, indicating OA progression.
-Secondary Outcomes: Secondary outcomes included improvements in pain, joint function, and quality of life, assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score. Changes in laboratory markers (CRP, ESR) and MRI findings were also analyzed.

5. Data Analysis
The data were analyzed using SPSS software. Descriptive statistics were used to summarize patient demographics, baseline characteristics, and treatment data. The following statistical methods were employed:

5.1. Descriptive Statistics:
- Patient demographics (age, gender, BMI, disease duration) were summarized using means, standard deviations, and percentages.
- Baseline imaging, laboratory data, and functional outcomes were summarized and compared across different treatment groups (pharmacotherapy + physical therapy vs. pharmacotherapy alone).

5.2. Comparative Analysis:
- A paired t-test was used to compare baseline and follow-up imaging results (joint space width, cartilage integrity) and laboratory markers (CRP, ESR) over 12 months.
- Differences in pain, mobility, and WOMAC scores between the pharmacotherapy + physical therapy group and the pharmacotherapy-only group were analyzed using analysis of variance (ANOVA).

5.3. Correlation Analysis:
- Pearson correlation coefficients were calculated to assess the relationship between laboratory markers (CRP, ESR), imaging findings, and clinical outcomes (pain, mobility, joint space narrowing).

5.4. Multivariate Analysis:
- Multivariate regression models were used to identify independent predictors of OA progression, focusing on the effects of physical therapy, pharmacological treatments, imaging findings, and laboratory markers.

6. Ethical Considerations

This study was conducted in accordance with the ethical guidelines set forth by the ethics committee. Ethical approval was obtained. As the study involved retrospective data collection, informed consent was waived, but all patient data were anonymized to ensure confidentiality. Access to patient records was restricted to authorized researchers, and all data were stored securely in compliance with hospital data protection policies.

7. Trustworthiness and Rigor

To ensure data accuracy and reliability, two independent researchers were responsible for data extraction and validation. Any discrepancies were resolved through discussion and consensus. The study utilized both imaging and laboratory markers to provide a comprehensive assessment of OA progression, enhancing the rigor of the analysis. Furthermore, all statistical analyses were reviewed by an experienced statistician to ensure the robustness of the results.

Findings

This study analyzed data from 250 patients with osteoarthritis (OA) treated in a tertiary hospital. The results focus on the progression of OA based on imaging findings, laboratory markers, pharmacological treatments, and the effectiveness of physical therapy in improving functional outcomes.

1. Patient Demographics and Baseline Characteristics

Table 1 summarizes the demographic and clinical characteristics of the study population. The mean age of the patients was 63.2 years, with a slightly higher prevalence of OA in females. Most patients were diagnosed with knee OA, and nearly half of the cohort had comorbidities such as hypertension or diabetes.

Table 1: Patient Demographics and Baseline Characteristics

Characteristic	Total (n=250)
Age (mean ±SD)	63.2 ±8.7
Gender (Female)	152 (60.8%)
BMI (mean ±SD)	29.8 ±3.5
OA Type	
- Knee OA	168 (67.2%)
- Hip OA	82 (32.8%)
Comorbidities	
- Hypertension	130 (52%)
- Diabetes	85 (34%)
- Cardiovascular disease	45 (18%)

2. Imaging and OA Progression

X-ray and MRI results were analyzed to assess OA progression. Table 2 presents the radiographic findings at baseline and after 12 months of treatment, focusing on joint space width and the presence of osteophytes. MRI data also captured cartilage integrity and synovitis in a subset of patients.

Table 2: Radiographic and MRI Findings Over 12 Months

Imaging Parameter	Baseline	Follow-Up (12 months)
Joint Space Width (mm)	2.3 ±0.6	1.9 ±0.5
Osteophyte Formation (%)	56%	62%
Cartilage Degradation (MRI subset)	Mild: 45%, Severe: 55%	Mild: 35%, Severe: 65%
Synovitis (MRI subset	40%	45%

Key Findings:
- Joint space narrowing progressed significantly over 12 months, with a mean reduction of 0.4 mm ($p < 0.01$).
- The prevalence of osteophyte formation increased from 56% at baseline to 62% after 12 months.
- In the MRI subset (n=100), 65% of patients showed severe cartilage degradation at follow-up, compared to 55% at baseline.
- Synovitis, as detected by MRI, was present in 45% of patients at follow-up, up from 40% at baseline.

3. Laboratory Markers and Inflammation
Inflammatory markers (CRP and ESR) were measured at baseline and at 6-month intervals. Table 3 presents the changes in CRP and ESR over the study period and their correlation with imaging findings.

Table 3: Laboratory Markers Over Time

Laboratory Marker	Baseline (mean ± SD)	12 months (mean ± SD)	p-value
C-reactive protein (CRP, mg/L)	6.2 ±2.1	5.8 ±2.0	0.08
Erythrocyte sedimentation rate (ESR, mm/hr)	18.4 ±6.8	17.9 ±6.5	0.12

Key Findings:
- There was no statistically significant change in CRP and ESR levels over the 12-month period ($p > 0.05$).
- Higher baseline CRP and ESR levels were modestly correlated with more severe cartilage degradation and joint space narrowing ($r = 0.42$, $p < 0.05$).

4. Impact of Pharmacological Interventions
The effectiveness of pharmacological treatments was analyzed by comparing pain relief, joint mobility, and functional improvement between patients receiving NSAIDs, corticosteroid injections, or combination therapy. Table 4 highlights the impact of different pharmacological treatments on patient outcomes.

Table 4: Impact of Pharmacological Treatment on Outcomes

Pharmacological Treatment	Pain Reduction (VAS, 0-10)	Improvement in Joint Mobility (%)	WOMAC Score Improvement
NSAIDs only	4.1 ±1.2	40%	25%
Corticosteroid Injections	3.8 ±1.1	38%	22%

Combination Therapy (NSAIDs + Injections)	5.3 ±1.4	55%	35%

Key Findings:
- Patients receiving combination therapy (NSAIDs + corticosteroid injections) reported the highest pain reduction (mean 5.3) and the greatest improvement in joint mobility (55%).
- NSAID-only therapy was associated with a 40% improvement in joint mobility, while corticosteroid injections alone resulted in a 38% improvement.
- The WOMAC score improved by 35% in patients on combination therapy, indicating better overall functional outcomes compared to monotherapy.

5. Impact of Physical Therapy
The study assessed the role of physical therapy in improving pain, mobility, and functional outcomes. Table 5 summarizes the differences between patients receiving both physical therapy and pharmacological interventions versus pharmacological treatment alone.

Table 5: Comparison of Outcomes With and Without Physical Therapy

Treatment Group	Pain Reduction (VAS, 0-10)	Improvement in Joint Mobility (%)	WOMAC Score Improvement (%)
Pharmacological Treatment Only	3.7 ±1.1	35%	22%
Pharmacological + Physical Therapy	5.6 ±1.3	60%	45%

Key Findings:
- Patients receiving both pharmacological treatment and physical therapy reported significantly greater pain reduction (mean 5.6, $p < 0.01$) compared to those receiving pharmacotherapy alone (mean 3.7).
- Joint mobility improved by 60% in the combined treatment group, compared to 35% in the pharmacotherapy-only group.
- WOMAC scores improved by 45% in the combined treatment group, suggesting better functional outcomes.

Discussion
This study evaluated the effectiveness of a multidisciplinary approach in managing osteoarthritis (OA) through the integration of imaging, laboratory markers, pharmacological interventions, and physical therapy. The results indicate that this comprehensive strategy yields improved patient outcomes, including reduced pain, increased joint mobility, and better overall functional status, especially when combining pharmacotherapy with physical therapy. These findings align with the growing body of evidence supporting the need for multimodal care in the management of chronic degenerative conditions like OA (Wieland et al., 2005).

1. Imaging and OA Progression
The imaging findings in this study revealed significant joint space narrowing and increased osteophyte formation over the 12-month period, confirming the progressive nature of OA. The reduction in joint space width observed (0.4 mm) reflects the continued cartilage degradation typical of OA progression, as

documented in previous research (Felson et al., 2000). The MRI subset also showed increased cartilage degradation and synovitis, which are strongly associated with increased pain and functional decline in OA patients (Roemer et al., 2011).

These findings underscore the importance of incorporating imaging into OA management. X-rays remain a cornerstone for monitoring joint space narrowing and osteophyte formation, while MRI provides additional value by detecting soft tissue changes such as cartilage loss and inflammation, which are not always visible on X-rays. MRI's ability to detect early-stage OA changes allows for timely intervention, potentially delaying disease progression and improving long-term outcomes (Hunter and Guermazi, 2012).

2. Laboratory Markers and Inflammation

Laboratory markers, specifically C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), did not show significant changes over the study period. However, elevated baseline CRP and ESR levels were modestly correlated with more severe cartilage degradation and joint space narrowing. This is consistent with other studies that have identified low-grade inflammation as a factor in OA progression (Attur et al., 2015). While CRP and ESR are non-specific inflammatory markers, their correlation with disease severity suggests that systemic inflammation contributes to OA pathology in some patients.

Although laboratory markers alone are insufficient for diagnosing or tracking OA progression, their use in conjunction with imaging provides a more comprehensive picture of disease activity. Monitoring inflammatory markers may be particularly useful in patients with advanced disease or those who exhibit higher levels of systemic inflammation, guiding more targeted treatment interventions.

3. Impact of Pharmacological Interventions

Pharmacological interventions, particularly NSAIDs and corticosteroid injections, were effective in reducing pain and improving joint mobility. Patients receiving combination therapy (NSAIDs + corticosteroid injections) reported the greatest improvements in pain reduction (mean 5.3) and functional outcomes, compared to monotherapy. This finding is consistent with existing evidence that combining anti-inflammatory treatments can provide more effective symptom relief in OA patients (Hochberg et al., 2012).

However, the long-term use of NSAIDs raises concerns about potential adverse effects, such as gastrointestinal and cardiovascular complications (Zhang et al., 2010). Corticosteroid injections, while effective in providing short-term pain relief, may contribute to cartilage degradation if used repeatedly, highlighting the need for caution in their long-term use (McAlindon et al., 2014). These risks reinforce the importance of balancing symptom control with the long-term safety of pharmacological interventions, particularly in older OA patients with comorbidities.

4. The Role of Physical Therapy in OA Management

Physical therapy was a critical component of the multidisciplinary approach, significantly enhancing patient outcomes. Patients who participated in both pharmacotherapy and physical therapy reported greater pain reduction, increased joint mobility, and improved overall function compared to those who received pharmacotherapy alone. Joint mobility improved by 60% in the combined treatment group, while the WOMAC score improved by 45%, indicating substantial improvements in pain, stiffness, and physical function.

These findings support the existing literature, which emphasizes the importance of physical therapy, particularly strength training and aerobic exercise, in managing OA (Bennell et al., 2012). Physical therapy not only helps reduce pain but also strengthens the muscles surrounding the affected joints, reducing the mechanical load on the joint and slowing OA progression (Fransen et al., 2015). The sustained improvements in function observed in this study highlight the long-term benefits of physical therapy as a cornerstone of OA management.

5. Multidisciplinary Approach and Clinical Implications

The results of this study underscore the value of a multidisciplinary approach to OA management. Combining imaging, laboratory markers, pharmacological interventions, and physical therapy provides a comprehensive framework for addressing the complex nature of OA. Imaging allows for the detection and monitoring of structural changes, while laboratory markers offer insights into the inflammatory processes that may exacerbate OA. Pharmacological treatments provide effective symptom relief, and physical therapy improves joint function and delays disease progression.

The integration of these modalities allows for personalized treatment plans that address both the structural and functional aspects of OA. This approach is particularly important in managing chronic conditions like OA, where long-term care and ongoing monitoring are essential to improving patient outcomes and maintaining quality of life (Wieland et al., 2005).

6. Limitations and Future Research

Several limitations should be considered when interpreting the findings of this study. First, the study was conducted in a single tertiary hospital, which may limit the generalizability of the results to other healthcare settings. Second, while the study included a relatively large sample size, the MRI subset was smaller, which may have limited the statistical power of the MRI findings. Future studies should aim to include larger patient cohorts with more comprehensive imaging data.

Additionally, while the study focused on the effectiveness of NSAIDs and corticosteroid injections, newer pharmacological treatments, such as disease-modifying osteoarthritis drugs (DMOADs), were not included. Future research should explore the long-term effects of these emerging therapies, particularly in combination with physical therapy, to determine their potential in modifying OA progression.

7. Conclusion

In conclusion, this study demonstrates that a multidisciplinary approach to managing osteoarthritis, integrating imaging, laboratory markers, pharmacological interventions, and physical therapy, provides significant benefits in improving pain, joint function, and overall patient outcomes. Imaging plays a critical role in monitoring OA progression, while laboratory markers offer insights into underlying inflammation. Pharmacological treatments, particularly when combined with physical therapy, result in better functional outcomes than pharmacotherapy alone. These findings support the need for personalized, multimodal care in the management of OA, ultimately improving patient quality of life.

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