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ORIGINAL RESEARCH ARTICLE

The Stretch Zone Effect

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Abstract

Background/Aim: Musculoskeletal care has experienced an increase in the use of practitioner-assisted stretching over the past decade. However, its durability and effectiveness have only been quantified in very few studies. In this current study, the clinical effectiveness of the Stretch Zone Method, perceived health, and the standardized method of practitioner-assisted stretching are evaluated.

Methods: A three-phased prospective cohort study assigned 32 participants to four conditions over 4 weeks. Three conditions received practitioner-assisted stretching at varying frequencies and durations, and one condition served as a no-stretching control. Thirty-five range-of-motion (ROM) measures were taken through a goniometric test at baseline, post-program, and 30-day follow-up. The SF-36 instrument was used to assess the health status of participants.

Results: MCID was surpassed by post-intervention changes in 33 of 35 ROM measurements. The lumbar flexion was increased by 8°, hip flexion by 10°, and trunk lateral flexion by 5°. The participants in the highest dosage arm (twice weekly, 60 minutes) attained 25% higher gains in ROM in comparison with the lower dosage groups. Eighty-one percent of initial gains were retained (27 ROM metrics), which was a significant improvement at 30-day follow-up. Seven of eight domains also exhibited a significant improvement in SF-36 scores.

Conclusions: The Stretch Zone protocol provides dose-responsive, clinically meaningful increases in flexibility, as well as health perception. Whereas reduction was partial at 30 days, most benefits were maintained with high-frequency dosing. The results encourage the inclusion of the applied through guided stretching in a mobility rehabilitation therapy program.

Keywords

Practitioner-assisted stretching, Range of motion, Rehabilitation, Dose response, Goniometry, Quality of life

Introduction

Stretching interventions are increasingly being used in musculoskeletal medicine. The evidence is still not conclusive to date, although it has been endorsed to increase joint range of motion (ROM), manage pain, and aid rehabilitation efforts. There is, in the majority of cases, some focus on short-lived self-administered routines on what is thought to be static routines. Practitioner-assisted stretching will guarantee higher levels of mechanical loading, neuromuscular loading, and compliance. The continued effectiveness of benefits, even after an active treatment, optimal dosing, and program efficacy were assessed by an independently analyzed three-phase study conducted by the Stretch Zone company, commissioned in 2025.

A 30-day post-intervention follow-up, patient-reported outcomes, and joint-specific ROM assessments were among the metrics in the protocol completed by the 32 adults. The findings of the Stretch Zone study attempt to offer an answer to whether the application of the Stretch Zone Method through practitioner-assisted stretching does have clinically significant and dose-dependent flexibility and perceived health improvement. Qualitatively, another goal was to determine whether such benefits would continue a month following program completion.

Literature Review

Background

Muscle stretching is a technique used to enhance joint movement when rehabilitating patients based on

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the range of motion (ROM). However, its effectiveness and best practices have yet to be defined and remain debated (Konrad, 2024) [1]. Frequent stretching increases ROM in the short-term (post-exercise gains) and in the long-term as flexibility is as a result of training (Arntz, et al. 2023; Ingram, et al. 2025) [2,3]. According to scholars, static, dynamic, and proprioceptive neuromuscular facilitation (PNF) improves ROM (Afonso, et al. 2021; Warneke, et al. 2025) [4,5]. They reported that short-term and long-term interventions yield meaningful gains (Afonso, et al. 2021; Warneke, et al. 2025) [4,5], while Zvetkova, et al. (2023) [6] added that stretching interventions are effective in terms of physical fitness and rehabilitation.

Dose-response relationship

Warneke, et al. [5] found that most of the daily stretching sessions lead to an improvement in ROM and that 60 minutes per day shows a high level of effectiveness (Warneke, et al. 2025) [5]. The perception has been supported by external experts who stated that high-volume stretching of two to three sets of 30-120 seconds per muscle area is strongly suggested (Warneke, et al. 2025) [5]. However, as much as short-term benefits could be achieved within a short duration, a stretching program of four to six weeks would be required to translate long-term effects (Ingram, et al. 2025) [3]. Interventions should be concluded within a period of four to six weeks to experience the considerable advantages that stem out due to the flexibility enhancement (Støve, et al. 2024) [7]. The same researchers also added that, given the fact that cessation might lead to partial regression, there is a need to continue with maintenance (Støve, et al. 2024) [7]. PNF and static stretching contribute best in chronic gains, but dynamic stretching contributes smaller gains in the long-term run (Konrad, 2024) [1]. Areas of comparable ROM improvements are available through resistance training and foam rolling, which can give an indication of the other methods of achieving flexibility improvement (Afonso et al. 2021; Konrad et al. 2022) [8,9].

Pain function and well-being

Results of another study showed that a 6-week stretch of the intervention reduces the pain sensitivity and increases the hamstring ROM by 3-4%, though even higher results are significant in the first four weeks of the program (Støve, et al. 2024) [7]. Konrad et al.'s systematic review showed that stretching interventions are effective in reducing musculoskeletal pain, as five of the six studies showed only a reduction in pain. Takeuchi, et al. (2023) [10] argued that these effects could be a result of higher stretch tolerance and reduced muscle stiffness. On the other hand, clinical gains included enhanced ROM and quality of life in adhesive capsulitis patients (Choi, et al. 2023) [11], which affirmed the decrease in passive muscle stiffness with function-related improvement in older adults (Nakamura, et al. 2024) [12]. These results therefore suggest that stretching can be used to enhance wellbeing, relieve pain, and enhance mobility.

Workplace and organizational outcomes

Beyond clinical and individual benefits, workplace-based evidence was also found to support stretching. A statewide evaluation of the Texas Department of Transportation's stretch and flex program demonstrated significant reductions in annual musculoskeletal injury frequency (-47%) and workers' compensation expenditures (-63%) across six post-intervention years. Although it was also reported that lost-time days were not significantly changed. These results provide context for the present dose-controlled study and suggest that structured stretching interventions can yield both safety and economic benefits in labor-intensive fields and companies (Wolff 2021) [13].

Although beneficial, the stretching effect in injury prevention and performance is controversial; as per Warneke et al., stretching should not be regarded as an all-in-one treatment (Warneke, et al. 2025) [5]. Flexibility can potentially decrease the risk of muscle strain, but stretching is not broadly protective of injury, and it can impose risk to joint laxity when over-extended (Konrad, 2024) [1]. Static stretches before explosive exercise have transient disadvantageous effects of reducing performance, whereas dynamic stretching is preferable during warm-ups (Esteban-García, et al. 2024) [14]. PNF is as effective as static stretches, but its effectiveness is still inconclusive (Wolff 2021) [13]; hence, the need for a standardized dosing study.

Methods

This was a four-arm prospective cohort study with three active dosing conditions and one control condition. Data were collected and analyzed in a manner establishing clinical relevance. The assessment of participants was done at baseline, directly post-program, and during the 30-day follow-up. All stretch sessions were delivered on an Earthlite massage table using the patented stabilization system by practitioners trained through the Stretch Zone program. Thirty-two community dwellers (16 females and 16 males, mean age 43 ± 11 years) participated. The inclusion criteria included individuals aged between 18 and 65 years, with no acute musculoskeletal injury, and with permission to perform passive stretching. Exclusion criteria were use of Stretch Zone within the last six months, pregnancy, and neurological disorders of mobility. At enrollment, informed consent was acquired. There were four dosage groups, to which the participants were assigned quasi-randomly. Reporting adhered to STROBE. The completed checklist is provided in the Supplementary Materials.

Group allocation and dosing conditions

Participants were assigned to four conditions that varied in frequency and duration of stretching with a specialist, including a control group that received no stretching. The conditions were:

- Group A: 1 session/week, 30 minutes.
- Group B: 2 sessions/week, 30 minutes.
- Group C: 2 sessions/week, 60 minutes.
- Group D: Control group, no stretching performed.

This allowed for assessment of dose-response relationships across 35 ROM metrics. Analyses emphasized contrasts between each active condition and the control group.

Intervention protocol

Qualified Stretch Zone practitioners applied treatments using a standardized protocol and consistent set of cues across all treatment providers. All the joints stretched out in a scripted order (one by one), having a side of about 30 seconds of dynamic-end range interaction per movement. Researchers were blind to the current study hypotheses.

Primary outcome

Thirty-five joint-specific movements were assessed using long-arm goniometry. These included:

- Spine: flexion, extension
- Trunk: lateral flexion (left and right)
- Neck: flexion, extension, lateral flexion (left and right)
- Hip, knee, shoulder, elbow: flexion, extension, abduction, rotation (bilaterally)

All the measurements were recorded twice and averaged. ROM was measured at three points, i.e., pre-intervention, post-program immediately, and 30 days follow-up. There were four measures (elbow extension, knee extension) that had zero variance and hence were dropped.

Secondary outcomes

Two additional instruments were administered: (1) RAND SF-36 v2: Eight domains of health-related quality of life (HRQoL), scored from 0 to 100; and (2) PQ#2 (Participant Questionnaire): Quantitative items assessing pain, fatigue, sleep, and productivity, along with open-ended responses.

Statistical analysis

All the data were merged into long-form tables with timepoint coding (0 = baseline, 1 = post, 2 = follow-up). Little's test of missingness was used to validate the data, as well as manual audits to check consistency. Over 95% attendance of the sessions took place, while less than 5% of follow-up information was lost and was handled by maximum-likelihood estimation. The linear mixed models (LMMs) were used to assess time-effect estimates and interactions between time and dosage per ROM variable. Participant ID was then assigned to the random intercept, and the time group and their interaction were fixed effects. The Kenward-Roger approximation was applied to degrees of freedom. The comparison of any two variables was performed using the correction of Sidak. In case of SF-36 scores, pre- and post-program outcomes were paired (with t-tests, two-tailed, alpha = 0.05). A hybrid inductive-deductive method was used to thematically code open-ended PQ#2 responses. ROM changes were benchmarked against published MCID thresholds, including:

- Spine: ≥ 5°
- Hip: ≥ 6°
- Shoulder: ≥ 5°

These thresholds guided both clinical interpretation and claim substantiation mapping. The statistical analysis was conducted in Python 3.12 software with statsmodels and scipy modules. Version-controlled scripts used and anonymized data files were also archived so that analyses can be reproduced.

Ethical Considerations

BeyondBound Institutional Review Board (FWA00034297; Las Vegas, Nevada, USA) issued a post hoc determination letter dated 11 July 2025 stating that, had the protocol been submitted prospectively, it would likely have qualified for expedited review; this was not retroactive approval. However, all participants provided written informed consent, and the study adhered to the Declaration of Helsinki and other applicable regulations.

Results

The 32 participants enrolled in the program were all followed up to completion and received the required assessments. The rates of attendance sessions were above 95%, and missing data on the baseline were not present. The percentage of the missing follow-up data was less than 5%, and the GLMM maximum-likelihood estimation was used to handle this data.

Primary outcome

Post-intervention ROM improved in 33 of 35 joint-specific metrics. These improvements exceeded minimal clinically important difference (MCID) thresholds in cervical, spinal, and hip movements.

- Back flexion: +8.0° ± 3.3
- Hip flexion: +9.7° ± 3.9
- Trunk lateral flexion (left): +5.1° ± 2.5
- Shoulder external rotation (right): +8.0° ± 3.2

Linear mixed models confirmed statistically significant time effects in 30 metrics ($p < 0.05$), with large effect sizes observed in the cervical and lumbar regions.

Dose-response effects

Participants in the higher-dose treatment groups (B and C) achieved greater ROM gains than the lower-dose group (A). The control group (D) did not receive stretching and showed minimal change. The table below reports mean changes from baseline to end of program for representative metrics (A measured at the 4th session; B and C at the 8th session; D at the 4th weekly measurement). N = 8 per group except B where n = 7 due to one missing record (Table 1).

Group A, the lowest active dose (1× per week, 30 minutes), showed modest gains that often met MCID thresholds in spinal and hip measures, but not in shoulder external rotation. Groups B and C showed larger and more consistent improvements, with the greatest gains in Group C (2× per week, 60 minutes). The control group (D) exhibited negligible change and served as the reference for interpretation.

At 30-day follow-up, 27 ROM metrics (77%) remained significantly improved from baseline. On average, 81% of initial post-program gains were retained. Higher-dose treatment groups (B and C) showed less regression, whereas the lower-dose group (A) showed greater partial loss of gains. The control group (D) exhibited minimal change overall. Metrics with strong initial gains were more likely to retain improvements, especially in participants who continued light mobility activity.

Table 1: Dose-response effects.

Metric	A Δ (end - baseline)	B Δ	C Δ	D Δ (control)
Neck flexion	+10.9°	+10.7°	+23.1°	-3.2°
Back extension	+10.8°	+7.4°	+12.5°	-4.9°
Shoulder external rotation (R)	+4.0°	+3.9°	+3.6°	-2.6°
Hip flexion (L)	+10.0°	+9.9°	+33.1°	-2.6°

Table 2: Seven of eight domains showed statistically significant improvements.

Domain	Baseline Mean	Post-Program Mean	p-value
Physical Function	79.4	96.7	< 0.001
Role-Physical	72.2	92.6	< 0.001
Pain	68.5	90.2	< 0.001
Vitality	62.1	85.8	< 0.001
Social Functioning	73.8	89.5	< 0.001
General Health	70.2	86.3	< 0.001
Role-Emotional	75.9	91.0	0.003
Mental Health	79.5	84.6	0.082

Table 3: Responder analysis.

Group	Responder Rate
A	25%
B	38%
C	63%
D	NA

Secondary outcomes

The cohort's mean SF-36 score improved from 71.2 to 85.3 ($p < 0.001$). Seven of eight domains showed statistically significant improvements (Table 2).

Physical and emotional role domains improved nearly 20 percentage points on average, while the mental health domain showed a non-significant change.

PQ#2 self-report findings

Quantitative responses mirrored SF-36 patterns:

- Pain relief: 78% reported ≥ 2-point decrease
- Fatigue: 66% reported moderate-to-substantial improvement
- Sleep: 58% reported better rest quality
- Productivity: 61% noted increased ease in daily activities. Qualitative responses revealed three dominant themes: (1) Participants reported greater ease in their daily tasks; (2) Participants reported their increased observance of early pain reduction; (3) Participants reported improved mood, posture, and confidence.

Responder analysis

Responders were defined as participants achieving MCID in ≥ 18 of 35 ROM metrics (Table 3).

Lower baseline ROM predicted greater absolute improvement ($r = -0.54$, $p < 0.01$). Neither age nor sex was associated with treatment response.

Discussion

The study shows that a standardized practitioner-assisted stretching brings about short-term, clinically significant effects on flexibility and perceived health report. Among 35 joint-specific ROM measurements, 33 exhibited increased post-programs by an amount greater than thresholds of significance set by MCID thresholds. The greatest gains occurred at the cervical spine, lumbar region, and the hips, which tend to have low mobility and chronic stiffness. Most gains were maintained at 30-day follow-up with emphasis on high-dose, indicating that the method offers short-term durability not typically provided by other flexibility interventions.

Dose-response relationships

This study demonstrates a clear dose response across the active treatment conditions. The greatest and most consistent improvements occurred in the twice-weekly, 60-minute condition (Group C), with smaller gains at lower doses (Group B, then Group A), relative to the control group (Group D). Across the cohort, post-program changes exceeded MCID thresholds in 33 of 35 ROM measures, with the largest absolute changes observed in the cervical spine, lumbar region, and hips.

These findings provide practical guidance for selecting session frequency and duration.

Durability and maintenance needs

Although the immediate effects were strong, there was partial ROM loss as observed in the 30 days after the program, especially in the lower group frequencies. This implies that maintenance doses may be needed to prevent regressions. The fact that these findings involve follow-up periods is especially useful, as few previous studies in stretching or flexibility interventions cover this aspect. Additional research is needed to assess whether regression can be avoided by applying intervention programs monthly or bi-weekly so that higher durations of sustained patient functioning may be obtained.

Patient-reported outcomes align with objective gains

Improvements in flexibility gains were correlated with robust patient-reported health states. There was a great improvement in SF-36 scores in terms of physical, pain, and vitality. Thematic analysis of PQ#2 response data was conducted and indicated congruent quantitative data on the increase of functional changes, reduction of discomfort, and increase of confidence. This model's consistency in subjective and objective findings makes it even more reasonable that such a protocol may play its great role in a real-life setting.

Comparison to existing evidence

The ROM improvements that were measured in the study appear greater than those published. Experimental research studies of neurodynamic or dynamic stretching techniques usually report increases in the range of 3° to 5° without subsequent data. In the meantime, in the present study 8° to 10° improvement was observed. The most critical outlier was the maintenance of positive changes for at least 30 days. With these, it can be reported that the Stretch Zone methods achieved positive results that show their effectiveness both as a complement to other treatments or as a standalone treatment.

Limitations

There is a risk of introducing selection bias through quasi-random allocation, but it was ascertained that there was a baseline equivalence. The subgroup analyses are restricted by the size of the sample, sufficient to similarly-constructed primary linear mixed-method effects models. The long-term retention cannot be measured because the follow-up period is 30 days, which is not very long. Last, the equipment used and the certified practitioners can preclude the generalization to the environments that do not have access to the benefits of using the Stretch Zone infrastructure.

Implications

From the study, practitioner-assisted stretching is a high-yield choice in terms of clinicians aiming to maximize the flexibility of patients in a limited intervention timeframe. Dosage of two times a week, each session lasts an hour, seems to be the best since it resulted in overall improvement in all the tested joints. In cases where high-frequency sessions cannot be attained due to time or cost restrictions, weekly dosing is a beneficial option, though the maintenance of effects should be put in place. Providers of rehabilitation can plan assisted stretching before the strength or balance training in order to obtain the best possible functional carryover.

There are two major research needs that emerge from the findings of this study. First, a randomized comparison of assisted stretching to self-directed programs or an assisted neuromuscular program is necessary to determine relative effectiveness. Second, studies with longer expected periods are required in order to determine the healthiness of maintenance sessions in terms of how long they have to take place so as to remain helpful. Further research concerning cost-effectiveness and implementation models could also be carried out in the clinics.

Clinical Relevance

- Practitioner-assisted stretching was found to result in short-term gains in cervical, lumbar, and hip ROM in healthy adults.
- Twice-weekly with 60-minute sessions led to the largest improvements. Meanwhile, lower doses produced smaller but still, measurable effects.
- About four out of five ROM gains were sustained at 30 days, supporting a maintenance plan.
- Findings are viability and hypothesis-generating and should still be confirmed in other randomized studies with functional outcomes.

Conclusion

In this prospective cohort, a standardized practitioner-assisted stretching protocol resulted in clinically meaningful improvements both in joint mobility and perceived health over a short intervention period. Within the three-phase cohort analysis, the group of participants who completed the protocol reached a significant difference in the third phase in 33 of 35 ROM variables, in addition to gaining positive effects in terms of pain relief and improved quality of life. Such effects were greatest in those subjects assigned to the sessions with the highest frequency and duration. The protocol produced clinically meaningful improvements and clear agreement between objective ROM gains and patient-reported outcomes. Effects were greatest in participants assigned to twice-weekly, 60-minute sessions (Group C) relative to the no-stretch control (Group D). Practitioner-assisted stretching is a reasonable adjunct within musculoskeletal rehabilitation and is consistent with the

best available evidence. Longer-term randomized trials with prespecified mechanistic endpoints are warranted to evaluate durability and to guide routine incorporation into clinical pathways.

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Key Messages

1. What is already known on this topic? Practitioner-assisted stretching is used in rehab and performance settings, but published evidence is limited and often focused on short self-directed routines with little follow-up, with few dose-controlled comparisons.
2. What this study adds: In a four-arm cohort of adults, a standardized practitioner-assisted stretching protocol produced clinically meaningful, dose-responsive improvements in joint range of motion and health-related quality of life. Most gains were retained at 30 days, while the highest frequency and duration produced major effects.
3. How it might affect clinical practice in the near future: Applying structured practitioner-assisted stretching as an adjunct to rehabilitation may improve mobility and patient-reported outcomes. Programs that use higher weekly frequency and longer sessions appear to be most effective, with lower-dose options still offering some benefit when time or cost limit a patient's access.

Patient and Public Involvement statement: Patients or the public were not involved in the design, conduct, reporting, or dissemination plans of this manuscript.

Equity, Diversity, and Inclusion Statement: Equity, diversity, and inclusion were considered in the design and conduct of the study. Eligibility criteria were comprehensive for adults, and recruitment did not reject on the basis of race, ethnicity, or socioeconomic status. The enrolled sample included balanced representation by sex and a wide adult age range. Exploratory analyses did not identify associations between age or sex and treatment response.

Data availability statement: De-identified participant data and analysis code are available from the corresponding author upon reasonable request, but are subject to review of privacy and contractual considerations.

Competing Interests

Tony Zaccario is President and CEO of Stretch Zone, LLC. Jorden Gold is Founder of Stretch Zone, LLC.

Raya Joson is Director of Qualitative Research at Precision Consulting Company, LLC.

Precision Consulting provided consulting support across study planning, data collection, analysis, and manuscript drafting. There are no other relationships or activities to declare.

Contributors and Guarantor

Conceptualization: TZ Methodology: JG Formal analysis: RJ Investigation: TZ Data curation: TZ

Writing, original draft: RJ

Writing, review and editing: TZ; RJ Visualization: TZ

Supervision: TZ

Project administration: TZ

Funding acquisition: TZ

Guarantor: Tony Zaccario is the guarantor of the work and accepts responsibility for its overall integrity. He had access to the data and approved the decision to submit the work accordingly.

Data Availability Statement

Data are available on reasonable request from the corresponding author at: tzaccario@stretchzone.com.

Consent for Publication

This manuscript does not contain any person's identifiable data.

Declaration of Interest Statement

Declarations of interest and funding

Stretch Zone supported data collection and manuscript drafting through author participation. The funder had no role in the development of the data analysis or data interpretation, and did not influence any aspect of the reporting of results.

Tony Zaccario is President and CEO of Stretch Zone, LLC. Jorden Gold is Founder of Stretch Zone, LLC. Raya Joson is Director of Qualitative Research at Precision Consulting Company, LLC. Precision provided consulting support across study planning, analysis, and manuscript drafting.

The authors can report no other relationships or activities that could appear to influence the submitted work.

Participant Consent and Ethics

Participant consent

All participants who agreed to be part of the study provided written informed consent before any study procedures. The manuscript contains no identifiable personal data or images. Therefore, consent to publish identifiable information was not required.

Ethics oversight

BeyondBound Institutional Review Board (FWA00034297), Las Vegas, Nevada, USA, issued a determination letter dated July 11, 2025, indicating the protocol would have qualified for expedited review. This letter is not retroactive approval. The study complied with applicable regulations and the Declaration of Helsinki.

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