Research Article

Clinical Effectiveness of Kinesio Taping on Pain, Swelling, Proprioception, Deformity and Quality of Life in Individuals with Hemophilia: A Systematic Review

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Abstract

Background: Hemophilia leads to frequent joint/muscle resulting in bleeds, hemophilic arthropathy (HA), chronic pain, swelling, proprioceptive disorders, deformity, as well as reduced quality of life (QoL). Kinesio taping (KT) is emerging as an adjunctive physiotherapy in hemophilia, and there is no synthesis on core outcomes.

Objectives: The purpose of the study is to conduct a systematic review of the RCTs that evaluate the superiority of KT as the only intervention or with physiotherapy, compared with non-KT controls, in the management of pain, swelling, proprioception, deformity, functioning, and health-related QoL in patients with hemophilia.

Methods: PRISMA 2020-conformant review, searched PubMed, Web of Science, Scopus, PEDro, Cochrane Library (inception - December 2025) was found to identify RCTs in hemophilia A/B. Eligible: KT vs. non-KT. Primary: pain, swelling, proprioception, deformity, QoL; secondary: functional, independence. Quality was measured by PEDro scale, Cochrane RoB 2 measured bias. Heterogeneity/small trials Narrative synthesis.

Findings: There were four RCTs (n=128 males, 1040 years; primarily moderate-severe hemophilia A) that covered low back pain, acute hematomas, knee problems and HA, among adolescents. KT was 2 days 13 weeks, frequently with exercise/CO_2 laser. KT reduced pain in all experiments, improved functioning (FISH, HJHS, 6MWT) in three and accelerated hematoma clearance (ultrasound) in one. No proprioception/QoL data. PEDro: 5–7/10 (moderate quality). RoB 2: low randomization bias; three with some concerns (intervention deviations, measurement); impossible, performance likely in pain.

Conclusion: Finding of moderate quality of small RCTs puts KT as potentially useful in short-term pain relief, functional improvements and hematoma in hemophilia. Limitations: small samples, heterogeneity, lack of results. Require bigger multicenter blinded-assessor RCTs in which standardized KT, core sets proprioception, QoL, bleeds, joints are used in rehabilitation guidelines.

Keywords: kinesio taping, hemophilia, hemophilic arthropathy, pain

1. Introduction

Hemophilia A and B is X-linked recessive bleeding disease which is caused by pathologic variants in F8 and F9 genes that result in loss or impairment of clotting factor IX and IX respectively (1). Hemophilia A has a worldwide incidence of about 1 in 5,000 live male births and hemophilia B has an incidence of about 1 in 30,000, spontaneous or trauma induced bleeding usually affects the synovial joint ,knees, ankles, elbows and muscle (1), and the resultant hemarthroses activates a cascade of pathological events well described, synovial hypertrophy, hemosiderin deposition, chronic inflammation, pannus formation, cartilage degradation, subchondral bone damage, progressive joint destruction and ultimately hemophilic arthropathy (2).

In adulthood, clinical relevant HA develops in over 80% of people with moderate to severe hemophilia and is frequently associated with persistent pain (VAS/NRS mostly >5/10), synovial effusion and swelling, impaired proprioception as a result of destroyed mechanoreceptors and joint effusion, muscle atrophy and functional limitations (3). Such musculoskeletal complications are manifested in the form of decreased mobility, academic and occupational functioning restrictions and psychosocial load (4,5). The effect of the disease is often measured using measures like the Hemophilia Joint Health Score (HJHS 2.1; 0-124, high = poor joint health), the Functional Independence Score in Hemophilia (FISH; 057, higher = better independence) and disease-specific quality of life questionnaires like the HAEM-A-QoL (1).

Standard care is the prophylactic factor replacement therapy (FRT) with the ability to decrease the number of bleeding incidents 70-90 times, delay the development of arthropathy by 5-10 years, and increase FISH scores by 15-20 points (1). However, FRT has significant side effects: it fails to repair established joint damage, it develops inhibitors in about 25-30% of patients, stimulating immune tolerance is expensive and the cost of treatment per patient annually may be very high, easily surpassing health system affordability in low and middle-income countries (LMICs) (1). The difference in the diagnosis and access to prophylaxis among countries worldwide ensures that less than a quarter of every 400,000 individuals with hemophilia in the world are well-served by optimal factor replacement (1), and in some countries, such as India, a significant number of people with the condition are either never diagnosed or under-treated (1).

In this case, adjunctive physiotherapy plays a decisive role as secondary and tertiary musculoskeletal sequelae prevention (6). Physiotherapy interventions can comprise of pain neuromodulation, edema management, proprioceptive retraining, contracture management to reduce deformity and strengthening/endurance training to re-establish functionality (6,7). Potential modalities that have emerged as having evidence in the treatment of hemophilia are aquatic therapy, neuromuscular electrical stimulation, and orthotic interventions but the adoption of these modalities is limited by resource availability, lack of trained therapists and unequal geographic distribution of hemophilia treatment centres (6).

Kinesio Taping (KT) is a skin imitating waterproof cotton tape with an elastic base that is introduced by Kenzo Kase in the 1970s (8). It is commonly used with 15-75 percent stretch, to create skin convictions, raise the epidermis and dermis a little, and adjust the lymphatic and vascular circulation (8). Proposed mechanisms involve increased microcirculation, activation of low-threshold cutaneous mechanoreceptors (Ruffini, pacinian, merkel endings) which can possibly increase proprioceptive input and activation of nociceptive signalling by gate-control mechanisms (9). In contrast to the use of rigid strapping, KT provides virtually full field of movement, which is especially appealing to the dynamic rehabilitation of hemophilia (8).

In the non hematological field, meta-analyses show small to moderate improvements in KT in terms of pain and function in knee osteoarthritis, chronic low back pain and shoulder impingement (10,11). In hemophilia management, KT has been anecdotally applied to aid in the management of acute muscle hematoma, to stabilize arthropathic joints and as a part of post-bleed rehabilitation. National and international physiotherapy guidelines on hemophilia list KT as a possible alternative; however, the evidence behind this is typically dispersed and usually consists of case reports, small series case studies, or underpowered pilot controlled trials (6).

Past physiotherapy reviews on hemophilia have tended to focus extensively on interventions and to lack systematic-based evaluation of KT as compared to core outcome domains of hemophilia rehabilitation (pain, swelling, proprioception, deformity, and QoL)(6). In addition, there has been too little or heterogeneous data on KT to make robust guideline recommendations based on structured schemes like GRADE (6).

Due to the growing clinical interest in KT, its low unit price relative to factor concentrates, and the possible applicability of the solution to task-shifting and self-management in LMIC populations, there is a need to synthesize high-level evidence (1). The proposed systematic review will thus highlight and critically evaluate RCT evidence on the clinical efficacy of KT among people with hemophilia with special focus on core hemophilia outcomes, methodological quality, and risk of bias (14, 17).

2. Methodology

2.1 Design and Registration

This review of RCTs was a systematic review following PRISMA 2020 statement. All the review steps: the identification of the study, screening, and the assessment of its eligibility, data extraction and the assessment of risk-of-bias were conducted based on PRISMA 2020 (14-17).

The review protocol was prospectively registered in PROSPERO prior commencement of this review ensuring methodological transparency and minimizing the risk of selective reporting.

In response to this, complete eligibility criteria, search strategy, and intended results are as follows.

2.2 Information Sources and Search Strategy

Electronic search was performed through databases since the beginning of time until December 2025: PubMed/MEDLINE, Web of Science, Scopus, Physiotherapy Evidence Database (PEDro), Cochrane Central Register of Controlled Trials (CENTRAL) (6).

Additional studies were hand-searched on physiotherapy/KT in hemophilia by searching reference lists of trials and other reviews used. There were no language, year of publication or country constraints. Full texts that were in non-English were translated provided that the abstracts mentioned eligibility.

PubMed search string: A comprehensive literature search was conducted across PubMed, Web of Science, Scopus, and PEDro databases. The search strategy combined terms related to taping interventions and hemophilia using Boolean operators. Representative search terms included “kinesio taping,” “kinesiotaping,” and “elastic taping,” combined with “hemophilia” or “haemophilia,” along with terms indicating randomized study designs such as “randomized,” “randomised,” or “randomized controlled trial.” Exact search strings were adapted according to the indexing and search functionalities of each database.

2.3 Eligibility criteria

The eligibility criteria were based on the a priori PICOS framework:

PICOS Element	**Criteria**
Population	Children, adolescents, adults with confirmed hemophilia A or B (any severity), with/without HA or acute muscle hematomas.
Intervention	Kinesio taping (stand-alone or combined with physiotherapy, e.g., exercise, rehab, CO_2 laser), as core experimental component.
Comparator	Non-KT: sham/placebo taping, no taping, conventional exercises/physiotherapy, or other non-KT interventions.
Outcomes Primary	Pain (VAS/NRS), swelling (clinical grading, ultrasound), proprioception (joint position sense), deformity/joint health (HJHS), QoL (HAEM-A-QoL, SF-36).
Outcomes Secondary	Function/independence (FISH, 6MWT, validated tests), adverse events.
Study Design	RCTs (parallel or randomized case-control) with ≥1 non-KT comparator. Excluded: non-randomized, observational, case series/reports, non-hemophilia, non-elastic tapes only.

2.4 Study Selection

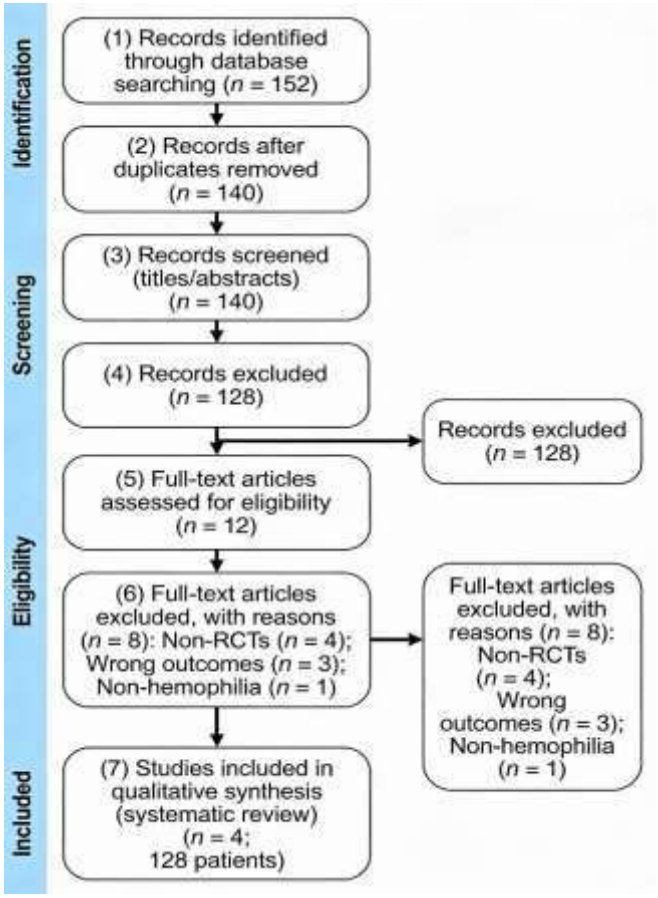


Figure 1: PRISMA 2020 Flowchart

Database search records were exported to reference management software and duplicate records were removed. The title and abstract screening to identify the eligibility were done by two independent reviewers. Records of potentially eligible and uncertain records were retrieved. The screening of the full-text was then done twice, by the two reviewers, with disagreements resolved by the two somehow, or by a third reviewer (14-17).

The flowchart of PRISMA 2020 illustrates the screening process: 152 records were first identified and 12 duplicates were eliminated, so the final number of records to be screened is 140 records. Thereafter, 128 records were deleted at the title/abstract phase because of ineligible design, intervention, or population. Out of the rest 12 records, full-text measurements were carried out, and eight of them were excluded because of the following reasons: non-randomized design (n=4) non-hemophilia patient population (n=1), and lack of knowledge-translation results (n=3) (14-17).

Four randomized controlled trials were included in qualitative synthesis because they met all the inclusion criteria.

2.5 Data Extraction

The extracted data of the included studies were done through standardized, piloted forms to ensure consistency and reduce extraction bias. Items that were extracted were: author and year of publication, country, sample size, participant characteristics (age, type and severity of hemophilia, joints targeted), description of the KT protocol (taping technique, tension, duration, frequency, and part of the body), comparator interventions, follow-up period, and all reported primary and secondary outcome measures (15-17). Pre- and post-intervention means, standard deviation and p-values were also documented (where available) as well as any reported effect sizes. Two reviewers conducted data extraction; the discrepancies were solved by consensus after reviewing the original articles again (14-17).

2.6 Quality Evaluation and Threat to Bias.

The quality of methodology of the included studies was evaluated with the Physiotherapy Evidence Database (PEDro) scale that has 11 items out of which 10 compose the total score (range 0-10). The items analyse internal validity and interpretability, which include randomisation, concealment of allocation, baseline comparability, the unawareness of the participants, therapists and assessors, adequate follow-up (less than 15 per cent attrition), intention to treat analysis, and comparisons across the groups. Scores under 6 were termed as low quality, 6-7 as moderate quality and 8-10 as high quality. Independent rating was done by two reviewers; a consensus was reached where there is any discrepancy between the ratings (7).

Primary outcomes risk of bias was evaluated using the revised Cochrane Risk of Bias tool of randomised trials (RoB 2); this tool covers five domains: (i) bias is as an outcome of randomisation process; (ii) bias is as a result of non-adherence to the planned interventions; (iii) bias is as a result of non-reporting an outcome; (iv) bias is as a result of measuring outcome; and (v) bias is as a result of selection of the reported result. Each of the domains was rated as being of low risk, of some concerns, or high risk, which formed an overall risk of bias judgment of the study. Traffic-light plots (e.g. generated with robvis package) were used to illustrate the findings in order to summarise across studies (7).

2.7 Data Synthesis

Due to the limited number of trials (n = 4), the high heterogeneity in clinical settings, including low back pain, knee complaints, arthropathy, and acute muscular hematomas, and the apparent variation in kinesio-taping (KT) protocols and the wide range of outcome measures, a more traditional meta-analytic technique was found to be inappropriate. Therefore, narrative synthesis was carried out (14-17). Once the studies were reviewed, the direction and the magnitude of the change on the main indicators, such as pain, swelling, proprioception, deformity, functional performance, and quality of life, were outlined, which made a comparative evaluation of KT in relation to its respective comparator(s) easier. Where the empirical data allowed the credible approximation of the effect sizes, they were reported descriptively; nevertheless, they were not pooled into one estimate (14-17).

3. Results

3.1 Study selection and overview

Four randomized controlled trials that included 128 male subjects between the ages of 10 and 40 years have been identified through the selection process. Most of the respondents were known to have moderate and severe haemophilia A; a sub-group of respondents had mild severity or none specified and limited information was available on the representation of haemophilia B. The study designs were diversified so that they used three arm parallel randomized controlled trials, two arm randomized trials, and randomized case control design (14-17).

3.2 Characteristics of included studies

TABLE 1: Studies included in the review

Author/Year	Population	Intervention	Comparison	Outcomes	Key Findings
Azab et al., 2020 (14)	45 adolescents (10–13y) with moderate hemophilia A, chronic low back pain (>1m)	Paraspinal KT + exercise (3x/wk, 3m)	Placebo taping + exercise; exercise only	Pain (NRS), back endurance (Sorensen), 6MWT	Greater pain reduction (p=0.001), endurance gains vs both controls; 6MWT improved vs exercise-only
Scaturro & Vitagliani, 2022 (15)	39 adults with acute muscle hematoma	KT + rehab + CO_2 laser	Rehab + CO_2 laser (no KT)	Hematoma size (US), pain (NRS), FISH, factor days	Faster hematoma resolution, greater pain/FISH

					improvement vs control
Chen et al., 2020 (16)	20 adults with knee symptoms (hemophilia-related, past year	KT (anterior thigh/knee, 2 days); pre-post design	Own controls (no separate group)	Walking pain (VAS), 6MWT, knee HJHS	Pain ↓, 6MWT ↑ ($p<0.05$); HJHS unchanged; mild itching (n=4)
Kazanci et al., 2023 (16)	26 children/adults with hemophilic arthropathy	KT (3x/wk, 3w) + home exercises	Home exercises only	Pain (VAS), HJHS, FISH (baseline, 1w, 3w)	Greater improvements in pain/HJHS/FISH ($p<0.001$) vs control

Among the reviewed studies, kinesio-taping (KT) was mostly applied through the traditional methods like I- or Y-strips across the area of symptoms. The tension applied was either light or moderate, however, the specific tension parameters, the taping patterns, and compliance guidelines have been reported inconsistently and often were missing. The follow-up interventions were between 2 days to 12 weeks and the maximum period of observation was recorded in the study by Azab et al (14).
It is worth noting that none of the studies included directly measured proprioceptive function, e.g. joint -position sense or passive motion detection threshold or health -related quality of life using hemophilia-specific scales like the HAEM -A -QoL. In spite of the fact that the FISH and the 6-minute walk tests were useful in terms of collecting the data on the level of functional status and independence, they fail to fully represent the overall quality of life.

3.3 Methodological quality (PEDro)
The PEDro scoring gave the range of 5 to 7 out of 10 which shows a moderate quality of the overall methodology (14-17). The experiment carried out scored 7/10, which is equal to evident randomization protocols, baseline comparability, low attrition, and conductive between-group statistics (15-17).
The rest 3 trials scored between 5-6/10, this mainly due to the lack of documents on allocation concealment, lack of blinding process, and missing some analytic information (14-17).

Common strengths included: Random assignment was applied in all the studies. Multi-arm designs used in studies found baseline similarity between groups between key variables. All trials had a loss to follow-up less than 15. Between-group comparisons were displayed in means and variability measures, which allowed the approximate estimation of the effect sizes (14-17).

Common limitations were: The studies did not blind the participants and therapists since Kinesio Tape is an observable item, therefore presenting a possible performance sbias in subjective outcomes (pain and self-perceived function). The outcome assessor also was not uniformly reported, with some studies reporting assessor blinding, some giving inadequate details and therefore scoring lower in terms of PEDro scores. The intention to treat analyses were not always reported (14-17).

Collectively, these results indicate the moderate level of internal validity at the trial level and condition that the results might be used cautiously, especially in cases when the subjective outcomes are used as the main endpoints.

3.4 Risk of bias (RoB 2)

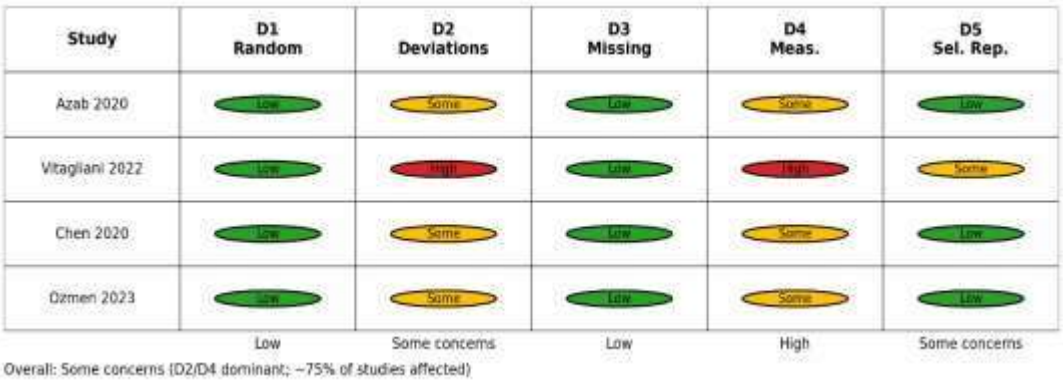


Figure 2: Traffic Light Plot of mentioned studies

Randomization procedure: The four trials were all considered to be low risk of bias, and the randomization procedures were described adequately (or, in Chen et al. case, the pre- post design with a consistent use of KT by all respondents) (14-17). Three out of four of the studies were rated to have some concerns because lack of participant and therapist blinding posed a challenge to exclude deviation of intended physiotherapy or co-interventions (15-17). Furthermore, compliance with home-exercise elements was not necessarily tracked and reported in an elaborate manner. Missing outcome data: There was low attrition and all the trials reported equal withdrawal across the groups thereby making the risk of bias low in this domain (14-17). The outcomes of one study were considered to be of some concern or high risk because the assessors were not blinded, and the standardized measures with high dependence on subjective measures also indicated the same. The other studies were rated as being at low risk since blinding of assessors and use of standardized measures were reported (14-17). Three studies were questionable in that the protocols were not preregistered and the reporting of the outcomes was not complete. Indicatively, the variability measures were not clearly reported in some of the trials or all prespecified outcomes were not described. All three trials were deemed to have some concerns on overall risk of bias and none of the trials were considered overall high risk (14-17). This trend suggests that although the use of gross methodological flaws cannot be evident, the overall inability to blind individuals and therapists and incomplete reporting of certain results can have overblown benefit estimates (15-17). Non-blinding bias during performance is likely to be present in KT studies and must be considered as real cause of uncertainty instead of being treated as an insignificant problem especially in drawing conclusions on how pain ratings have improved (14-17).

3.5 Effects of KT on primary outcomes

All four trials assessed outcome pain utilizing either a Visual Analog Scale (VAS) or a Numeric Rating Scale (NRS). KT significantly improved pain levels when compared to control conditions (exercise alone, sham taping, or no taping) (14-17). KT estimated mean standardized differences that were calculable and ranged from approximately -1.2 to -2.1, indicating a large short-term improvement, and though the estimates are imprecise due to small sample size and incomplete documentation, There is an evident short-term pain relief, despite the variation of benefits across different anatomical areas (low back, knee, arthropathy affected joints, and acute muscle hematomas).The acute muscle hematoma study is the only study that used an ultrasound to measure swelling (15,18). KT, in conjunction with rehabilitation and a CO_2 laser, was associated with a reduction in the size of the hematoma and clinical resolution, in comparison to rehabilitation and CO_2 laser alone. This indicates that KT may enhance fluid dynamics and acceleration of soft tissue healing, but this is currently based on single study evidence, which is not sufficient for application beyond identical clinical situations. None of the RCTs reviewed, studied the outcomes relating to proprioception such as joint position sense or the threshold to the detection of passive motion (14-17). This noteworthy considering the fact that while proprioceptive feedback is known to be impaired in the case of joint damage/hemophilia, improving proprioception is often given as a reason for the use of KT (14-17).

Two studies assessed joint health using the HJHS scale. In the short-term knee study (Chen et al.) HJHS changed meaningfully over the two-day period which, given the structural nature of the measure, is expected (16,18). In contrast, the 3-week Kazanci et al. arthropathy study reported both control and KT groups symptomatic relief after 3 weeks and KT group showed further “significant” relief so that their HJHS scores improved significantly over the

control group. Given the short follow-up and small sample size, it appears that the changes were more structural rather than the symptomatic driven domains of the HJHS (such as pain, swelling, and gait) (16-17). None of the four RCTs utilized validated hemophilia-specific QoL instruments (Haem-A-QoL) or QoL scales (SF-36) as either primary or secondary outcomes. FISH and 6MWT are important indicators of function and independence; however, they do not address the psychosocial and emotional domains. Therefore, the effect of KT on health-related QoL in hemophilia remains completely unmeasured in the RCTs (14-17).

3.6 Effects on secondary outcomes and adverse events

Among the four trials, three reported KT improving functional outcomes such as FISH and 6MWT following KT intervention (14,15,17). Azab et al. showed KT plus exercise improved back extensor endurance and 6MWT distance compared to exercise alone. Scaturro & Vitagliani et al. noted KT yielded greater improvements in FISH with acute muscle hematomas. Kazanci et al. reported the KT group showed FISH improvement significantly more than the exercise only group after 3 weeks. When KT is combined with active rehabilitation, it results in clinically important functional changes (14-17). Adverse events were reported, but were minor. Chen et al. reported 4 participants had mild, local itching that did not require them to stop KT (16). No serious adverse events or bleeding complications directly related to KT were reported throughout the trials (14-17).

4. Discussions

This systematic review has found four studies that look at KT as a complementary physiotherapy option for people with hemophilia (14-17). In different studies, KT was consistently linked with a reduction in pain and enhancement of function, and in one study, a quicker resolution of muscle hematomas. Nonetheless, evidence was limited in quantity and quality with respect to proprioception and quality of life; factors that pertain to the theory of KT and the experience of people with hemophilia (14-17).

Pain alleviation due to the KT in this review is no different from what has been found in the non-hemophilia populations, for example, knee osteoarthritis, non-specific low back pain, and shoulder disorders where, in conjunction with exercise, KT has had a small to moderate effect (10,11). Some of the proposed mechanisms for this pain reduction include skin lifting that could lower interstitial pressure, increases in lymphatic movement, improved microcirculation, and reduction in the sensitivity of pain receptors (9,10); more skin receptors being hit with friction which helps to lower the sensitivity of pain receptors (9); better movement and muscle engagement around the hypermobile joints (11).

The functional gains noted in the FISH and 6MWT are important from a clinical perspective; people with hemophilia experience difficulty with mobility and participation as a result of joint pain, stiffness, and bleeding apprehension (5,6). The supportive effects of KT with exercise, as noted in Azab et al. and Kazanci et al., are in alignment with the broader Rehabilitation literature, which suggests that multimodal approaches, as opposed to single modalities, are more likely to result in clinically important changes (7,8,14,17).

The sole RCT examining acute muscle hematomas provides a particularly interesting signal; KT, combined with functional rehabilitation and CO_2 laser, seemed to provide an enhancement to pain and hematoma relief (15). Muscle bleeds are a significant source of morbidity for patients with hemophilia, and prolonged recovery periods from muscle bleeds delay the return to activity and increase the need for factor (15). If replicated, this could contribute positively to both patient and healthcare outcomes. Evidence stems from one centre with a modest sample; a variety of centres and larger samples are needed for future RCTs (15).

Despite the promising results, numerous significant limitations constraining the strength of the conclusions need to be noted. The quantity and quality of evidence that exists on this topic is minimal; only four RCTs with 128 participants were found, and the individual trials did not have the power to detect small but important effects or differences between subgroups (14-17). The resulting effect estimate remains uncertain and the findings less applicable to broader populations (14-17). In reviews, co-interventions ranged from CO_2 laser to co taping, while intervals, duration, and tension of the tapes varied. Such heterogeneity makes it difficult to determine the best KT protocols, and may, in part, be the reason why there are different outcomes from different studies. Most studies looked at outcomes from only days to weeks. Because of this, the long-term impact of KT on actual joint components, the progression of the deformity, frequency of bleeds, and sustained functional or QoL gain remains unanswered (14-17).

None of the studies looked at proprioception (9), even though from the marketing, KT was purported to improve proprioceptive input. None of the studies included measures of disease specific QoL, which leaves the KT marketed presumed benefits of improving proprioception and the overall QoL untargeted in the RCTs in hemophilia (6).
Most of the studies are performed with big concerns on randomization and missing data; three out of four had "some concerns" in RoB 2 overall. There is no way to blind the KT from the study participants or the therapists, which is part of the design of the study, and this creates a performance bias, especially when the studies look at self-reported outcomes (pain, perceived function) (14-17).
This bias is real and has to be accepted when looking at the outcomes of the study and the recommendations. Some studies failed to report all variability measures or predefined outcomes, resulting in challenges when trying to compute standardized effect sizes or integrate all outcomes into comparative syntheses. The lack of registered protocols enhances the risk of selective outcome reporting (14-17).

Considering these factors, it is reasonable to assess the primary evidence base and this systematic review as moderate quality overall. The review adhered closely to the PRISMA framework and employed risk of bias and outcome measures using the validated tools (PEDro, RoB 2), but the limited amount of diverse RCTs and outcome reporting deficits are the main factors that weaken the potential clinical recommendations (7,14-17).

5. Limitations

Apart from the inherent limitations of the included RCTs, certain limitations were present at the review level. Although PROSPERO registration was completed after initiation of the review, predefined and systematic methods were consistently applied to enhance transparency and rigor. However, the absence of prospective registration is acknowledged as a potential limitation with respect to selection or reporting bias. Due to the limited number of included studies and marked clinical and methodological heterogeneity, a meta-analysis was not undertaken. Although narrative synthesis allows findings to be interpreted within their clinical context, it does not permit the generation of pooled quantitative effect estimates.
A potential risk of language and publication bias should also be acknowledged. Grey literature and unpublished studies were not systematically searched, which may have resulted in the omission of studies reporting negative or null findings. Although no formal language restrictions were applied, the use of proprietary databases and limited access to translations may have inadvertently favored English-language publications. Furthermore, while several major databases (Cochrane, Scopus, Web of Science, PubMed, and PEDro) were searched, relevant studies indexed in other specialized databases may have been missed. Nevertheless, considering the rarity of hemophilia and the specificity of the intervention, it is unlikely that a substantial number of eligible RCTs were overlooked. Despite these limitations, this review provides a comprehensive synthesis of the available RCT evidence on Kinesio Taping in hemophilia and identifies important methodological gaps to inform future research.

6. Clinical and Research Implications

In clinical practice, kinesiology tape (KT) is an example of an adjunctive physiotherapy option for helping with pain relief and improved functioning in individuals with hemophilia, specifically in those individuals with chronic pain from hemophilia A and or from acute muscle hematomas (AMHs). KT is reasonably priced, is a non-pharmacological intervention, and can be taught to individuals to apply on their own. These features of KT are especially appealing in resource-stratified settings, which may have limited access to specialized physiotherapy (PT) and/or continuous prophylaxis (CP). Despite these benefits of KT, it should not be portrayed as a single, or core, therapy. KT should be incorporated as one component of a more complete hemophilia care program which consists of more than just standard hematologic care, and may include individualized exercise programs, instruction on joint protection, and the use of other physiotherapy modalities.

7. Future Recommendations:

With respect to KT as a research intervention, future RCTs are recommended to:

Be multicentre with appropriate power for clinical significance and for the ability to perform meaningful sub-analyses (e.g. age, disease severity, presence of inhibitors, and the involvement of joints versus muscles). Having a consistent

KT methodology that describes the actual tape, including the tape materials and/or types used, pattern used, tension applied, duration of tape application, and to be more ideal, the tape removal and re-taping intervals. Include some of the already established core outcome sets, which, depending on the clinical population, may include pain, swelling, and joint assessment (HJHS), proprioception, disease-specific quality of life (QoL), bleeding events and/or bleeding history, and structural imaging if it is feasible. Include blinded assessments of the outcomes, particularly for the objective measures of the HJHS and ultrasound, in order to minimize detection bias. To reduce the risk of selective reporting, outcomes should be finalized prior to the study's commencement, and study protocols should be registered in advance. Balance budget impact analyses within LMICs, where the use of physiotherapy, KT tape, and the specified factors, will be of greater concern. Closing these gaps will enable future systematic reviews to bolster evidence quality and lift the evidence grade from moderate to support for more definitive, guideline altering, recommendations regarding the integration of KT into rehabilitation algorithms for hemophilia.

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