RESEARCH PAPER

EFFECTIVENESS OF DYNAMIC VS ISOMETRIC ACTIVATION BREAKS DURING WORK HOURS FOR REDUCTION OF VARICOSE VEINS SYMPTOMS AMONG PROLONGED STANDING WORKERS

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ABSTRACT

Background: Varicose veins are a common chronic venous disorder characterized by dilated, tortuous superficial veins of the lower limbs resulting from venous valve incompetence and impaired venous return. The condition is particularly prevalent among workers who are required to stand for prolonged periods, such as healthcare professionals, teachers, retail employees, and factory workers. Prolonged standing increases venous pressure in the lower extremities, leading to symptoms including leg pain, heaviness, swelling, fatigue, and discomfort, which can negatively affect work performance and quality of life. Workplace exercise interventions have been recommended to enhance the calf muscle pump and improve venous circulation. Among these interventions, dynamic activation breaks and isometric activation breaks are commonly used; however, there is limited evidence comparing their effectiveness in reducing varicose vein symptoms among prolonged standing workers. Therefore, this study aims to evaluate and compare the effectiveness of dynamic versus isometric activation breaks during work hours for the reduction of varicose vein symptoms in this population.

Objective: The objective of this study was to assess varicose vein symptoms, pain intensity, and lower limb swelling among prolonged standing workers using the VVQ, NPRS, and lower limb circumference measurements. The study aimed to implement dynamic and isometric activation break protocols during work hours and evaluate their effectiveness in reducing symptoms.

Methods: This study will follow an experimental interventional research design with a pre-test and post-test format. The participants will be assessed before and after the implementation of a structured activation break protocol to evaluate its effectiveness on varicose vein symptoms among prolonged standing workers. The study will be conducted over a specific period and will include two intervention groups: one performing dynamic activation breaks and the other performing isometric activation breaks during work hours. This design will measure within-group changes over time as well as between-group differences.

Results: Following the 6-week intervention, statistically significant improvements were observed in all outcome measures. Mean NPRS scores decreased significantly from baseline, indicating a reduction in lower limb pain ($p < 0.001$). VVQ scores also showed a significant reduction, reflecting improvement in varicose vein-related symptoms ($p < 0.001$). Additionally, lower limb circumference measurements decreased significantly following the intervention ($p < 0.001$), suggesting a reduction in limb swelling. Comparatively, the dynamic activation break group demonstrated greater improvements in pain, symptom severity, and lower limb swelling than the isometric activation break group.

Conclusion: The present study demonstrated that both dynamic and isometric activation break protocols were effective in reducing pain, varicose vein symptoms, and lower limb swelling among prolonged standing workers. However, the dynamic activation break program showed greater improvements across the measured outcomes compared to the isometric activation break program. These findings suggest that dynamic activation breaks may serve as a simple, safe, and effective workplace intervention for managing varicose vein symptoms and improving lower limb health in workers exposed to prolonged standing.

Keywords: Varicose veins; Prolonged standing workers; Dynamic activation breaks; Isometric activation breaks; Venous insufficiency; Workplace rehabilitation; VVQ; Numerical Pain Rating Scale (NPRS); Lower limb swelling; Physiotherapy.

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INTRODUCTION

Prolonged standing during working hours is a

common occupational requirement in professions such as teaching, healthcare, manufacturing, and retail. Maintaining a standing posture for extended periods without adequate movement increases venous pressure in the lower limbs due to the effects of gravity and reduced efficiency of the calf muscle pump. Over time, this may result in venous stasis, lower limb swelling, discomfort, fatigue, and the development of varicose veins. Varicose veins are dilated and tortuous superficial veins caused by venous valve incompetence and impaired venous return. Common symptoms include heaviness, aching pain, swelling, and a feeling of fatigue in the legs, which can negatively impact occupational performance and overall quality of life. Therefore, strategies aimed at improving venous return and promoting calf muscle activation are essential, particularly for workers who stand for prolonged periods during the day.

Varicose veins represent a significant public health and occupational health concern worldwide. Epidemiological studies suggest that approximately 20–30% of adults are affected by varicose veins, with a higher prevalence among occupations requiring prolonged standing. In India, the prevalence among industrial, healthcare, and retail workers has been reported to range between 10% and 25%, indicating a considerable occupational burden. Although various preventive and therapeutic measures are available, workplace-based interventions remain underutilized. Regular activation breaks involving muscle contractions may help improve venous circulation, reduce venous pooling, and alleviate symptoms associated with chronic venous insufficiency. However, limited research has compared the effectiveness of different activation strategies, particularly dynamic and isometric activation breaks, among prolonged standing workers in the Indian context.

Conventional management of varicose veins includes compression therapy, limb elevation, anti-embolism stockings, pharmacological management, and surgical or minimally invasive procedures such as sclerotherapy and endovenous laser ablation. Physiotherapy interventions commonly include calf stretching, ankle mobility exercises, walking programs, and patient education regarding posture and activity modification. Occupational recommendations such as anti-fatigue mats and ergonomic footwear are also frequently suggested. While these methods may provide symptomatic relief, they often have limitations related to cost, compliance, accessibility, and practicality during working hours. Compression stockings may be uncomfortable in hot and humid climates, surgical interventions are expensive and generally reserved for advanced cases, and workplace modifications alone may not adequately stimulate venous return.

Activation breaks offer a practical and cost-effective alternative that can be easily incorporated into the work routine. Dynamic activation exercises, such as ankle pumps and heel raises, involve rhythmic muscle contractions that enhance the calf muscle pump mechanism and promote venous return. In contrast, isometric activation exercises involve sustained muscle contractions that can compress deep veins and facilitate blood flow without requiring substantial movement or workspace. Comparing the effectiveness of these two exercise approaches may help identify the most beneficial intervention for reducing varicose vein symptoms among prolonged standing workers.

The novelty of the present study lies in its direct comparison of dynamic and isometric activation breaks as workplace interventions for the management of varicose vein symptoms. By evaluating their effects on pain, symptom severity, and lower limb swelling, this study aims to provide evidence for a simple, low-cost, and feasible preventive strategy that can be implemented in occupational settings. The findings may assist physiotherapists, occupational health professionals, and employers in developing effective workplace wellness programs to improve vascular health, reduce discomfort, minimize absenteeism, and enhance the overall well-being of workers exposed to prolonged standing.

Materials and Methods

Study Design

The present study was conducted using an experimental pre-test and post-test comparative study design to evaluate the effectiveness of dynamic versus isometric activation breaks during work hours for the reduction of varicose vein symptoms among prolonged standing workers. Outcome measures including the Varicose Vein Questionnaire (VVQ), Numerical Pain Rating Scale (NPRS), and lower limb circumference measurements were assessed before and after the intervention period to determine changes in symptom severity, pain intensity, and limb swelling.

Study Setting

The study was conducted in the Department of Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India.

Study Population

Patients clinically diagnosed with varicose veins presenting with symptoms were recruited for the study.

Sampling Technique

A purposive sampling technique was used to recruit participants who fulfilled the inclusion and exclusion criteria. Based on the calculation, the estimated sample size was 28 participants. Considering feasibility and possible dropouts, a total of 30 participants were recruited for the study.

Inclusion Criteria

Individuals aged between 25–50 years. Workers who stand for at least 6 hours per day during working hours. Participants with mild to moderate symptoms of varicose veins, confirmed through screening or questionnaire (VVQ). Individuals with visible superficial veins or symptoms such as heaviness, pain, or swelling in the lower limbs after prolonged standing.

Exclusion Criteria

Individuals with severe or advanced varicose veins. individual using stockings for varicose veins. History of deep vein thrombosis (DVT) or recent lower limb surgery/injury. Presence of neurological or musculoskeletal disorders affecting lower limb movement. Individuals on medications affecting circulation, such as anticoagulants or vasodilators. Pregnant women or individuals with systemic conditions (e.g., diabetes, hypertension, or cardiac disease) that may interfere with exercise participation.

Ethical Approval and Participant Consent

The Ethical Approval for undertaking the proposed study has been obtained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), Karad, Maharashtra, India, with their Letter No. KVV/IEC/02/2026 dated 21st January 2026. Written informed consent was obtained from all the participants, who were assured of confidentiality and their right to withdraw anytime.

Outcome Measures

Numeric Pain Rating Scale (NPRS)

Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), a valid and reliable self-reported outcome measure consisting of an 11-point scale ranging from 0 to 10, where 0 represents “no pain” and 10 represents “worst imaginable pain.”

Lower Limb Girth Measurement

Lower limb girth was assessed using a non-elastic measuring tape. Participants were positioned comfortably in standing, and circumference measurements were taken at predetermined anatomical landmarks on the affected lower limb using a standardized procedure. Three measurements were recorded for each participant, and the average value was considered for analysis.

The measurements were used to assess the extent of lower limb swelling associated with varicose vein symptoms.

VVQ (Varicose veins Questionnaire)

The VVQ is a validated patient-reported outcome measure used to evaluate the severity and frequency of symptoms associated with varicose veins, including heaviness, aching, swelling, throbbing, itching, and discomfort in the lower limbs. Higher scores indicate greater symptom severity and a higher burden of venous disease.

Procedure

Participants fulfilling the inclusion criteria were informed about the study protocol, and written informed consent was obtained prior to participation. Baseline assessments including pain intensity, venous symptom severity, and lower limb girth measurements were recorded before initiation of the intervention.

All participants were randomly allocated into two groups: the Dynamic Activation Group and the Isometric Activation Group. The intervention program was conducted for a duration of 6 weeks during work hours under the supervision and guidance of a physiotherapist. Participants in the Dynamic Activation Group performed exercises such as calf raises, heel-to-toe rocking, ankle movements, marching in place, and step-ups, while participants in the Isometric Activation Group performed static calf contractions, heel presses, toe presses, wall calf holds, and calf squeeze exercises. The exercise protocol was progressively advanced throughout the intervention period.

The activation break exercises were incorporated into the participants' work schedules to enhance calf muscle pump activity, improve venous return, and reduce venous stasis associated with prolonged standing. Outcome measures including the Numeric Pain Rating Scale (NPRS), Varicose veins Questionnaire (VVQ), and Lower Limb Girth Measurement were assessed before and after completion of the intervention.

At the end of the 6-week intervention period, post-treatment assessments were conducted using the same outcome measures to evaluate changes in pain intensity, venous symptoms, and lower limb swelling.

INTERVENTIONAL PROTOCOL

Table 1. INTERVENTIONAL PROTOCOL

Week	*Dynamic Exercise*	*Reps*	*Sets*	*Isometric Exercise*	*Reps*
1	*Double-leg calf raises*	*10–12*	*2*	*Heel press*	*5–8*
1	*Heel-to-toe rocking*	*10–12*	*2*	*Toe press*	*5–8*
1	*Marching in place*	*10 steps*	*2*	*Calf squeeze*	*5*
2	*Double-leg calf raises*	*12–15*	*2*	*Heel press*	*8–10*
2	*Heel-to-toe rocking*	*12–15*	*2*	*Toe press*	*8–10*
2	*Marching in place*	*15 steps*	*2*	*Calf squeeze*	*8*
3	*Single-leg calf raises*	*15–20*	*3*	*Heel press*	*10–12*
3	*Heel-to-toe rocking*	*15–20*	*3*	*Toe press*	*10–12*
3	*Marching in place*	*20 steps*	*3*	*Calf squeeze*	*10*
4	*Single-leg calf raises*	*20–25*	*3*	*Heel press*	*12–15*
4	*Heel-to-toe rocking*	*20*	*3*	*Toe press*	*12–15*
4	*Marching in place*	*25 steps*	*3*	*Calf squeeze*	*12*
5	*Step-ups (low platform)*	*10–12 each leg*	*3*	*Wall calf hold*	*Hold 10 sec × 8 reps*
5	*Ankle circles*	*10 each direction*	*2*	*Isometric quadriceps set*	*Hold 8 sec × 10 reps*

5	*Marching in place*	*30 steps*	*3*	*Toe grip (press toes into ground)*	*Hold 5 sec × 8 reps*
6	*Single-leg calf raises*	*25–30*	*3*	*Heel press*	*15*
6	*Step-ups*	*12–15 each leg*	*3*	*Wall calf hold*	*Hold 10–12 sec × 8 reps*
6	*Heel-to-toe rocking*	*25*	*3*	*Toe press*	*15*
6	*Marching in place*	*35 steps*	*3*	*Calf squeeze*	*15*

RESULT

A total of 30 participants with mild to moderate symptoms of varicose veins completed the 6-week activation break intervention program. Participants were divided into two groups: Dynamic Activation Group (n = 15) and Isometric Activation Group (n = 15). All participants successfully completed the intervention protocol and post-intervention assessment. No major adverse events or exercise-related complications were reported during the study period.

Baseline and post-intervention assessments were conducted using the Numeric Pain Rating Scale (NPRS), Varicose veins Questionnaire (VVQ), and Lower Limb Circumference Measurement to evaluate pain intensity, venous symptom severity, and lower limb swelling, respectively. The findings demonstrated improvements in all outcome measures following both interventions, with the Dynamic Activation Group showing greater reductions in pain, venous symptoms, and lower limb swelling compared to the Isometric Activation Group.

Demographic Characteristics

The demographic and occupational characteristics of the participants are presented in Table 1. A total of 30 prolonged standing workers with mild to moderate symptoms of varicose veins participated in the study. The mean age of the participants was **38.67 ± 6.24 years**. Female participants constituted the majority of the study population. The average duration of occupational standing was **8.13 ± 1.12 hours per day**.

Table 2. Demographic Characteristics of Participants (N = 30)

Variable	Mean ± SD / Frequency (%)
Age (years)	38.67 ± 6.24
Female	18 (60%)
Male	12 (40%)
Occupational Standing Duration (hours/day)	8.13 ± 1.12
Retail Workers	12 (40%)
Teachers	10 (33.3%)
Healthcare Workers	8 (26.7%)

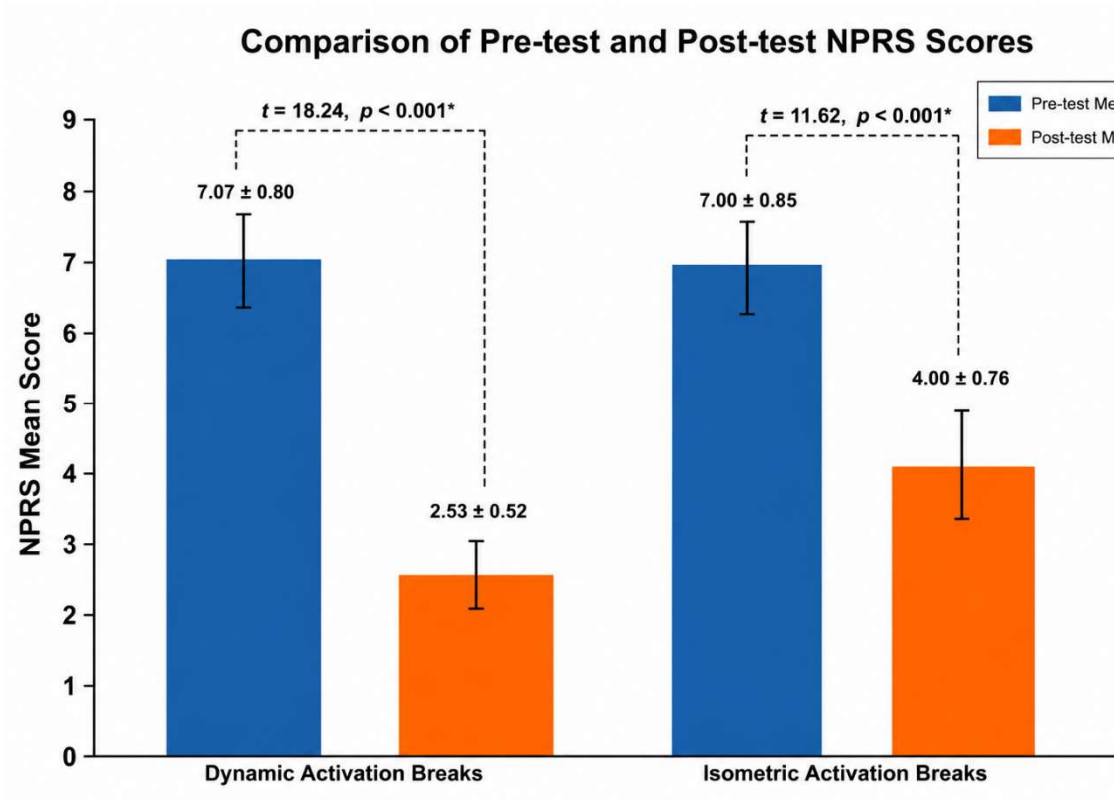
Comparison of Pain Intensity Before and After Intervention in both groups

Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS). A statistically significant reduction in pain intensity was observed following completion of the 6-week activation break intervention program in both the Dynamic Activation Break Group and the Isometric Activation Break Group. The Dynamic Activation Break Group demonstrated a greater reduction in pain intensity, with the mean NPRS score decreasing from **7.07 ± 0.80** during the pre-intervention assessment to **2.53 ± 0.52** following intervention. Similarly, the Isometric Activation Break Group showed significant improvement, with the mean NPRS score decreasing from **7.00 ± 0.85** at baseline to **4.00 ± 0.76** after completion of the intervention. Paired t-test analysis demonstrated statistically significant improvement in the Dynamic Activation Break

Group (**t = 18.24, p < 0.001**) and the Isometric Activation Break Group (**t = 11.62, p < 0.001**).

Table 3. Comparison of Pre- and Post-Intervention NPRS Scores

Outcome Measure	Group	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	p-value
NPRS	Dynamic Activation Breaks	7.07 ± 0.80	2.53 ± 0.52	18.24	<0.001*
NPRS	Isometric Activation Breaks	7.00 ± 0.85	4.00 ± 0.76	11.62	<0.001*

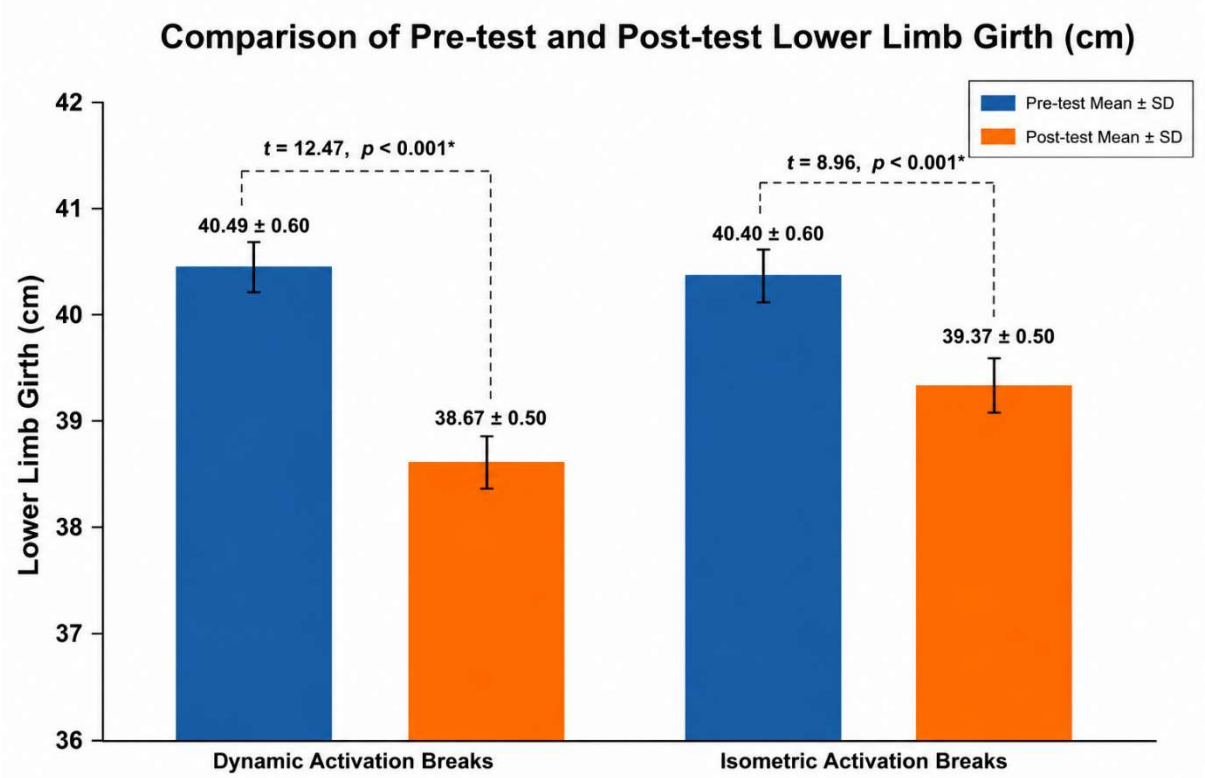


Comparison of Lower Limb Girth Before and After Intervention in both groups

Lower limb girth was measured using a standard measuring tape at predetermined anatomical landmarks to assess lower limb swelling associated with varicose veins. A significant reduction in lower limb girth was observed following completion of the 6-week activation break intervention program in both the Dynamic Activation Break Group and the Isometric Activation Break Group. The Dynamic Activation Break Group demonstrated a greater reduction in lower limb girth, with the mean girth decreasing from 40.49 ± 0.60 cm during the pre-intervention assessment to 38.67 ± 0.50 cm following intervention. Similarly, the Isometric Activation Break Group showed significant improvement, with the mean girth decreasing from 40.40 ± 0.60 cm at baseline to 39.37 ± 0.50 cm after completion of the intervention. Statistical analysis revealed a significant difference between pre- and post-intervention values in both groups ($p < 0.001$).

Table 4. Comparison of Pre- and Post-Intervention Lower Limb Girth

Outcome Measure	Group	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	p-value
Lower limb girth (cm)	Dynamic Activation Breaks	40.49 ± 0.60	38.67 ± 0.50	12.47	<0.001*
Lower limb girth (cm)	Isometric Activation Breaks	40.40 ± 0.60	39.37 ± 0.50	8.96	<0.001*



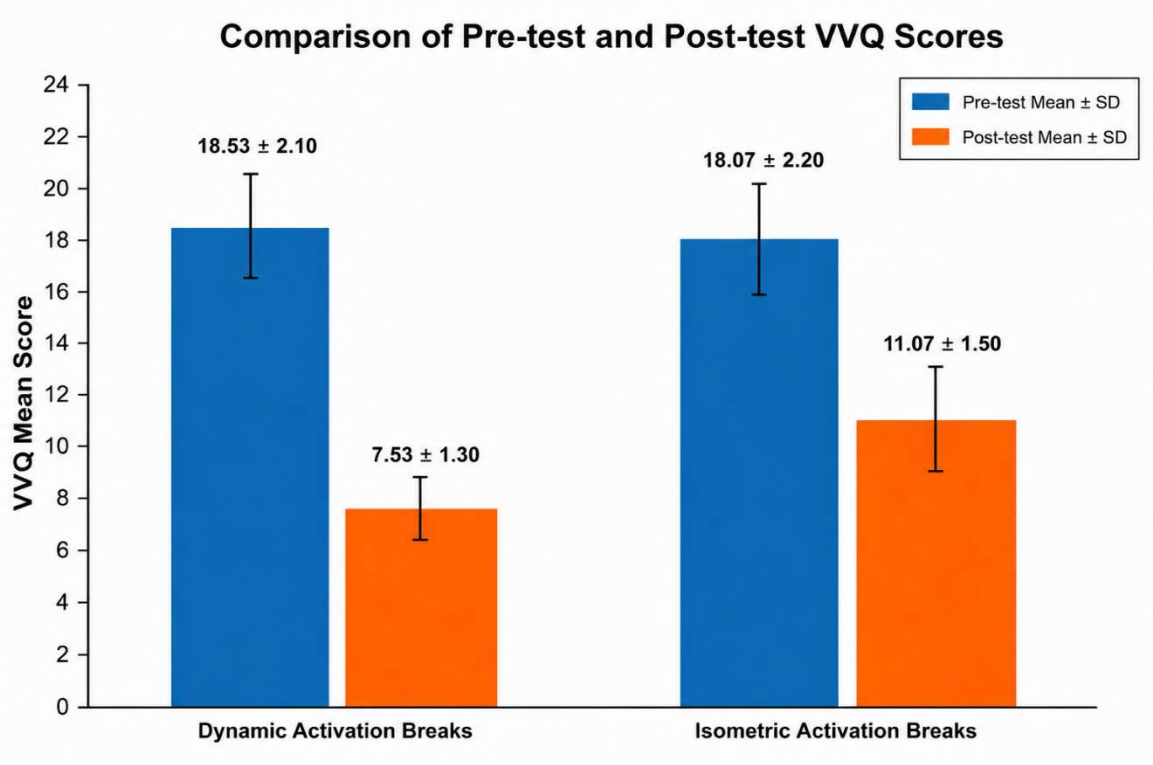
Comparison of Venous Symptoms Before and After Intervention in both Groups

Venous symptom severity assessed using the Varicose veins Questionnaire (VVQ) showed statistically significant improvement after the intervention period in both the Dynamic Activation Break Group and the Isometric Activation Break Group. The Dynamic Activation Break Group demonstrated a greater reduction in venous symptoms, with the mean VVQ score decreasing from 18.53 ± 2.10 at baseline to 7.53 ± 1.30 following intervention. Similarly, the Isometric Activation Break Group showed significant improvement, with the mean VVQ score decreasing from 18.07 ± 2.20 at baseline to 11.07 ± 1.50 after completion of the intervention. Paired t-test analysis demonstrated statistically significant improvement in venous symptoms in both groups ($p < 0.001$).

Table 5. Comparison of Pre- and Post-Intervention VVQ Scores in both groups

Outcome Measure	Group	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	p-value
VVQ	Dynamic activation breaks	18.53 ± 2.10	7.53 ± 1.30	15.38	<0.001*

VVQ	Isometric activation breaks	18.07 ± 2.20	11.07 ± 1.50	10.84	<0.001*



The findings of the present study demonstrated statistically significant improvements in pain intensity, venous symptom severity, and lower limb swelling following the 6-week activation break intervention program among prolonged standing workers with varicose vein symptoms. Both the Dynamic Activation Break Group and the Isometric Activation Break Group showed significant improvements across all outcome measures following the intervention.

Participants in the Dynamic Activation Break Group exhibited greater reductions in pain intensity, venous symptom severity, and lower limb circumference compared to those in the Isometric Activation Break Group. Similarly, participants in the Isometric Activation Break Group demonstrated clinically meaningful improvements in pain, venous symptoms, and lower limb swelling following the intervention protocol. The results suggest that both dynamic and isometric activation break exercises are effective workplace rehabilitation and preventive strategies for enhancing venous return, reducing venous stasis, and improving lower limb function and occupational comfort in individuals exposed to prolonged standing. However, dynamic activation exercises appeared to produce superior outcomes compared to isometric activation exercises.

DISCUSSION

The present study evaluated the effectiveness of dynamic versus isometric activation breaks during work hours on pain intensity, venous symptom severity, and lower limb swelling among prolonged standing workers with varicose vein symptoms. The findings demonstrated statistically significant improvements in all outcome measures following the 6-week intervention protocol in both groups. Significant reduction in pain intensity, improvement in venous symptoms, and reduction in lower limb girth suggest that activation break exercises are beneficial in the management of varicose vein symptoms associated with prolonged standing occupations. However, the Dynamic Activation Break Group demonstrated greater improvements compared to the Isometric Activation Break Group across all outcome measures.

Pain intensity assessed using the Numeric Pain Rating Scale (NPRS) showed a significant reduction following the intervention in both groups. The Dynamic Activation Break Group demonstrated a greater reduction in pain intensity than the Isometric Activation Break Group. The reduction in pain may be attributed to improved venous return, activation of the calf muscle pump,

and reduction of venous stasis in the lower limbs. Regular activation breaks promote blood circulation and decrease venous pooling, thereby reducing discomfort, heaviness, and pain experienced during prolonged standing. The superior improvement observed in the Dynamic Activation Break Group may be due to repetitive muscle contractions producing a stronger pumping effect and enhanced circulation.

Lower limb girth measurements demonstrated statistically significant improvement after the intervention period in both groups. The reduction in limb circumference indicates decreased venous congestion and lower limb swelling. Activation exercises stimulate muscle contractions that facilitate venous drainage and enhance circulation, thereby reducing edema. Dynamic activation exercises, in particular, provide greater mechanical pumping action through repetitive ankle and calf movements, contributing to more effective venous return and a greater reduction in swelling compared to isometric contractions.

The present study also demonstrated significant improvement in venous symptoms assessed using the Varicose veins (VVQ) in both groups. Participants reported reductions in symptoms such as heaviness, aching, swelling, throbbing, and discomfort following the intervention. The incorporation of structured activation breaks during work hours may have improved lower limb circulation and reduced the physiological stress associated with prolonged standing, thereby enhancing overall comfort and functional capacity during occupational activities. The Dynamic Activation Break Group exhibited greater improvement in VVQ scores, suggesting that dynamic movements may be more effective in alleviating venous symptoms.

The progressive nature of the intervention protocol may also have contributed to the positive outcomes observed in the present study. Gradual progression of exercise intensity and repetitions likely improved calf muscle endurance, neuromuscular efficiency, and venous pump function without causing excessive fatigue or discomfort. No major adverse events were reported during the intervention period, indicating that both dynamic and isometric activation break protocols are safe, feasible, and easily implementable in workplace settings.

Despite the positive findings, the study had certain limitations including a relatively small sample size, short intervention duration, and lack of long-term follow-up. Further randomized controlled trials with larger sample sizes and extended follow-up periods are recommended to establish the long-term effectiveness of dynamic and isometric activation break programs for the prevention and management of varicose vein symptoms among prolonged standing workers.

Limitations

The present study has certain limitations that should be considered while interpreting the findings. The study was conducted with a relatively small sample size, with only 15 participants in the Dynamic Activation Break Group and 15 participants in the Isometric Activation Break Group, and lacked a non-intervention control group for comparison. The duration of the intervention was limited to six weeks, and long-term follow-up was not performed to determine the sustainability of the observed improvements in pain intensity, venous symptom severity, and lower limb swelling in either group.

In addition, the study focused primarily on clinical outcome measures including the Numeric Pain Rating Scale (NPRS), Varicose veins (VVQ), and lower limb girth measurements without assessing venous hemodynamics through Doppler ultrasonography. Quality of life, occupational productivity, and participant satisfaction were also not evaluated. Variations in occupational demands, duration of standing, physical activity levels, and lifestyle factors may have influenced the treatment outcomes in both groups.

Furthermore, although both dynamic and isometric activation break protocols demonstrated significant benefits, the study did not investigate the optimal frequency, intensity, or duration of activation breaks required to achieve maximum therapeutic effects. Further randomized controlled trials with larger sample sizes, objective vascular assessments, inclusion of a control group, and long-term follow-up are recommended to establish stronger evidence regarding the comparative effectiveness of dynamic and isometric activation break programs for the prevention and management of varicose vein symptoms among prolonged standing workers.

Clinical Implications

The findings of the present study suggest that both dynamic and isometric activation break exercises may serve as effective workplace-based interventions for reducing pain, venous symptoms, and lower limb swelling among prolonged standing workers with varicose vein symptoms. Incorporation of structured activation breaks into routine work schedules may enhance venous return, improve calf muscle pump efficiency, and reduce venous stasis associated with prolonged standing occupations.

Participants in both the Dynamic Activation Break Group and the Isometric Activation Break

Group demonstrated significant improvements in pain intensity, venous symptom severity, and lower limb swelling. However, the Dynamic Activation Break Group exhibited greater improvements across all outcome measures, indicating that dynamic movements may provide superior activation of the calf muscle pump and more effective enhancement of venous circulation. Nevertheless, isometric activation exercises also produced clinically meaningful benefits and may be particularly useful in workplace environments where space or movement is limited.

These simple, low-cost, and time-efficient exercises can be easily implemented in various occupational settings without the need for specialized equipment. The intervention protocols used in the present study may be clinically applicable in physiotherapy and occupational health settings for individuals presenting with mild to moderate varicose vein symptoms, thereby promoting vascular health, workplace comfort, functional capacity, and occupational productivity.

Conclusion

The present study demonstrated that both Dynamic Activation Break and Isometric Activation Break programs significantly improved pain intensity, venous symptom severity, and lower limb swelling among prolonged standing workers with varicose vein symptoms. The intervention protocols effectively enhanced venous return, reduced venous stasis, and improved lower limb comfort without producing adverse effects.

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