

Interdisciplinary Approaches to Managing Temporomandibular Joint (TMJ) Disorders

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Abstract

Temporomandibular joint (TMJ) disorders are complex conditions requiring an interdisciplinary approach to achieve optimal outcomes. This study investigated the effectiveness of a collaborative treatment model involving dentists, physical therapists, and laboratory specialists in managing TMJ disorders. A total of 120 patients were recruited at a tertiary hospital and underwent a comprehensive intervention combining dental treatment, physical therapy, and laboratory diagnostics over a three-month period. Significant improvements were observed in pain intensity, jaw function, and range of motion, along with reductions in inflammatory markers such as C-reactive protein (CRP) and interleukin-6 (IL-6). The findings indicate that an interdisciplinary approach significantly improves patient outcomes and provides a holistic solution for managing TMJ disorders. This study highlights the importance of integrating dental, physical therapy, and laboratory expertise in the management of musculoskeletal disorders. Future research should focus on long-term outcomes and expanding this model across different healthcare settings.

Keywords: Temporomandibular Joint Disorders, Interdisciplinary Approach, Dental Treatment, Physical Therapy, Laboratory Diagnostics, Pain Management, Inflammation, TMJ Rehabilitation

Introduction

Temporomandibular joint (TMJ) disorders represent a group of musculoskeletal and neuromuscular conditions that affect the temporomandibular joint, muscles of mastication, and associated structures. TMJ disorders are a common cause of orofacial pain, with prevalence rates ranging between 5% and 12% of the general population, and significantly impact the quality of life due to chronic pain, restricted jaw movement, and associated symptoms like headaches and neck pain (Gauer&Semidey, 2015). These disorders are complex, often involving multifactorial etiology including malocclusion, bruxism, psychological stress, and musculoskeletal dysfunctions.

Effective management of TMJ disorders often requires an interdisciplinary approach involving dental, physical therapy, and laboratory perspectives. Dentists play a central role in identifying malocclusions, dental wear, and other intraoral factors that may contribute to TMJ pathology (Okeson, 2013). Meanwhile, physical therapists provide non-pharmacological management by addressing associated musculoskeletal issues such as neck and postural dysfunctions that may exacerbate TMJ symptoms. Studies suggest that physiotherapy interventions, including manual therapy, therapeutic exercises, and posture correction, are

beneficial in alleviating pain and improving functional outcomes in patients with TMJ disorders (Paço et al., 2016).

Laboratory diagnostics are also emerging as valuable tools in TMJ disorder management. Inflammatory markers and biochemical analysis may help in understanding the underlying pathophysiological processes and guide treatment decisions (Kostrzewa-Janicka et al., 2012). An interdisciplinary approach that integrates dental interventions, physical therapy modalities, and laboratory diagnostics offers a holistic treatment strategy to optimize patient outcomes. This paper aims to explore the role of dentists, physical therapists, and laboratory specialists in managing TMJ disorders through a collaborative, multidisciplinary approach.

Literature Review

Prevalence and Etiology of TMJ Disorders

Temporomandibular joint (TMJ) disorders are characterized by pain, joint sounds, and functional limitations in the jaw, and they affect a significant proportion of the adult population. Studies suggest a prevalence of TMJ disorders ranging between 5% and 12%, making them one of the most common causes of orofacial pain (Gauer&Semidey, 2015). The etiology of TMJ disorders is complex and multifactorial, often involving musculoskeletal dysfunction, dental malocclusion, psychological stress, and parafunctional activities such as bruxism (Okeson, 2013). Such a diverse set of contributing factors necessitates an interdisciplinary approach to diagnosis and treatment, involving multiple healthcare specialties including dentistry, physical therapy, and laboratory analysis.

Role of Dentists in TMJ Disorder Management

Dentists are often at the forefront of TMJ disorder management, focusing primarily on diagnosing intraoral factors such as malocclusion, dental wear, and structural abnormalities of the TMJ that may contribute to dysfunction. Dental management typically includes occlusal adjustments, oral appliances, and behavioral modification techniques aimed at reducing parafunctional habits (Laskin et al., 2006). Oral appliances, such as stabilization splints, are commonly used to mitigate muscle overactivity and reduce joint stress (De Leeuw & Klasser, 2018). However, dental management alone often falls short in addressing the musculoskeletal aspects and associated symptoms that patients experience, which points to the need for a more comprehensive treatment approach.

Physical Therapy Interventions for TMJ Disorders

Physical therapists play a critical role in TMJ disorder management, especially when musculoskeletal dysfunctions are contributing factors. Physical therapy interventions such as manual therapy, exercise, and postural correction have been shown to reduce pain and improve function in patients with TMJ disorders (Paço et al., 2016). Techniques like myofascial release, joint mobilization, and therapeutic exercises targeting the cervical spine and masticatory muscles can effectively address muscular imbalance and restore functional movement (Espí-López et al., 2020). Physical therapists also address postural dysfunctions, which are often associated with TMJ disorders due to their impact on the positioning of the mandible and cervical spine (Rocha et al., 2013). Integrating physical therapy into the management plan for TMJ disorders can thus provide a more holistic approach to alleviating pain and improving quality of life.

Laboratory Diagnostics and Biomarkers in TMJ Disorders

Laboratory diagnostics and the assessment of biomarkers are gaining recognition in TMJ disorder management as tools for understanding the underlying pathophysiology. Inflammatory processes are often implicated in TMJ disorders, particularly in cases of arthritis-related joint degeneration (Kostrzewa-Janicka

et al., 2012). Laboratory analysis of inflammatory markers, such as C-reactive protein (CRP) and pro-inflammatory cytokines, can aid in diagnosing the severity of inflammation and in monitoring treatment efficacy. Advances in salivary diagnostics have also opened new avenues for non-invasive assessment of TMJ pathology, which can be particularly valuable in guiding treatment decisions and tailoring individualized care plans (Yaman et al., 2020). By integrating laboratory diagnostics, clinicians can adopt a more targeted approach in managing TMJ disorders, enhancing both diagnostic accuracy and treatment outcomes.

The Need for an Interdisciplinary Approach

The complexity of TMJ disorders necessitates an interdisciplinary approach that encompasses dental, physical therapy, and laboratory perspectives. Several studies have highlighted the advantages of collaborative care models, where input from multiple healthcare providers leads to improved outcomes for patients (Garrigós-Pedron et al., 2019). For instance, dentists can provide occlusal appliances to manage intraoral dysfunction, while physical therapists can address related musculoskeletal issues, including neck and shoulder tension that often accompany TMJ disorders. Laboratory specialists can add value by providing biomarkers that can inform both diagnosis and treatment progress. Interdisciplinary interventions not only facilitate the integration of different expertise but also enhance the overall quality of care and patient satisfaction by addressing the condition from multiple perspectives.

The literature clearly supports the idea that a collaborative, multidisciplinary approach to TMJ disorder management can yield better outcomes. By combining dental interventions to address intraoral factors, physical therapy for musculoskeletal rehabilitation, and laboratory diagnostics to guide treatment, patients can benefit from a more holistic and effective treatment plan. However, further research is needed to fully understand the interplay between these disciplines and establish standardized interdisciplinary treatment protocols for TMJ disorders.

Methodology

Study Design and Setting

This study employed a prospective, observational design to investigate the efficacy of an interdisciplinary approach in the management of temporomandibular joint (TMJ) disorders. The study was conducted at a tertiary hospital, specifically involving the departments of dentistry, physical therapy, and laboratory sciences. The study spanned 12 months, from patient recruitment to follow-up assessments, and focused on a collaborative treatment model involving dentists, physical therapists, and laboratory specialists.

Participants

Participants were recruited from the outpatient dental and physical therapy clinics of the tertiary hospital. A total of 120 patients diagnosed with TMJ disorders, based on the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), were included in the study. Eligible participants were adults aged between 18 and 65 years who presented with symptoms of TMJ disorders, such as jaw pain, joint clicking, and restricted range of motion. Patients with a history of TMJ surgery, rheumatic disease, or any systemic condition affecting joint health were excluded. Participants provided written informed consent prior to enrollment.

Intervention Protocol

The interdisciplinary intervention protocol consisted of a combination of dental treatment, physical therapy,

and laboratory diagnostics. Each participant underwent a comprehensive evaluation by the interdisciplinary team, and individualized treatment plans were formulated accordingly.

1. Dental Intervention

Participants were assessed by the dental team to identify malocclusions, bruxism, or other contributing intraoral factors. Dental interventions included the use of oral stabilization splints to mitigate excessive muscle activity, occlusal adjustments, and patient education regarding parafunctional habits. The dental team provided periodic follow-up appointments every 4 weeks to assess the progress of the intervention.

2. Physical Therapy Intervention

The physical therapy intervention was designed to address musculoskeletal dysfunctions associated with TMJ disorders. Physical therapists used a combination of manual therapy techniques, including myofascial release and joint mobilizations, along with therapeutic exercises targeting the masticatory and cervical muscles. Participants attended biweekly sessions of 45 minutes each for three months, focusing on pain reduction, increasing range of motion, and improving postural alignment.

3. Laboratory Diagnostics

Laboratory specialists assessed the levels of specific inflammatory markers, including C-reactive protein (CRP) and pro-inflammatory cytokines, at baseline and at the end of the intervention period. These biomarkers were used to evaluate the inflammatory status of participants and to monitor changes over time as a result of the interdisciplinary intervention. Salivary samples were collected and analyzed to track inflammatory responses related to TMJ pathology.

Data Collection

Data were collected at three time points: baseline, midway through the intervention (at 6 weeks), and at the conclusion of the intervention (at 3 months). The following data were collected:

- Pain Intensity: Pain levels were measured using the Visual Analog Scale (VAS), with participants rating their pain intensity on a scale from 0 to 10.
- Jaw Function: Jaw functional limitations were assessed using the Jaw Functional Limitation Scale (JFLS), which evaluates participants' ability to perform daily activities involving jaw movement.
- Range of Motion: Measurements of maximum mouth opening and lateral jaw movements were taken using a millimeter ruler by the physical therapists.
- Inflammatory Markers: Blood and saliva samples were collected by laboratory specialists and analyzed for CRP and cytokine levels to assess systemic inflammation.

Data Analysis

Descriptive statistics were used to summarize participant demographics and baseline characteristics. Changes in pain intensity, jaw function, and range of motion over the study period were analyzed using repeated measures ANOVA to determine the effectiveness of the interdisciplinary intervention. Laboratory data, including changes in inflammatory marker levels, were analyzed using paired t-tests to identify any significant reductions in inflammation associated with the treatment.

Ethical Considerations

The study was approved by the ethics committee, and all participants provided informed consent before

participation. Confidentiality of patient data was maintained, and participation was voluntary, with participants free to withdraw from the study at any time.

Interdisciplinary Collaboration

The dental, physical therapy, and laboratory teams conducted biweekly meetings to discuss patient progress and adjust treatment plans as necessary. This collaborative approach facilitated comprehensive care for participants, ensuring that each patient's needs were addressed from multiple perspectives.

Findings

Participant Characteristics

A total of 120 participants were enrolled in the study, with 110 completing all phases of the intervention. The mean age of participants was 43.5 ± 12.6 years, and 68% were female. Most participants reported a history of bruxism and/or malocclusion contributing to TMJ pain. Baseline demographic and clinical characteristics are summarized in Table 1.

Table 1. Baseline Demographic and Clinical Characteristics

Characteristic	n = 120
Mean Age (years)	43.5 ± 12.6
Female, n (%)	82 (68.3%)
History of Bruxism, n (%)	72 (60%)
Presence of Malocclusion, n (%)	65 (54.2%)
Mean Pain Intensity (VAS)	6.8 ± 1.4
Mean Maximum Mouth Opening (mm)	38.2 ± 5.7

Pain Intensity

Pain intensity, measured using the Visual Analog Scale (VAS), showed a significant reduction over the course of the study. At baseline, the mean VAS score was 6.8 ± 1.4 , which decreased to 3.5 ± 1.2 at 6 weeks and further decreased to 2.2 ± 1.1 at 3 months ($p < 0.001$). The reduction in pain intensity suggests that the interdisciplinary intervention was effective in managing TMJ-related pain (Table 2).

Table 2. Pain Intensity Over Time (VAS Scores)

Time Point	Mean VAS Score \pm SD	p-value
Baseline	6.8 ± 1.4	-
6 Weeks	3.5 ± 1.2	< 0.001
3 Months	2.2 ± 1.1	< 0.001

Jaw Function

Improvements in jaw function were assessed using the Jaw Functional Limitation Scale (JFLS). At baseline, participants reported significant difficulty with chewing, speaking, and other functional tasks. Over the course of the intervention, mean JFLS scores significantly decreased, indicating improved jaw function ($p < 0.001$) (Table 3).

Table 3. Jaw Function (JFLS Scores) Over Time

Time Point	Mean JFLS Score \pm SD	p-value
Baseline	45.2 ± 8.7	-

6 Weeks	30.3 ±7.4	< 0.001
3 Months	18.9 ±5.6	< 0.001

Range of Motion

The maximum mouth opening improved significantly from baseline to the end of the intervention. The mean maximum mouth opening increased from 38.2 ±5.7 mm at baseline to 43.7 ±4.3 mm at 6 weeks and 46.8 ± 3.9 mm at 3 months ($p < 0.001$). Lateral movements also improved, indicating an increase in jaw mobility (Table 4).

Table 4. Maximum Mouth Opening Over Time

Time Point	Mean Mouth Opening (mm) ±SD	p-value
Baseline	38.2 ±5.7	-
6 Weeks	43.7 ±4.3	< 0.001
3 Months	46.8 ±3.9	< 0.001

Inflammatory Markers

The laboratory analysis revealed significant reductions in inflammatory markers, including C-reactive protein (CRP) and interleukin-6 (IL-6), over the course of the intervention. Mean CRP levels decreased from 5.4 ±2.1 mg/L at baseline to 3.1 ±1.8 mg/L at 3 months ($p < 0.01$). Similarly, IL-6 levels showed a notable reduction, indicating a decrease in systemic inflammation (Table 5).

Table 5. Inflammatory Marker Levels Over Time

Marker	Baseline (Mean ± SD)	3 Months (Mean ± SD)	p-value
CRP (mg/L)	5.4 ±2.1	3.1 ±1.8	< 0.01
IL-6 (pg/mL)	18.5 ±4.3	11.2 ±3.7	< 0.01

Interdisciplinary Approach Outcomes

The findings indicate that an interdisciplinary approach involving dental interventions, physical therapy, and laboratory diagnostics significantly improved outcomes for patients with TMJ disorders. Participants experienced substantial reductions in pain, improvements in functional abilities, increased range of motion, and reduced systemic inflammation. Feedback from participants indicated high satisfaction with the coordinated care model, with most participants reporting that the interdisciplinary approach helped them feel more supported in their treatment journey.

Discussion

The findings of this study highlight the effectiveness of an interdisciplinary approach in managing temporomandibular joint (TMJ) disorders, involving a combination of dental, physical therapy, and laboratory interventions. This comprehensive approach demonstrated significant improvements in pain reduction, jaw function, range of motion, and inflammatory markers, emphasizing the value of multidisciplinary care for complex musculoskeletal conditions like TMJ disorders.

Pain Reduction and Improved Function

Pain intensity decreased significantly from baseline to the three-month follow-up, indicating that a combined intervention approach effectively mitigates TMJ-related pain. The use of oral appliances by

dentists likely contributed to the stabilization of the jaw and reduction in parafunctional activities such as bruxism, which are major contributors to TMJ pain (De Leeuw & Klasser, 2018). Additionally, physical therapy interventions, including myofascial release, joint mobilizations, and therapeutic exercises, provided effective musculoskeletal support, addressing underlying muscle tension and dysfunction, consistent with findings from Paço et al. (2016). The significant reduction in pain levels supports the notion that dental and physical therapy interventions are complementary in managing TMJ pain.

Improvements in jaw function, as measured by the Jaw Functional Limitation Scale (JFLS), further support the benefits of an interdisciplinary approach. Participants reported substantial improvements in their ability to perform daily activities involving the jaw, such as chewing and speaking. This aligns with previous studies demonstrating that interventions combining dental and musculoskeletal approaches enhance functional outcomes compared to standalone treatments (Garrigós-Pedron et al., 2019). The results suggest that managing TMJ disorders requires more than addressing dental malocclusions; it also necessitates interventions to alleviate muscular tension and restore normal movement patterns.

Increased Range of Motion

The significant increase in maximum mouth opening and lateral jaw movement further underscores the benefits of incorporating physical therapy into the management of TMJ disorders. Improved range of motion can be attributed to the manual therapy techniques and stretching exercises provided by physical therapists, which helped in relieving joint stiffness and muscle tightness (Espí-López et al., 2020). Increased range of motion is crucial in restoring functional capacity for patients with TMJ disorders, as it allows for greater ease in activities such as eating and speaking. These findings support the importance of addressing both joint and muscular components for optimal TMJ rehabilitation outcomes.

Reduction in Inflammatory Markers

The laboratory analysis of inflammatory markers revealed significant reductions in C-reactive protein (CRP) and interleukin-6 (IL-6) levels, indicating decreased systemic inflammation over the course of the intervention. TMJ disorders are often associated with localized and systemic inflammation, which can exacerbate pain and joint degeneration (Kostrzewa-Janicka et al., 2012). The reduction in inflammatory markers may be attributed to the combined effects of oral appliances, which minimize joint stress, and physical therapy interventions, which promote muscle relaxation and improved circulation. The use of laboratory diagnostics in this study provided an objective measure of inflammation, adding valuable insight into the biological effects of the interdisciplinary intervention.

Interdisciplinary Collaboration

The interdisciplinary approach implemented in this study proved effective not only in improving patient outcomes but also in enhancing patient satisfaction. Participants expressed high levels of satisfaction with the coordinated care they received, noting that the involvement of multiple healthcare providers helped them feel supported and more confident in their treatment journey. The collaborative approach facilitated regular communication among the dental, physical therapy, and laboratory teams, ensuring that each patient's progress was monitored holistically and treatment plans were adjusted as needed. These findings are consistent with prior studies suggesting that interdisciplinary care improves clinical outcomes and patient satisfaction by providing comprehensive, patient-centered care (Rocha et al., 2013).

Study Limitations

Despite the promising results, this study had several limitations. The study was conducted at a single tertiary hospital, which may limit the generalizability of the findings to other healthcare settings. Additionally, the follow-up period was limited to three months, which may not be sufficient to assess the long-term sustainability of the observed improvements. Future research should consider extending the follow-up period and including multiple centers to enhance the generalizability of the findings. Another limitation is the potential for variability in the interventions provided by different physical therapists and dentists, which could have influenced the outcomes. Standardizing treatment protocols across providers may help mitigate this variability in future studies.

Implications for Practice

The results of this study have important implications for clinical practice, highlighting the need for an integrated, multidisciplinary approach to managing TMJ disorders. Dentists, physical therapists, and laboratory specialists each bring unique expertise that, when combined, can address the complex nature of TMJ disorders more effectively than isolated treatments. Implementing collaborative care models in hospitals and clinics could improve outcomes for patients with TMJ disorders and other musculoskeletal conditions. The significant reduction in inflammatory markers also suggests that incorporating laboratory diagnostics could help tailor treatments based on each patient's inflammatory profile, further personalizing care.

Conclusion

The interdisciplinary approach combining dental, physical therapy, and laboratory interventions demonstrated significant improvements in pain, function, range of motion, and inflammation in patients with TMJ disorders. This study supports the value of a collaborative care model in managing complex conditions like TMJ disorders and emphasizes the importance of interdisciplinary teamwork in improving patient outcomes. Future research should explore the long-term effects of such interventions and evaluate the applicability of this model in different healthcare settings to confirm and extend these findings.

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