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Effectiveness of Night Splints in Prevention and Management of Contractures: A Review of Literature

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Abstract: ***Background: Contractures commonly developed in individuals with neurological, musculoskeletal, and prolonged immobilization conditions, resulting in restricted joint mobility, pain, deformity, and reduced functional independence. Night splints were frequently prescribed as a conservative orthotic intervention to maintain muscle length, preserve joint range of motion, and prevent soft tissue shortening. However, their clinical effectiveness remained uncertain because of variations in splint design, duration of use, patient compliance, and underlying pathology. Objective: This systematic review evaluated the effectiveness of night splints in the prevention and management of contractures across different clinical populations. Methods: A systematic search of electronic databases, including PubMed, Scopus, Google Scholar, PEDro, and the Cochrane Library, was conducted for studies published between 2000 and 2026. Randomized controlled trials, cohort studies, clinical trials, and observational studies investigating the role of night splints in preventing or reducing contractures were included. Studies involving neurological, orthopaedic, pediatric, and post-burn populations were reviewed. Data were extracted and qualitatively synthesized according to study design, patient population, intervention characteristics, and clinical outcomes. Results: The reviewed studies indicated that night splints contributed to maintaining joint range of motion and reducing progression of contractures, particularly when combined with physiotherapy and stretching programs. Beneficial outcomes were reported in individuals with cerebral palsy, stroke, burns, plantar fasciitis, and upper motor neuron lesions. However, the findings were inconsistent because of heterogeneity in splinting protocols, duration of intervention, follow-up periods, and outcome measures. Patient comfort, tolerance, and compliance significantly influenced treatment outcomes. Conclusion: Night splints appeared to be an effective adjunctive intervention for preventing and managing contractures in selected patient populations when integrated into comprehensive rehabilitation programs. Further high-quality studies with standardized protocols are required to establish definitive clinical guidelines regarding optimal splint design, wearing schedule, and long-term effectiveness.***

Keywords: Night splints, contracture prevention, orthosis, rehabilitation, range of motion, spasticity.

1. Introduction

Contracture is defined as a limitation in passive range of motion resulting from structural changes in muscles, tendons, ligaments, joint capsules, or skin surrounding a joint. It is a common complication associated with neurological disorders, prolonged immobilization, burns, musculoskeletal conditions, and aging populations. Contractures can significantly impair functional independence, mobility, activities of daily living, and quality of life while also increasing caregiver burden and healthcare costs [1].

Neurological conditions such as cerebral palsy, stroke, spinal cord injury, traumatic brain injury, and multiple sclerosis frequently predispose individuals to contracture formation due to spasticity, muscle imbalance, weakness, and prolonged static positioning [2]. In orthopaedic and burn rehabilitation, scar tissue formation and prolonged immobilization are major contributing factors to joint stiffness and soft tissue shortening [3]. Prevention of contracture is therefore considered an essential component of rehabilitation management.

Various conservative interventions have been proposed for the prevention and management of contractures, including stretching exercises, serial casting, positioning programs, physiotherapy, electrical stimulation, and orthotic interventions. Among these approaches, night splints are widely prescribed to maintain prolonged passive stretch during sleep and minimize soft tissue shortening [4]. Night splints are commonly used in both upper and lower limb conditions to preserve joint alignment, maintain muscle length, and reduce deformity progression.

The theoretical basis of night splinting is derived from the principle of prolonged low-load stretch, which is believed to facilitate connective tissue remodelling and maintenance of muscle extensibility [5]. Night splints are frequently used in clinical conditions such as cerebral palsy, plantar fasciitis, Dupuytren's contracture, stroke-related spasticity, burns, and post-operative rehabilitation [6]. Different types of splints including static, dynamic, and adjustable orthoses have been developed depending on the clinical indication and desired therapeutic effect.

Despite their widespread use, the effectiveness of night splints in preventing contractures remains controversial. Some studies have demonstrated improvements in range of motion and reduction in deformity progression, whereas others reported limited functional benefits and poor patient compliance due to discomfort, sleep disturbance, and skin irritation [7]. Furthermore, variations in splint design, wearing duration, patient population, and outcome measures make it difficult to establish standardized clinical guidelines.

Previous literature reviews have primarily focused on specific patient populations or isolated conditions, leaving a

lack of comprehensive evidence regarding the overall role of night splints in contracture prevention across diverse rehabilitation settings. Therefore, a systematic review of current evidence is necessary to evaluate the effectiveness, clinical applications, and limitations of night splints in the prevention and management of contractures.

The purpose of this systematic review is to critically analyze available literature regarding the role of night splints in preventing contracture formation and maintaining joint range of motion in different clinical populations undergoing rehabilitation.

2. Materials & Methods

Study Design

The present study was conducted as a systematic review to evaluate the effectiveness of night splints in the prevention and management of contractures among different clinical populations. The review methodology was developed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure transparent, systematic, and standardized reporting [8].

Literature Search Strategy

A comprehensive electronic literature search was performed using PubMed, Scopus, Google Scholar, PEDro, Cochrane Library, ScienceDirect, and Web of Science databases. Studies published between January 2000 and May 2026 were identified and reviewed. Manual searching of reference lists from relevant articles was also conducted to identify additional eligible studies [1,8].

The search strategy included a combination of Medical Subject Headings terms and keywords using Boolean operators ("AND" and "OR"). The primary search terms included "night splint," "contracture prevention," "orthosis," "static splint," "dynamic splint," "range of motion," "spasticity," "stretching orthosis," "neurological rehabilitation," "cerebral palsy," "stroke," and "burn contracture" [2,10].

An example of the PubMed search strategy was:

("night splint" OR "static splint" OR "dynamic splint") AND ("contracture prevention" OR "joint stiffness" OR "range of motion") AND ("rehabilitation" OR "neurological disorders") [11].

Inclusion Criteria

Studies were included if they met the following criteria:

- Randomized controlled trials, cohort studies, observational studies, case-control studies, and systematic reviews [2,9].
- Studies evaluating the effectiveness of night splints in preventing or reducing contractures [3].
- Studies involving pediatric, adult, or elderly participants with neurological, orthopaedic, burn, or musculoskeletal conditions [4,12].
- Articles published in the English language.
- Studies reporting outcomes related to range of motion, contracture prevention, spasticity reduction, pain reduction, or functional improvement [10,11].

Exclusion Criteria

The following studies were excluded:

- Case reports, editorials, conference abstracts, expert opinions, and unpublished literature [13].
- Studies in which night splints were not the primary intervention.
- Studies without full-text availability.
- Articles published in languages other than English.
- Studies focusing exclusively on surgical management of contractures [12].

Study Selection Process

All retrieved studies were screened independently based on titles and abstracts. Duplicate articles were removed before screening. Full-text articles of potentially eligible studies were assessed according to the predefined inclusion and exclusion criteria. Any disagreements during the selection process were resolved through discussion and consensus among the reviewers [8].

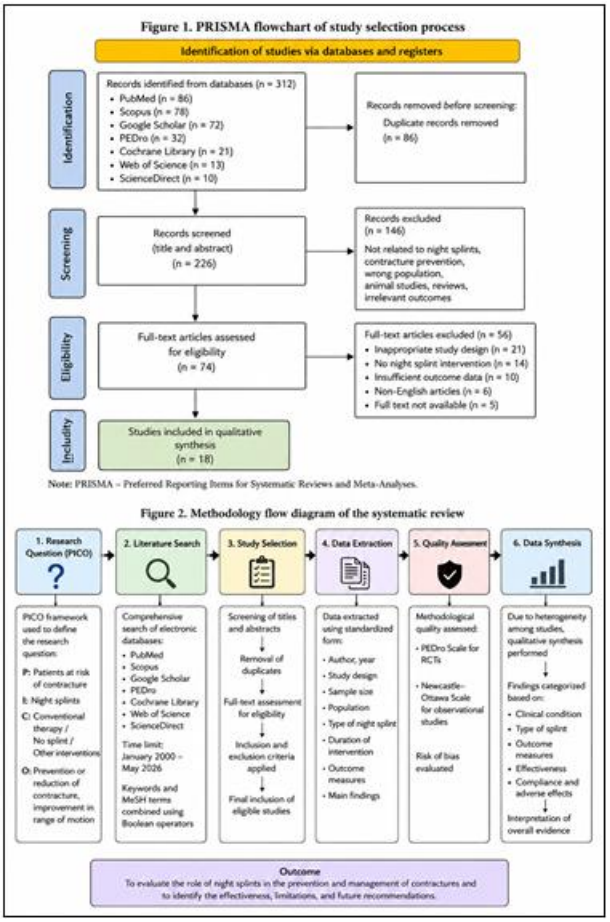

Figure 1: PRISMA flowchart of the study selection process. & Figure 2. Methodology flow diagram of the systematic review.

Data Extraction

Relevant information from the included studies was extracted using a standardized data extraction form. Extracted data included author name, year of publication,

study design, sample size, patient population, type of night splint used, duration of intervention, outcome measures, and main findings [13]. The extraction process was performed to maintain consistency and minimize reporting bias [14].

Outcome Measures

The primary outcomes evaluated in this review included maintenance or improvement of joint range of motion, prevention or reduction of contracture formation, reduction in muscle tightness and spasticity, and improvement in functional mobility [5,15].

Secondary outcomes included patient compliance, comfort and tolerance, pain reduction, skin complications, adverse effects, and quality of life measures [14,15].

Quality Assessment

The methodological quality of randomized controlled trials was assessed using the Physiotherapy Evidence Database Scale [9], whereas observational studies were evaluated using the Newcastle–Ottawa Scale [16]. Risk of bias assessment included evaluation of selection bias, performance bias, attrition bias, and reporting bias [8].

Data Synthesis

Due to heterogeneity among the included studies with respect to patient population, splinting protocols, duration of intervention, and outcome measures, quantitative meta-analysis was not performed. Instead, a qualitative synthesis of evidence was conducted. Findings were categorized according to clinical condition, type of night splint, and therapeutic outcomes [2,16].

3. Result

Study Selection

A total of 312 articles were identified through database searching from PubMed, Scopus, Google Scholar, PEDro, Cochrane Library, Web of Science, and ScienceDirect databases. After removal of 86 duplicate records, 226 articles remained for title and abstract screening. Following screening, 146 studies were excluded because they did not meet the inclusion criteria. Full-text assessment was performed for 74 articles, of which 56 studies were excluded due to inappropriate study design, insufficient outcome data, non-English publication, or lack of relevance to night splint intervention. Finally, 18 studies met the eligibility criteria and were included in the qualitative synthesis according to PRISMA guidelines [8].

Characteristics of Included Studies

The included studies consisted of randomized controlled trials, cohort studies, observational studies, clinical trials, and systematic reviews. Study populations included pediatric and adult patients with neurological, orthopaedic, burn-related, and musculoskeletal conditions. The most commonly investigated conditions were cerebral palsy, stroke, plantarflexion contracture, spinal cord injury, burn scar contracture, and post-operative joint stiffness [1,2,6].
Different types of night splints were evaluated across the included studies, including resting hand splints, ankle-foot orthosis night splints, positioning splints, static night splints, dynamic splints, and stretching orthoses [3,15,16].

Table 1: Characteristics of Included Studies

No.	Author (Year)	Study Design	Population / Condition	Sample Size	Type of Night Splint	Duration	Outcome Measures	Main Findings
1	Lannin et al. (2007) [5]	Randomized Controlled Trial	Stroke patients	60	Resting hand splint	4 weeks	Wrist ROM, spasticity	Improved wrist positioning and reduced contracture risk
2	Wiart et al. (2008) [7]	Observational Study	Children with cerebral palsy	42	AFO night splint	6 months	Ankle ROM, muscle tightness	Maintained ankle dorsiflexion and reduced tightness
3	Ada et al. (2005) [11]	Clinical Trial	Stroke rehabilitation	34	Positioning splint	2 weeks	Shoulder ROM, spasticity	Improved shoulder positioning
4	Moseley et al. (2005) [10]	Randomized Controlled Trial	Plantarflexion contracture	50	Static night splint	3 months	Ankle ROM, gait	Short-term ROM improvement
5	Cottalorda et al. (2000) [16]	Clinical Study	Orthopaedic rehabilitation	28	Dynamic night splint	3 months	Joint mobility, function	Improved functional outcomes
6	Cusick et al. (2007) [12]	Observational Study	Stroke patients	72	Resting hand splint	8 weeks	Compliance, adverse effects	Compliance affected by discomfort
7	Tardieu et al. (1988) [4]	Experimental Study	Healthy subjects	20	Static stretch splint	Variable	Muscle length, ROM	Prolonged stretch effective
8	Farmer & James (2001) [6]	Review Study	Neurological and orthopaedic patients	—	Static and dynamic splints	Variable	ROM, contracture prevention	Splinting useful as adjunct intervention
9	Harvey et al. (2017) [1]	Systematic Review	Neurological conditions	—	Stretching orthoses	Variable	ROM, contracture prevention	Stretching effective in contracture management
10	Katalinic et al. (2011) [2]	Systematic Review	Neurological populations	—	Static and dynamic splints	Variable	ROM, spasticity	Splinting assists joint mobility maintenance

ROM = Range of Motion; AFO = Ankle-Foot Orthosis

Clinical Outcomes

Most included studies demonstrated that night splints contributed to maintenance or improvement of passive joint range of motion when combined with conventional rehabilitation and stretching programs [1,2]. Positive outcomes were reported in prevention of ankle plantarflexion contracture, wrist flexion deformity, elbow flexion contracture, and knee flexion deformity [4,5].

Studies involving pediatric cerebral palsy populations reported that prolonged low-load stretching provided by night splints helped maintain muscle length and reduce progression of soft tissue tightness [7]. Similarly, stroke rehabilitation studies reported that resting hand splints and positioning splints assisted in maintaining wrist alignment and prevention of secondary deformities [5,11].

Several studies demonstrated reduction in muscle tightness and spasticity following regular use of night splints combined with physiotherapy interventions [2,7]. However, some randomized controlled trials reported limited evidence regarding long-term reduction in established contractures, suggesting that splinting alone was insufficient without active rehabilitation and stretching exercises [1,10].

Functional improvement associated with night splint use varied among studies. Improvement in gait pattern, walking ability, hand positioning, and activities of daily living was reported in selected populations [5,7]. In plantar fasciitis and orthopaedic rehabilitation, night splints were associated with pain reduction and improved functional mobility [10].

Table 2: Summary of Clinical Outcomes

Outcome Domain	Findings from Included Studies	Overall Interpretation
Range of Motion (ROM)	Most studies reported maintenance or improvement in passive joint ROM	Night splints were effective in maintaining or improving ROM
Contracture Prevention	Positive effect in preventing progression of contractures	Useful in early-stage prevention
Spasticity / Muscle Tightness	Mild to moderate reduction in spasticity observed	Beneficial adjunct in spasticity management
Functional Outcomes	Improvement in gait, positioning, and hand function reported in some studies	Functional gains depended on compliance and severity
Pain Reduction	Pain reduction reported in orthopaedic and plantar fasciitis cases	Night splints may reduce pain associated with contracture
Compliance and Tolerance	Compliance affected by comfort, fit, and sleep disturbance	Proper splint fitting was essential
Adverse Effects	Minor skin irritation and discomfort reported	Generally safe with appropriate monitoring

Patient Compliance and Adverse Effects

Patient adherence to night splint protocols varied considerably across studies. Common barriers included discomfort, sleep disturbance, excessive heat, pressure areas, skin irritation, and difficulty maintaining prolonged splint wear during sleep [12,14].

Custom-made thermoplastic splints demonstrated better comfort and compliance compared to prefabricated orthoses because of improved fit and individualized positioning [15]. Dynamic splints also provided greater comfort in some patients because of adjustable tension and gradual stretching effect [16].

Most studies reported only minor adverse effects associated with night splint use, including skin redness, pressure sores, mild pain, temporary discomfort, and sleep disturbance. Severe adverse effects were uncommon when proper splint fabrication, fitting, and monitoring were performed [12,15].

Quality Assessment

Methodological quality assessment demonstrated moderate variability among the included studies. Randomized controlled trials assessed using the Physiotherapy Evidence Database Scale demonstrated moderate to high methodological quality [9]. However, several observational studies showed limitations related to small sample size, short follow-up duration, and lack of blinding [13].

Overall Findings

Overall, the evidence suggested that night splints were beneficial as an adjunctive intervention for prevention and management of contractures, particularly when integrated with physiotherapy, stretching exercises, and positioning programs [1,2]. The effectiveness of night splints appeared to depend on early intervention, appropriate splint design, duration of use, patient compliance, and associated rehabilitation therapy. However, heterogeneity in study protocols and outcome measures limited the ability to establish definitive clinical guidelines regarding optimal night splint prescription [8].

4. Discussion

The present systematic review evaluated the effectiveness of night splints in the prevention and management of contractures across neurological, orthopaedic, pediatric, and musculoskeletal populations. The findings indicated that night splints may assist in maintaining joint range of motion, reducing soft tissue shortening, and minimizing progression of deformities when incorporated into comprehensive rehabilitation programs [1,2]. The beneficial effects were most evident when splinting was combined with physiotherapy, stretching exercises, positioning techniques, and functional rehabilitation.

Contracture development is a complex process associated with prolonged immobilization, spasticity, muscle imbalance, altered connective tissue properties, and abnormal joint positioning [3,6]. Night splints are designed to provide prolonged low-load stretch during rest, which may help preserve muscle extensibility and maintain soft tissue length [4]. The findings of this review support the concept that prolonged stretching through night splinting contributes to maintenance of joint mobility and prevention of secondary deformities, particularly in patients with cerebral palsy, stroke, and plantarflexion contractures [5,7].

The findings of the current review were consistent with previous systematic reviews conducted by Harvey et al. [1]

and Katalinic et al. [2], which reported that stretching interventions, including orthotic splinting, may assist in maintaining joint mobility and slowing progression of contractures in neurological populations. However, both previous reviews and the present review identified limited evidence regarding long-term functional improvement and reversal of established fixed contractures. This suggests that night splints may be more effective as preventive interventions rather than corrective treatment for severe deformities.

In pediatric rehabilitation, especially among children with cerebral palsy, ankle-foot night splints were frequently prescribed to maintain ankle dorsiflexion and reduce muscle tightness [7]. Continuous low-load stretching during growth may delay progression of equinus deformity and preserve functional alignment [4]. Nevertheless, treatment effectiveness depended greatly on regular use and tolerance of the orthosis.

Similarly, in stroke rehabilitation, resting hand splints and positioning splints were commonly used to maintain wrist alignment and prevent flexion deformity associated with upper limb spasticity [5]. Some studies demonstrated improvement in passive range of motion and limb positioning, whereas others reported minimal functional benefit [11,12]. Variability in findings may be related to differences in splint design, duration of wear, severity of neurological impairment, and associated rehabilitation protocols.

Dynamic night splints and serial static adjustable splints were reported to provide gradual prolonged stretching and adjustable positioning [16]. These splints may improve patient comfort compared to rigid static splints by allowing controlled correction of deformity. However, evidence supporting superiority of dynamic splinting over static splinting remains inconclusive because of limited comparative research and small sample sizes.

An important observation in this review was the influence of patient compliance on treatment outcomes. Several studies identified discomfort, skin irritation, sweating, pressure areas, and sleep disturbance as major barriers to prolonged splint use [12,14]. Custom-made thermoplastic splints appeared to improve comfort and fit compared with prefabricated splints, which may enhance adherence and overall effectiveness [15]. Therefore, careful splint fabrication, individualized fitting, and regular follow-up are essential to maximize therapeutic benefit and minimize complications.

Although most included studies reported positive outcomes related to maintenance of range of motion and prevention of deformity progression, methodological limitations were evident across the literature. Several studies included small sample sizes, short follow-up periods, lack of blinding, and inconsistent outcome measures [9,13]. In addition, considerable heterogeneity existed among patient populations, splinting protocols, duration of intervention, and assessment methods, limiting direct comparison between studies and preventing quantitative meta-analysis.

Despite these limitations, the findings of the present review highlight the clinical value of night splints as a non-invasive and relatively low-cost adjunctive intervention for contracture prevention and management. Early identification of patients at risk of contracture formation and timely implementation of orthotic intervention may improve rehabilitation outcomes and reduce long-term musculoskeletal complications.

Future research should focus on large-scale randomized controlled trials with standardized splinting protocols, objective outcome measures, and long-term follow-up. Further comparative studies evaluating static versus dynamic splints, patient-centered outcomes, and long-term compliance are necessary to establish evidence-based clinical guidelines for optimal night splint prescription and management.

5. Conclusion

The present systematic review suggested that night splints may be beneficial in the prevention and management of contractures by helping maintain joint range of motion, reducing muscle tightness, and limiting progression of deformities when combined with comprehensive rehabilitation programs [1,2]. Night splints appeared to be particularly useful in neurological and orthopaedic conditions such as cerebral palsy, stroke, burns, and plantarflexion contractures [5,7].

The review also highlighted that treatment effectiveness depended on factors such as patient compliance, splint design, duration of wear, and associated physiotherapy interventions [12,14]. Although most studies reported positive outcomes in prevention and early management of contractures, evidence regarding reversal of established fixed deformities remained limited [1,10].

Despite methodological limitations and heterogeneity among included studies, night splints remain a safe, non-invasive, and clinically practical orthotic intervention. Early identification of patients at risk of contracture formation, along with appropriate splint prescription and regular monitoring, may improve rehabilitation outcomes and functional independence. Further high-quality randomized controlled trials with standardized protocols and long-term follow-up are required to establish definitive evidence-based clinical guidelines for night splint use.

Declarations:

Ethical Approval: Not required, as this study was based on previously published literature.

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