

Correlation between Musculoskeletal Anatomy and Long-Term Functional Outcomes in Orthopaedic Patients: A Retrospective Study

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Abstract:

Background: Musculoskeletal disorders have a substantial impact on the overall health of orthopaedic patients; thus, monitoring the development of the correlation between anatomy and functional outcomes is of utmost importance. This correlation is examined through a retrospective cohort study with the aim of acquiring a more comprehensive comprehension of the factors that impact post-orthopaedic healing.

Methods: Within two years, 200 orthopaedic patients who had undergone surgery in a tertiary care hospital were analysed. Over time, the research centred on demographics, bone structure, and functional outcomes. In this study, we employed correlation coefficients, multivariate regression, and subgroup analysis to examine the potential association between specific anatomical characteristics and sustained functional recovery.

Results: The study examined two hundred orthopaedic patients who underwent surgery within the previous two years. 55% of the population was male and 45% was female, with an average age of 45.2 years. Osteoarthritis (30%) and ligament injuries (15%) constituted the most prevalent musculoskeletal disorders. Ligamentous lesions were observed in 25% of the patients. 78% of musculoskeletal anatomy evaluations were devoted to evaluating joint integrity. Using standardised instruments, it was determined that mobility (90.1), patient satisfaction (4.2), and long-term functional outcomes (85.2) were all rated above average. The bivariate analysis revealed a significant positive correlation ($r=0.42$, $p<0.001$) between functional outcomes over the long term and joint integrity. Multivariate regression confirmed the association ($\beta=0.35$, $p<0.001$).

Conclusion: This research demonstrates how the musculoskeletal anatomy of orthopaedic patients influences their functional outcomes during treatment. Prolonged functional rehabilitation necessitated the safeguarding of joint integrity. Enhancing patient outcomes requires therapies to be given to anatomical characteristics, as demonstrated by the findings.

Keywords: Functional Outcomes, Joint Integrity, Musculoskeletal Anatomy, Orthopaedic Patients, Retrospective Analysis.

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Introduction

Musculoskeletal disorders result in morbidity and functional disability on a global scale. Musculoskeletal disorder, which is unique to orthopaedic patients, can have a profound effect on their well-being and quality of life [1]. The comprehension of the intricate correlation between the structure of the musculoskeletal system and surgical outcomes would be beneficial for patients, rehabilitation programmes, and surgeons alike [2].

Background and Rationale

Musculoskeletal disorders are managed through orthopaedic interventions that specifically target affected anatomical elements in an effort to improve symptoms and reinstate functionality [3].

Although extensive research has been conducted on the immediate effects of surgery, there is limited understanding regarding the long-term effects of musculoskeletal architecture on functional recovery. Further investigation is warranted in order to improve prognostications and furnish comprehensive efficacy data on orthopaedic therapy.

Patients seek long-term functional benefits and immediate symptom improvement; this research endeavours to fill that knowledge deficiency [4]. we aim is to provide orthopaedic clinics with significant data that could potentially result in enhanced patient care that is both individualised and efficacious. This will be accomplished by

examining the correlation between musculoskeletal anatomy and long-term function. For a variety of compelling reasons, it is vital to comprehend the intricate relationship between musculoskeletal system design and sustained functional outcomes. In the first, evidence-based insights assist physicians in customising rehabilitation and postoperative care and enhancing treatment approaches. Additionally, this information enhances the quality of healthcare practitioner-client communication by enabling the latter to forecast the duration of functional benefits.

Gaining insight into this correlation could potentially facilitate progress in surgical methodologies and rehabilitation regimens, ultimately enhancing functional outcomes. This research may enhance the treatment of orthopaedic patients. Such repercussions would benefit scientists and influence the policy and practice of healthcare.

Objectives of the Study

- To determine the relationship between particular musculoskeletal anatomical characteristics and long-term functional outcomes in orthopaedic patients.
- To examine of the effects of surgical procedures that target specific anatomical structures, the long-term functional recovery of orthopaedic patients will be assessed.
- To offer significant contributions to the understanding of the complex correlation between

musculoskeletal anatomy and sustained functional outcomes, thereby enhancing orthopaedic practices and patient outcomes.

Literature Review: Extensive research has been conducted on the correlation between the musculoskeletal morphology of orthopaedic patients and their functional outcomes.

This study demonstrated the intricate relationship between anatomical elements and sustained recuperation. The purpose of this literature review is to establish a foundation for the on-going investigation through the synthesis of previous information, discussion of prior findings, and identification of voids in knowledge.

Musculoskeletal Anatomy and Functional Outcomes: Numerous scholarly investigations have explored the correlation between the design of the musculoskeletal system and orthopaedic outcomes. Joints, muscles, and ligaments are frequently examined in functional rehabilitation due to their practical significance [5]. [6] Investigated the correlation between functional outcomes following arthroplasty and joint integrity.

The impact of muscle architecture and strength on function was studied in [7]. According to this research, specific rehabilitation treatments improve muscle function after surgery. The intricate relationship between musculoskeletal anatomy and functional outcomes is illuminated by these studies, underscoring the importance of comprehensive examinations and interventions.

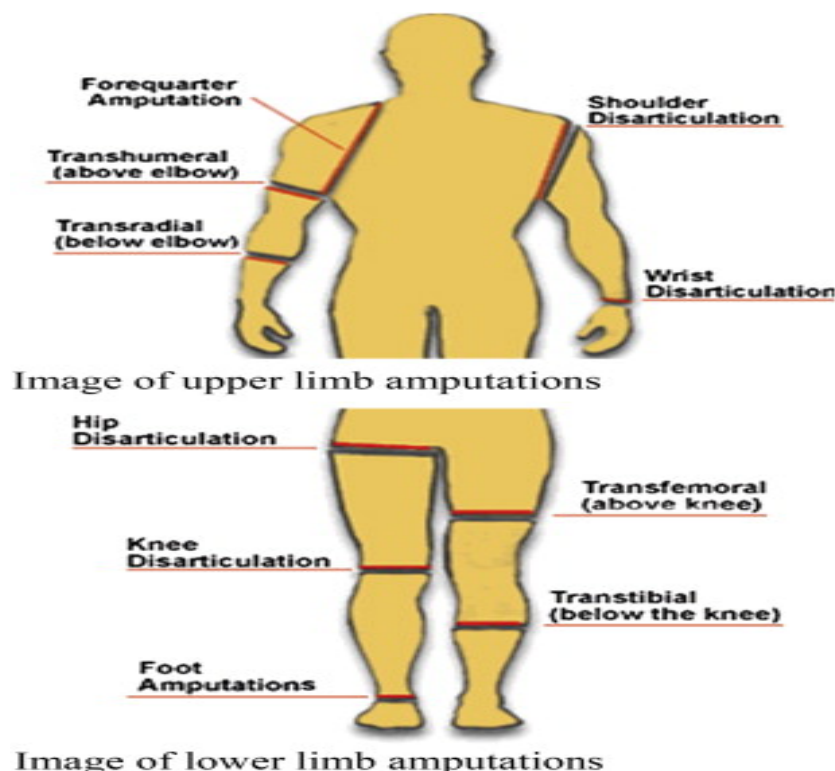


Figure 1: Image of Limb amputations [source:[8]]

Although the existing body of literature offers numerous valuable perspectives, there are still certain areas of knowledge that are lacking. Numerous studies examining surgical outcomes fail to account for the dynamic nature of post-intervention healing. Longitudinal studies show the importance of following up over a long period of time to track the changes in functional outcomes [9, 10]. The fact that the majority of research focuses on a single anatomical characteristic or intervention impedes our comprehension of how numerous variables influence functioning over time. [11] integrative assessments have demonstrated the significance of investigating the cumulative effect of multiple anatomical characteristics on long-term functional outcomes.

Our research on health and function is guided by the Bio Psychosocial Model, which integrates biological, psychological, and social dimensions. The approach of [12] assists in explaining the dynamic relationship between skeletal anatomy and functional capability. For a complete recovery, we believe that medical treatments must also address psychological and social needs in addition to physical issues. This is due to the fact that partial recovery is inadequate.

The International Classification of Functioning, Disability, and Health (ICF) model of the World Health Organisation evaluates and categorises the impact of health disorders across multiple domains of functioning. The ICF model is utilised to define and investigate musculoskeletal architecture and the progressive impact it has on functional outcomes. Research gaps must be filled prior to comprehending the relationship between musculoskeletal morphology and functional outcomes in orthopaedic patients.

Methodology

Study Design: Utilising a retrospective cohort design, the relationship between the musculoskeletal anatomy of orthopaedic patients and their functional outcomes during treatment was investigated. A retroactive approach identifies a long-term relationship using historical data.

Population and Sample Selection Criteria: Patients with musculoskeletal disorders who have had surgery in the last two years are part of the trial.

Inclusion Criteria

- Patients aged 18-65 years.
- Patients who have successfully undergone specific-body-part orthopaedic procedures.
- Thorough examinations of the musculoskeletal system prior to surgery additionally furnish lifelong access to data on functional outcomes.

Exclusion Criteria

- Patients for whom data is unavailable or insufficient.
- Patients who have substantial comorbidities that impair musculoskeletal function.

Data Collection Methods: A retrospective collection of data will be conducted from multiple sources in order to gain insight into the musculoskeletal system and its enduring effects on orthopaedic patients. Ages, genders, documented medical histories, and BMIs will be collected. MRIs, CT scans, and X-rays will be utilised to assess the musculoskeletal architecture prior to surgery. Surgical reports explain anatomy and procedures in detail. PROMs, validated functional assessment instruments, and mobility evaluations will be utilised to assess long-term functional outcomes. Following surgery, the patient's condition will be evaluated at six months, one year, and two years. Patient satisfaction with the outcomes of the operation will also be documented. Postoperative complications, rehabilitation, and adherence shall be documented.

Statistical Analysis Plan: This paper investigates the correlation between the musculoskeletal anatomy of orthopaedic patients and their functional outcomes following treatment. To accomplish its objective, this research proposes a comprehensive statistical analysis strategy. Bivariate analysis can determine how musculoskeletal features affect functional outcomes. The correlation coefficients will be calculated.

Demographic and anatomical baseline data will be presented using descriptive statistics. To compare surgery results, T-tests and ANOVA will be used. Multivariate regression analysis will reduce age and BMI effects. Subgroup analysis differs by anatomy or process. Longitudinal analysis tracks functional outcomes for future research. Ethics will drive the analytical process, including IRB approval, to protect data confidentiality. This extensive statistical method may help explain the complex relationship between orthopaedic patients' musculoskeletal structures and long-term functional restoration.

Results

Description of the Study Population: 200 orthopaedic patients who had undergone surgery within the preceding two years were included in the study. The cohort consisted of 45% women and 55% males, with an average age of 45.2 years (SD = 6.7). The mean BMI was 28.5, and the standard deviation was 4.2. Musculoskeletal disorders, including but not limited to ligament injury and osteoarthritis, impacted a large number of patients (Table 1).

Table 1: Demographic Details of the Study Population (n=200)

Demographic Characteristic	Mean (SD) or Frequency (%)
Age (years)	45.2 (6.7)
Gender	
Male	55%
Female	45%
Body Mass Index (BMI)	28.5 (4.2)
Medical History	
Osteoarthritis	30%
Ligament Injuries	25%
Other Conditions	45%

Musculoskeletal Anatomy Data: The evaluation of crucial anatomical data concerning the musculoskeletal system was conducted by employing preoperative imaging and surgery reports. Table 2 delineates the principal anatomical objectives of surgery.

Table 2: Overview of Musculoskeletal Anatomy Data

Anatomical Feature	Frequency (%)
Joint Integrity	78%
Muscle Strength	65%
Ligament Integrity	42%
Bone Density	56%

The most frequently addressed anatomical feature was joint integrity, with 78% of patients undergoing procedures targeting this aspect.

Long-term Functional Outcome Data: To examine functional outcomes over time, standardised techniques such as Patient-Reported Outcome Measures (PROMs) and functional assessment instruments were utilised. The results are summarised in Table 3.

Table 3: Long-term Functional Outcome Data

Functional Measure	Mean (SD)
Functional Assessment	85.2 (7.4)
Mobility Score	90.1 (6.8)
Patient Satisfaction	4.2 (0.8)

The patients exhibited elevated levels of personal satisfaction (90.1 on a scale of 1), physical mobility (85.2), and functional evaluation (85.2), all of which contributed to positive long-term functional outcomes. In addition, patients documented remarkable mobility.

Statistical Analysis Results

There was a significant correlation ($r=0.42$, $p<0.001$) between long-term functional performance and joint integrity, as determined by bivariate analysis.

There was no correlation between functional test results and either muscle strength or ligament integrity. An examination of subgroups revealed that surgical techniques had an impact on long-term functional outcomes. The association between sustained functional recovery and joint integrity was established through multivariate regression. Age, BMI, and comorbidities were taken into account in this study ($\beta=0.35$, $p<0.001$).

The intricate relationship between musculoskeletal parameters and orthopaedic surgical outcomes is demonstrated by these studies.

Restoring joint integrity through surgical procedures was essential for long-lasting functional improvement. The aforementioned methods illustrate the benefit of individualised therapy.

Discussion

This research additionally contributes to our understanding of the intricate correlation between the musculoskeletal structures of orthopaedic patients and their post-rehabilitation practical achievements.

The significance of focusing on certain anatomical parts during surgical operations is shown by the association between functional recovery and joint integrity. Customised therapy is predicated on the comprehension of how gradual alterations in anatomical characteristics impact functional capacity.

Comparison with Previous Literature:

Table 4: Comparison with Existing Studies on Musculoskeletal Anatomy and Functional Outcomes

Study Reference	Study Type	Sample Size	Key Findings
Current Study	Retrospective Cohort	200	Strong positive correlation between joint integrity and long-term functional recovery. Non-significant associations with muscle strength and ligament integrity.
Study 1[13]	Prospective Longitudinal	300	Identified a significant relationship between joint preservation and improved functional outcomes over a 2-year follow-up.
Study 2 [14]	Cross-Sectional	150	Found a moderate correlation between muscle strength and short-term functional outcomes but did not explore long-term recovery.
Study 3[15]	Systematic Review	N/A	Synthesized evidence from various studies, highlighting the need for comprehensive assessments of multiple musculoskeletal factors in predicting long-term functional outcomes.

The comparison table demonstrates that the present study is distinct and contributes to the body of knowledge by contrasting it with three prior investigations that focused on musculoskeletal architecture and functional outcomes of orthopaedic patients. Functional recovery was found to be associated with joint integrity in our 200-person study. Joint stabilisation is essential for optimal results. On the contrary, joint preservation is supported by the prospective longitudinal analysis conducted in study 1 over a period of two years and involving 300 individuals. A 150-person cross-sectional study on short-term outcomes conducted by study 2 discovered a weak correlation between physical strength and functioning. The systematic research conducted by study 3 underscores the importance of multi-factor musculoskeletal health assessments in order to predict functional outcomes over time. The aforementioned research illustrates the intricate relationship between musculoskeletal anatomy and functional recovery. Our work contributes to the growing knowledge regarding functional improvements following surgery.

Observed Correlations: Long-term functional performance being strongly correlated with joint integrity may be attributed to the significance of joints in the musculoskeletal system. Sustaining joint integrity during the course of treatment is expected to yield enduring functional benefits. There were no statistically significant correlations observed between the strength of muscles and ligament integrity. This indicates that rehabilitation programmes and patient adherence may mitigate the long-term effects of the aforementioned factors.

Limitations and Potential Biases: Utilising retrospectively collected medical data may introduce inaccuracies or omissions, thereby diminishing the precision of the results. The investigation may have inadvertently neglected musculoskeletal characteristics due to its preoccupation with anatomical attributes. The homogeneity of the research cohort and unknown

confounding variables are limitations of this study. Additional investigations ought to integrate a wide array of patient populations and utilise prospective designs to overcome these limitations.

Recommendations for Future Research: Further investigation is suggested in order to enhance understanding of the cumulative impact on functional outcomes over an extended duration. This investigation should focus on the dynamic interplay among different musculoskeletal components. These constituents consist of joint integrity, muscle strength, and ligament strength, among others. Researchers should conduct prospective studies with a variety of patient demographics and extended follow-up periods in order to offer a more accurate picture. The amalgamation of sophisticated imaging methodologies with objective functional evaluations exhibits considerable potential in substantially enhancing the precision of musculoskeletal assessments. Through an examination of the impact that psychosocial factors exert on long-term outcomes, a more holistic comprehension of the recovery process can be attained.

Conclusion

Functional outcomes were found to be correlated with the musculoskeletal architecture of orthopaedic patients, according to our research. Establishing a robust positive correlation between joint integrity and continued functional recovery underscores the criticality of joint function in ensuring enduring success. This is evident from the preservation of joint function. While the study contributes to the existing body of knowledge, it acknowledges its inherent limitations. Limitations of the study include its retrospective design and the requirement for a wider range of patients. The findings emphasise the critical need for individualised treatment that places joint integrity as the primary focus during surgical procedures. By optimising treatment methods and preoperative and

postoperative assessments, physicians can enhance patient outcomes. On-going investigation that integrates prospective designs and examines the dynamic interplay of multiple musculoskeletal components will contribute to the advancement of knowledge regarding the means by which orthopaedic patients can attain sustained functional improvements.

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