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Original Article

The Effect of Instrument-Assisted Application on Posture, Quality of Life, and Work Role Functionality in Office Workers

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Abstract

Objectives: To evaluate the effects of instrument-assisted spinal manipulation delivered with the Activator Method on posture, health-related quality of life, and work role functioning in office workers with musculoskeletal complaints related to prolonged sitting.

Methods: Fifty office workers (20–45 years) were randomly allocated to an Activator group (weekly Activator Method spinal manipulations for 6 weeks) or a control group (no intervention). Posture was assessed using the PostureScreen Mobile app. Quality of life and work role functioning were assessed with the SF-12 and Work Role Functioning Questionnaire (WRFQ), respectively, at baseline, week 3, and week 6. Data were analyzed in SPSS v22.0; statistical significance was set at $p<0.05$.

Results: At week 6, between-group differences favored the Activator group for the SF-12 physical component score, the WRFQ total score and physical demands subscale, and several postural parameters (nominal $p<0.05$; FDR-adjusted q-values reported for postural outcomes). Within the Activator group, improvements were observed in both SF-12 component scores, all WRFQ subdomains, and most postural parameters. The control group showed small but statistically significant changes in a limited number of work-role and postural outcomes ($p<0.05$).

Conclusion: Activator-assisted spinal manipulation was associated with improvements in posture, quality of life, and work role functioning in office workers. These findings suggest that instrument-assisted spinal manipulation may contribute to improvements in occupational health settings; however, confirmatory sham-controlled trials are needed.

Keywords: Activator method, office workers, posture, spinal manipulation, work role functioning.

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Modern working life often requires prolonged sitting. Among office workers, extended sedentary and non-ergonomic positions are associated with musculoskeletal complaints and reduced quality of life.[1] Office workers may spend a large proportion of the workday seated, often in uninterrupted bouts.[2] Sustained suboptimal posture can increase mechanical stress on musculoskeletal structures and contribute to symptoms such as neck, shoulder, and back discomfort.[3,4]

Posture is linked to both physical and psychological states.[5] Poor posture has been associated with reduced workplace performance and adverse psychosocial outcomes.[6] Therefore, posture-targeted interventions may be relevant for physiotherapy and occupational health.

Spinal manipulation therapy is a commonly used manual therapy approach for musculoskeletal disorders. The Activator Method® Chiropractic Technique (AMCT) is characterized by low-force, high-speed, instrument-

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assisted thrusts and is often considered a safe alternative because dosing is more standardized and less dependent on clinician-applied force.[7] The Activator Method aims to correct segmental dysfunction, optimize spinal alignment, and enhance proprioceptive stimulation.[8]

Previous studies suggest that Activator manipulation may positively affect pain, muscle activation, postural stability, and functional capacity across different clinical conditions.[9,10] However, research in sedentary worker populations that simultaneously evaluates multidimensional outcomes such as quality of life, work role performance, and postural parameters remains limited.

Accordingly, this study investigated the effects of instrument-assisted spinal manipulation on posture, health-related quality of life, and work role functioning in office workers. The aim was to provide evidence that may inform the integration of manual therapy with physiotherapeutic and ergonomic strategies in occupational settings.

Materials and Methods

Ethical Approval

Ethical approval for the study was obtained from a local Institutional Scientific Research and Publication Ethics Committee on October 26, 2022 (Decision No: 2022/6). All procedures were conducted in accordance with the Declaration of Helsinki and relevant ethical standards.

Participants

A total of 50 office workers aged 20–45 years voluntarily participated. Participants were recruited using purposive sampling based on predefined inclusion and exclusion criteria. Key inclusion criteria were office employment for ≥6 months, sedentary desk work ≥4 hours/day, no regular exercise in the previous 3 months, no contraindications to spinal manipulation, a forward flexion test angle <7°, and written informed consent. Exclusion criteria were recent surgery (past 6 months), prior cervical/thoracic/lumbar spinal surgery, and current or suspected pregnancy. Participants were randomized (Microsoft Excel sequence) with allocation concealment using sequentially numbered, sealed opaque envelopes; outcome assessments were performed by an independent researcher blinded to allocation.

A total of 50 individuals were enrolled in the study, and all participants completed the intervention and assessments as planned. Thus, the study was completed with 50 participants, as illustrated in Figure 1.

Instruments

Demographic information form

A demographic information form was used to collect participants' basic characteristics, including age, gender, height, weight, and body mass index (BMI), as well as general health status. The form was also used to screen for exclusion criteria, and was completed by the physiotherapist during the initial evaluation.

The work role functioning questionnaire (WRFQ)

The Work Role Functioning Questionnaire (WRFQ 2.0) is a self-administered tool assessing how health problems

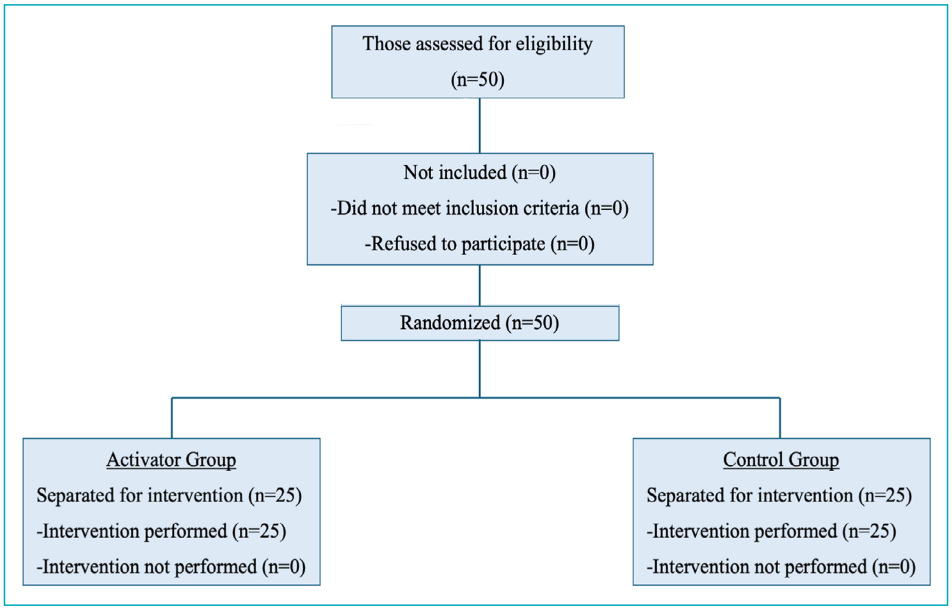

Figure 1. Study protocol.

affect the ability to meet work demands. It includes 27 items across five domains (work scheduling, output, physical, mental and social, and flexibility). Items are rated on a 5-point response scale, with "not applicable" responses excluded from scoring. Subscale and total scores are transformed to a 0–100 scale, with higher scores indicating better work functioning. The WRFQ has demonstrated high internal consistency (Cronbach's α>0.80) and good construct validity in occupational populations.[11]

Short form-12 (SF-12)

The Short Form-12 Health Survey (SF-12) was used to evaluate perceived physical and mental health status. The instrument provides two summary scores: the Physical Component Summary (PCS) and the Mental Component Summary (MCS), both scaled from 0 to 100, with higher scores indicating better perceived health status.[12] Scoring procedures were applied according to the SF-12 scoring guide.[13]

PostureScreen mobile app

Postural assessment was conducted using the PostureScreen Mobile App (PSM), a validated photogrammetric tool that analyzes head-to-toe posture through standardized anterior, posterior, and lateral photographs. Participants were photographed in standing position from four views (anterior, posterior, right lateral, and left lateral) using a tripod-mounted iPhone camera to ensure consistency in image capture. PSM was used to capture anterior and posterior (coronal plane), as well as left and right lateral (sagittal plane) views. The application digitally calculates postural variables by marking specific anatomical landmarks, with the analysis depending on the number and type of selected variables.[14]

Activator instrument

The Activator Instrument is a handheld, spring-loaded device designed to deliver a controlled and rapid mechanical thrust to specific vertebral segments. It is used in the Activator Method Chiropractic Technique (AMCT), a low-force spinal manipulative therapy that aims to restore joint mobility, improve alignment, and reduce neuromusculoskeletal pain.[15]

In this study, spinal manipulation was performed using the Activator Method Basic Scan Protocol, which includes systematic assessment and treatment of spinal segments based on leg length checks, motion palpation, and neurological responses. The method is considered safe and suitable for patients who may not tolerate manual high-velocity, low-amplitude (HVLA) thrusts.

Procedure

After providing informed consent, eligible participants completed a demographic information form and baseline assessments. Participants were allocated to the Activator or control group using a computer-generated random sequence, with concealment ensured by sequentially numbered, sealed opaque envelopes. The Activator group received one session per week of Activator Instrument spinal manipulation for 6 weeks, while the control group received no treatment. Assessments were performed at baseline (Week 0), Week 3, and Week 6 by a researcher blinded to group allocation, using the PostureScreen Mobile app (four views), SF-12, and WRFQ.

AMCT intervention protocol

Each treatment session followed the standardized Activator Method Basic Scan Protocol. Participants were positioned prone on a treatment table. The practitioner first performed a prone leg-length analysis and isolation tests (e.g., prone knee flexion) to identify a functional short leg and laterality. A structured scan was then conducted from the pelvis/sacroiliac region through the spine using segmental palpation and motion assessment, with confirmation using Activator isolation procedures. Target segments were selected only when the scan yielded a positive indicator (e.g., a change in leg-length inequality during isolation or reproduction of segmental tenderness), and could include pelvic/sacroiliac, lumbar, thoracic, and/or cervical segments depending on the individual findings.

For each indicated segment, an instrument-assisted impulse was delivered with the Activator device tip placed on the designated bony contact point; the thrust was applied perpendicular to the contact surface with minimal preload in accordance with the manufacturer's instructions. Typically, one impulse was applied per indicated segment and repeated only if the indicator persisted. Following each adjustment (and at the end of the session), the relevant indicators were re-checked to confirm response and to determine whether additional segments required treatment. No additional manual high-velocity thrust manipulation was performed.

Session frequency (once weekly for 6 weeks) and the sequence of treated regions/segments were standardized by the Basic Scan decision rules, and adherence was monitored by using a session checklist to document the indicated segments and completed steps at each visit.

Sample Size Justification

An a priori sample size calculation was not performed because there were insufficient prior data using a comparable Activator-assisted protocol and the same primary outcomes to support a reliable effect-size assumption. Therefore, the sample size =50; n=25 per group) was determined primarily by feasibility and recruitment capacity within the study period. With n=25 per group and a two-tailed α=0.05, the study has approximately 80% power to detect standardized between-group differences of about d ≈ 0.79 (large effect) in primary outcomes.

Post Hoc Power Analysis

In addition, a post hoc power analysis was conducted for exploratory purposes to evaluate the adequacy of the achieved sample size. Power calculations were based on observed effect sizes derived from the study data. Cohen's d values were calculated using the observed between-group t statistics and group sizes (n=25 per group) according to the standard formula for independent samples ($d=t \times \sqrt{(1/n_1+1/n_2)}$). Statistical power was estimated assuming a two-tailed significance level of α=0.05 using G*Power software (version 3.1.9.7; Heinrich Heine University, Düsseldorf, Germany). This analysis was conducted solely to contextualize sample adequacy and was not used to justify statistical significance or to interpret non-significant findings. Accordingly, the study was primarily powered to detect large effects, and smaller between-group effects cannot be ruled out. Using the between-group change-score comparisons for the primary outcomes (n=25 per group; two-tailed α=0.05), the observed effect sizes (Cohen's d) and corresponding achieved power values were: Physical Change (d=0.973; power=0.921), Mental Change (d=1.153; power=0.979), and Work Role Functionality Total Change (d=1.613; power=1.000). These values are reported to contextualize sample adequacy and were not used to justify statistical significance or interpret non-significant findings.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize the data. Between-group differences in categorical variables were assessed using the chi-square test. Continuous variables were compared between groups using the independent-samples t-test. Within-group changes over time were examined with repeated-measures analysis of variance (ANOVA), followed by Bonferroni-adjusted post hoc comparisons where appropriate.

To address multiplicity, outcomes were interpreted according to a prespecified hierarchy. Physical, mental, and work role functioning outcomes were considered primary, whereas individual postural parameters were treated as secondary/exploratory. For postural outcomes, multiplicity across the family of between-group change-score tests was controlled using the Benjamini–Hochberg false discovery rate (FDR), with adjusted q-values reported alongside nominal p-values. For between-group comparisons, standardized effect sizes (Hedges g) with 95% confidence intervals were reported to support interpretation beyond statistical significance.

Results

Sex distribution was identical in both groups (52% male, 48% female). There were no significant between-group differences in BMI categories (χ^2=3.148, p=0.533), age (31.35±5.29 vs. 34.92±7.55 years, p=0.062), height (174.15±12.10 vs. 169.83±7.68 cm, p=0.136), body weight (77.73±13.37 vs. 75.71±13.33 kg, p=0.595), or BMI (25.60±3.27 vs. 26.18±3.81 kg/m^2, p=0.562). Overall, these findings indicate that the Activator and control groups were comparable at baseline in terms of demographic and anthropometric characteristics.

For primary outcomes, a significant between-group difference in SF-12 physical component scores was observed at T2, favoring the Activator group (t(48)=2.929, p=0.007), whereas no between-group differences were found at T0 or T1. No significant between-group differences were detected in SF-12 mental component scores at the individual assessment time points (T0, T1, and T2); however, the Activator group demonstrated a significant within-group improvement at T2 compared with T0 and T1, while the control group showed no temporal changes. For total work role functioning, a significant between-group difference was identified at T2 in favor of the Activator group (t(48)=2.052, p=0.046). Within-group changes over time are presented descriptively in Table 1.

Postural outcomes were treated as secondary/exploratory variables. To reduce repetitive reporting across multiple planes and time points, postural results are summarized by overall patterns in the text, while detailed values are provided in Tables 2-5. Overall, the Activator group demonstrated more consistent directional improvements across translations and angulations over time compared with the control group. Accordingly, primary inference was based on between-group change scores together with standardized effect sizes (Hedges g) and FDR-adjusted q-values, while within-group changes are reported descriptively. Between-group change-score analyses favored the Activator group for the functional outcomes (physical, mental, and total work-role functioning), with

Table 1. Comparison of physical, mental, and work role functioning measures of activator and control groups over time

	AG (n=25) mean±SD	CG (n=25) mean±SD	t^a	p
Quality of life				
Physical				
T0	49.143±6.678	47.834±8.068	0.627	0.534
T1	51.014±5.065	47.655±8.435	1.722	0.100
T2	53.393±5.125	47.700±8.358	2.929	0.007
F^b	18.691	0.029		
p	0.000	0.905		
Bonferroni	1<2.3; 2<3			
Etakare	0.428			
Mental				
T0	44.631±11.470	45.955±11.448	-0.408	0.685
T1	46.760±9.698	45.622±11.558	0.378	0.707
T2	50.536±7.054	44.851±12.213	2.035	0.054
Bonferroni	1<3; 2<3			
Etakare	0.344			
F^b	13.100	0.897		
p	0.000	0.400		
Work role functioning				
T0	111.000±12.484	117.917±13.253	-1.900	0.063
T1	116.385±9.996	117.042±13.030	-0.201	0.842
T2	121.923±9.419	115.167±13.631	2.052	0.046
F^b	20.677	9.264		
p	0.000	0.002		
Bonferroni	1<2.3; 2<3	1>2.3; 2>3		
Etakare	0.453	0.287		

AG: Activator group, CG: Control group, SD: Standard deviation, $p<0.05$.

large standardized effects (Hedges g ≈ 0.96–1.59; Table 6). For postural parameters, between-group effects were not uniform across variables; therefore, we emphasize effect-size magnitude/direction and report FDR-adjusted q-values. After FDR correction, 21 of 28 postural change-score comparisons remained significant, whereas a subset (e.g., anterior shoulder translation, posterior hip–pelvis angulation, and selected left-sided knee measures) did not and are interpreted cautiously (Table 6).

Discussion

This study suggests that six weeks of Activator-assisted spinal manipulation was associated with improvements in physical quality of life, work role functioning, and several measures of postural alignment in office workers. Prolonged sitting and static working postures are common in office-based occupations and are frequently associated with self-reported musculoskeletal symptoms. These occupational exposures provide a plausible context in which interventions targeting spinal function and posture may influence symptoms and work-related outcomes. Consistent with this perspective, observational evidence reports a high prevalence of musculoskeletal complaints among office workers.[16]

To assess quality of life, the Short Form-12 (SF-12) questionnaire was utilized to evaluate both physical and mental health components.[13] Several randomized controlled trials have previously demonstrated improvements in SF-12 scores following spinal manipulation or in comparison to conventional treatments for musculoskeletal conditions.[17,18] In alignment with these findings, our study revealed a statistically significant increase in the SF-12 physical component scores in the Activator-assisted spinal manipulation group at the T2 time point compared to both T0 and T1.

Recent international clinical practice guidelines for low back pain commonly recommend remaining active, therapeutic exercise, and—in selected patients—spinal

Table 2. Changes in anterior and posterior translation measurements over time in activator and control groups

	AG (n=25) mean±SD	CG(n=25) mean±SD	t^a	p		AG (n=25) mean±SD	CG(n=25) mean±SD	t^a	p
Anterior translations head					Posterior translations head				
T0	0.667±0.530	0.716±0.630	-0.303	0.763	T0	0.690±0.542	0.755±0.639	-0.391	0.697
T1	0.612±0.508	0.686±0.601	-0.471	0.640	T1	0.635±0.512	0.729±0.619	-0.588	0.559
T2	0.570±0.489	0.680±0.585	-0.723	0.473	T2	0.569±0.488	0.724±0.613	-0.993	0.326
F^b	37.917	3.656			F^b	27.903	4.426		
p	**0.000**	0.059			p	**0.000**	**0.043**		
Bonferroni	**1>2.3; 2>3**				Bonferroni	**1>2.3; 2>3**	**1>2**		
Etakare	0.603				Etakare	0.527	0.161		
Anterior translations shoulder					Posterior translations shoulder				
T0	0.404±0.543	0.379±0.494	0.170	0.865	T0	0.720±0.543	0.545±0.605	1.080	0.285
T1	0.375±0.521	0.360±0.475	0.109	0.914	T1	0.636±0.512	0.545±0.607	0.571	0.571
T2	0.344±0.482	0.354±0.474	-0.070	0.944	T2	0.593±0.489	0.542±0.604	0.327	0.745
F^b	13.090	2.131			F^b	20.744	0.100		
p	**0.001**	0.156			p	**0.000**	0.798		
Bonferroni	**1>2.3; 2>3**				Bonferroni	**1>2.3; 2>3**			
Etakare	0.344				Etakare	0.453			
Anterior translations hip pelvis					Posterior translations hip pelvis				
T0	1.123±0.901	1.120±1.049	0.011	0.991	T0	0.899±0.887	0.748±0.641	0.683	0.498
T1	1.055±0.863	1.090±1.045	-0.132	0.895	T1	0.827±0.847	0.728±0.629	0.466	0.643
T2	0.988±0.832	1.068±1.041	-0.302	0.764	T2	0.760±0.786	0.715±0.636	0.221	0.826
F^b	28.568	3.491			F^b	22.276	4.523		
p	**0.000**	0.067			p	**0.000**	**0.032**		
Bonferroni	**1>2.3; 2>3**				Bonferroni	**1>2.3; 2>3**	**1>2.3**		
Etakare	0.533				Etakare	0.471	0.164		

AG: Activator group, CG: Control group, SD: Standard deviation, $p<0.05$.

manipulation as part of a multimodal approach. Therefore, the observed within-group improvements in SF-12 scores in the activator-assisted spinal manipulation group are directionally consistent with guideline-supported care pathways, although causal inference is limited by the absence of consistent between-group differences. [19]

The WRFQ v2.0 has demonstrated consistent factor structure across heterogeneous working samples, supporting its use to quantify health-related work functioning. In line with recommendations in the validation literature, reporting both total and subscale scores may provide more granular insight into which work demands change over time.[20]

Postural assessment was performed using PostureScreen Mobile, a digital photogrammetric posture assessment tool supported in the literature for posture evaluation using mobile applications. Previous studies suggest that mobile-application–based posture assessments can demonstrate acceptable validity and reliability under standardized conditions; however, measurement error and marker placement variability may still influence small between-group differences. Thus, non-significant between-group findings should be interpreted cautiously, especially for subtle postural changes.[21]

In our study, no statistically significant differences were observed between groups in anterior and posterior postural measurements (translations in cm and angulations in degrees).From a clinical perspective, the observed reductions in translations and angulations may reflect modest improvements in multidimensional alignment (e.g., less forward head/shoulder displacement and reduced lateral asymmetry), which could plausibly decrease cumulative mechanical loading, sustained muscle activation, and fatigue during prolonged desk work. In office workers, even small improvements in head–shoulder–pelvic alignment may translate into more comfortable sitting tolerance, fewer movement-compensation strategies, and improved ability to meet

Table 3. Changes in anterior and posterior angulation measurements over time in activator and control groups

	AG (n=25) mean±SD	CG(n=25) mean±SD	t^a	p		AG (n=25) mean±SD	CG(n=25) mean±SD	t^a	p
Anterior angulations head					Posterior angulations head				
T0	2.435±2.539	1.783±1.993	1.003	0.321	T0	1.477±1.453	1.579±1.672	-0.231	0.818
T1	2.354±2.494	1.767±1.978	0.917	0.364	T1	1.388±1.402	1.567±1.655	-0.412	0.682
T2	2.308±2.467	1.767±1.948	0.856	0.396	T2	1.332±1.351	1.571±1.652	-0.562	0.580
F^b	25.302	0.346			F^b	25.052	0.193		
p	**0.000**	0.631			p	**0.000**	0.693		
Bonferroni	**1>2.3; 2>3**				Bonferroni	**1>2.3; 2>3**			
Etakare	0.503				Etakare	0.501			
Anterior angulations shoulder					Posterior angulations shoulder				
T0	0.777±0.973	1.304±1.344	-1.598	0.117	T0	0.662±1.021	0.925±1.061	-0.894	0.376
T1	0.727±0.926	1.292±1.327	-1.756	0.091	T1	0.623±0.973	0.942±1.064	-1.106	0.274
T2	0.703±0.896	1.288±1.322	-1.844	0.077	T2	0.601±0.953	0.929±1.062	-1.152	0.255
F^b	13.196	0.555			F^b	9.002	1.000		
p	**0.000**	0.533			p	**0.003**	0.356		
Bonferroni	**1>2.3; 2>3**				Bonferroni	**1>2.3; 2>3**			
Etakare	0.345				Etakare	0.265			
Anterior angulations hip pelvis					Posterior angulations hip pelvis				
T0	1.046±1.187	0.729±0.932	1.044	0.301	T0	1.177±1.148	0.550±0.898	2.138	**0.038**
T1	1.000±1.145	0.696±0.894	1.041	0.303	T1	1.102±1.091	0.508±0.832	2.149	**0.037**
T2	0.957±1.126	0.721±0.926	0.807	0.424	T2	1.047±1.055	0.483±0.793	2.120	**0.039**
F^b	10.574	3.602			F^b	14.345	4.490		
p	**0.001**	**0.040**			p	0.000	0.042		
Bonferroni	**1>2.3; 2>3**	**1>2; 2<3**			Bonferroni	1>2.3; 2>3	1>3; 2>3		
Etakare	0.297	0.135			Etakare	0.365	0.163		

AG: Activator group, CG: Control group, SD: Standard deviation, $p<0.05$.

physical work demands across the workday. Although we did not directly measure pain intensity or objective work performance, the concurrent improvements in work role functioning suggest that postural changes—together with potential symptom modulation—may relate to perceived capacity to perform occupational tasks. However, the minimal clinically important difference for these posture metrics is not well established and measurement error may influence small changes; therefore, the clinical relevance of posture findings should be interpreted as preliminary and hypothesis-generating, ideally confirmed using objective biomechanical or symptom-based outcomes in future trials.

From a mechanistic standpoint, spinal manipulation has been proposed to influence sensorimotor control through neurophysiological pathways, including altered afferent input from paraspinal tissues and subsequent changes in central processing and reflex muscle activity. Such effects could plausibly contribute to improvements in movement patterns and posture-related measures, even if these changes are modest and not consistently detectable in between-group comparisons.[22]

In addition, improvements in work role functioning suggest that this intervention may enhance perceived capacity to meet work demands in occupational settings. More broadly, workplace-focused interventions aimed at musculoskeletal health—including strategies that reduce occupational sitting time—have shown potential to improve health and related outcomes, although evidence quality and effect sizes vary across intervention types. In this context, changes in work role functioning observed over time may reflect not only symptom modulation but also improved capacity to meet physical and psychosocial work demands.[23,24]

Despite the strengths of this randomized study, several limitations should be acknowledged. First, the control group did not receive a sham or active intervention, which limits the ability to fully account for placebo effects,

Table 4. Changes in right and left lateral translation measurements over time in activator and control groups

	AG (n=25) mean±SD	**CG(n=25) mean±SD**	**t^a**	**p**		**AG (n=25) mean±SD**	**CG(n=25) mean±SD**	**t^a**	**p**
Lateral translations right head					Lateral translations left head				
T0	3.784±2.437	4.194±2.184	-0.625	0.535	T0	3.211±2.485	4.040±1.588	-1.392	0.164
T1	3.682±2.421	4.172±2.153	-0.754	0.455	T1	3.087±2.441	3.983±1.527	-1.540	0.124
T2	3.585±2.392	4.123±2.122	-0.838	0.406	T2	3.003±2.421	3.926±1.522	-1.598	0.111
F^b	48.660	4.879			F^b	38.393	6.708		
p	**0.000**	**0.031**			p	**0.000**	**0.012**		
Bonferroni	**1>2.3; 2>3**	**1>3; 2>3**			Bonferroni	**1>2.3; 2>3**	**1>2.3; 2>3**		
Etakare	0.661	0.175			Etakare	0.606	0.226		
Lateral translations right shoulder					Lateral translations left shoulder				
T0	4.326±2.947	5.915±2.729	-1.973	0.054	T0	3.401±2.200	4.464±2.504	-1.597	0.117
T1	4.190±2.934	5.857±2.724	-2.076	**0.043**	T1	3.245±2.125	4.413±2.516	-1.778	0.082
T2	4.049±2.892	5.831±2.747	-2.230	**0.030**	T2	3.120±2.065	4.375±2.535	-1.925	0.060
F^b	39.686	4.643			F^b	35.637	6.180		
p	**0.000**	**0.037**			p	**0.000**	**0.014**		
Bonferroni	**1>2.3; 2>3**	**1>2.3**			Bonferroni	**1>2.3; 2>3**	**1>2.3; 2>3**		
Etakare	0.614	0.168			Etakare	0.588	0.212		
Lateral translations right hip pelvis					Lateral translations left hip pelvis				
T0	2.684±2.838	3.255±2.023	-0.813	0.420	T0	3.536±2.702	3.843±2.111	-0.445	0.659
T1	2.564±2.724	3.210±1.992	-0.951	0.347	T1	3.280±2.368	3.793±2.070	-0.812	0.421
T2	2.476±2.700	3.180±1.985	-1.044	0.302	T2	3.160±2.350	3.763±2.041	-0.965	0.339
F^b	17.586	4.895			F^b	7.910	3.843		
p	**0.000**	**0.034**			p	**0.008**	0.055		
Bonferroni	**1>2.3; 2>3**	**1>3; 2>3**			Bonferroni	**1>2.3; 2>3**			
Etakare	0.413	0.175			Etakare	0.240			
Lateral translations right knee					Lateral translations left knee				
T0	2.898±1.647	2.385±1.588	1.119	0.269	T0	2.556±1.941	3.208±1.833	-1.218	0.229
T1	2.775±1.625	2.356±1.568	0.926	0.359	T1	2.456±1.903	3.153±1.835	-1.317	0.194
T2	2.680±1.580	2.328±1.577	0.788	0.435	T2	2.355±1.807	3.133±1.836	-1.510	0.138
F^b	31.701	5.037			F^b	9.783	6.418		
p	**0.000**	**0.030**			p	**0.004**	**0.013**		
Bonferroni	**1>2.3; 2>3**	**1>2.3; 2>3**			Bonferroni	**1>2.3**	**1>2.3**		
Etakare	0.559	0.180			Etakare	0.281	0.218		

AG: Activator group, CG: Control group, SD: Standard deviation, $p<0.05$.

expectation bias, and nonspecific treatment effects. Therefore, improvements in the intervention group may partly reflect natural time-related changes and nonspecific effects (e.g., attention/Hawthorne effects) rather than a treatment-specific effect; accordingly, the results should be interpreted cautiously. Although randomization was applied and outcome assessments were performed by a blinded evaluator, the lack of participant and practitioner blinding may have influenced subjective outcomes, particularly quality of life and self-reported work role functioning measures. Second, the inclusion of a relatively large number of postural outcome variables increases the risk of type I error, even though FDR-based adjustments (Benjamini–Hochberg) were applied for the family of postural comparisons. However, residual false-positive risk cannot be fully eliminated when many correlated outcomes are tested; therefore, postural findings should be considered exploratory and interpreted cautiously, particularly when between-group differences are limited or inconsistent. Third, the reliance on within-group comparisons to describe improvements, while informative, does not provide the same level of causal inference as

Table 5. Changes in right and left lateral angulation measurements over time in activator and control groups

	AG (n=25) mean±SD	**CG(n=25) mean±SD**	**t^a**	**p**		**AG (n=25) mean±SD**	**CG(n=25) mean±SD**	**t^a**	**p**
Lateral angulations right head					Lateral angulations left head				
T0	10.900±6.108	12.513±6.036	-0.938	0.353	T0	9.523±6.115	12.704±4.727	-2.046	**0.046**
T1	10.699±6.045	12.467±5.958	-1.040	0.304	T1	9.335±6.035	12.671±4.712	-2.166	**0.035**
T2	10.492±5.894	12.417±5.871	-1.156	0.254	T2	9.222±6.037	12.621±4.679	-2.211	**0.032**
F^b	21.907	1.366			F^b	25.185	3.190		
p	**0.000**	0.261			p	**0.000**	0.068		
Bonferroni	**1>2.3; 2>3**				Bonferroni	**1>2.3; 2>3**			
Etakare	0.467				Etakare	0.502			
Lateral angulations right shoulder					Lateral angulations left shoulder				
T0	4.088±2.483	6.192±2.487	-2.990	**0.004**	T0	3.254±2.246	4.350±2.382	-1.675	0.100
T1	3.923±2.453	6.104±2.515	-3.103	**0.003**	T1	3.114±2.170	4.313±2.407	-1.852	0.070
T2	3.821±2.451	6.121±2.545	-3.255	**0.002**	T2	2.917±2.142	4.279±2.403	-2.119	**0.039**
F^b	56.985	4.615			F^b	18.256	2.931		
p	**0.000**	**0.033**			p	**0.000**	0.092		
Bonferroni	**1>2.3; 2>3**	**1>2**			Bonferroni	**1>2.3; 2>3**			
Etakare	0.695	0.167			Etakare	0.422			
Lateral angulations right hip pelvis					Lateral angulations left hip pelvis				
T0	5.196±4.937	6.767±3.817	-1.251	0.217	T0	6.704±4.364	7.817±4.191	-0.918	0.363
T1	4.882±4.611	6.675±3.801	-1.493	0.142	T1	6.377±4.089	7.763±4.111	-1.194	0.238
T2	4.805±4.628	6.663±3.779	-1.546	0.129	T2	6.323±4.142	7.742±4.101	-1.216	0.230
F^b	6.829	4.711			F^b	23.336	2.721		
p	**0.014**	**0.028**			p	**0.000**	0.102		
Bonferroni	**1>2.3; 2>3**	**1>2.3**			Bonferroni	**1>2.3; 2>3**			
Etakare	0.215	0.170			Etakare	0.483			
Lateral angulations right knee					Lateral angulations left knee				
T0	4.831±2.938	3.713±2.340	1.481	0.145	T0	4.062±2.942	4.983±2.766	-1.139	0.260
T1	4.650±2.868	3.638±2.333	1.363	0.179	T1	3.919±2.790	4.888±2.774	-1.230	0.225
T2	4.505±2.877	3.638±2.316	1.168	0.248	T2	3.846±2.801	4.888±2.761	-1.323	0.192
F^b	33.131	2.836			F^b	11.224	4.488		
p	**0.000**	0.094			p	**0.001**	**0.037**		
Bonferroni	**1>2.3; 2>3**				Bonferroni	**1>2.3; 2>3**	**1>2**		
Etakare	0.570				Etakare	0.310	0.163		

AG: Activator group, CG: Control group, SD: Standard deviation, $p<0.05$.

consistent between-group effects. Finally, the relatively short intervention duration and absence of long-term follow-up restrict conclusions regarding the sustainability of the observed improvements. Follow-up was limited to the immediate post-intervention assessment at Week 6, with no subsequent follow-up; therefore, the durability of effects beyond the intervention period remains unknown. Future studies should incorporate sham-controlled or active comparator designs, reduce the number of postural outcome measures to those of greatest clinical relevance, and include longer follow-up periods to better clarify the specific and lasting effects of instrument-assisted spinal manipulation. Because the sample size was feasibility-based and no a priori power analysis was performed, the study may be underpowered for small-to-moderate effects; therefore, non-significant findings should be interpreted cautiously. In addition, the modest sample size and the specific study population (office workers aged 20–45 years) may limit the generalizability of the findings to other occupational settings, age groups, or individuals with different baseline symptom profiles. Although participants spanned a broad age range (20–45

Table 6. Comparison of change scores of physical, mental, work role functioning, and postural parameters in activator and control groups

Groups	AG (n=25) mean±SD	CG (n=25) mean±SD	t	p	Hedges g [95% CI]	q (BH-FDR, postural)
Physical Change	4.250±4.153	-0.134±4.833	3.448	**0.001**	0.96 [0.38, 1.54]	
Mental Change	5.905±7.025	-1.104±4.958	4.045	**0.000**	1.13 [0.54, 1.73]	
Work Role Functionality Total Change	10.923±11.377	-2.750±3.768	5.607	**0.000**	1.59 [0.96, 2.22]	
Anterior Translations Head Change	-0.097±0.074	-0.037±0.095	-2.513	**0.015**	-0.69 [-1.26, -0.13]	0.023
Anterior Translations Shoulder Change	-0.060±0.081	-0.025±0.084	-1.483	**0.145**	-0.42 [-0.97, 0.13]	0.150
Anterior Translations Hip Pelvis Change	-0.135±0.117	-0.052±0.130	-2.380	**0.021**	-0.67 [-1.23, -0.11]	0.031
Anterior Angulations Head Change	-0.127±0.122	-0.017±0.146	-2.902	**0.006**	-0.80 [-1.36, -0.23]	0.011
Anterior Angulations Shoulder Change	-0.074±0.097	-0.017±0.101	-2.063	**0.045**	-0.57 [-1.12, -0.01]	0.057
Anterior Angulations Hip Pelvis Change	-0.089±0.122	-0.008±0.072	-2.812	**0.006**	-0.80 [-1.36, -0.23]	0.011
Posterior Translations Head Change	-0.121±0.106	-0.032±0.077	-3.391	**0.001**	-0.91 [-1.48, -0.33]	0.002
Posterior Translations Shoulder Change	-0.127±0.128	-0.003±0.051	-4.451	**0.000**	-1.23 [-1.81, -0.63]	0.001
Posterior Translations Hip Pelvis Change	-0.139±0.135	-0.033±0.070	-3.417	**0.001**	-0.94 [-1.51, -0.36]	0.002
Posterior Angulations Head Change	-0.145±0.133	-0.008±0.125	-3.748	**0.000**	-1.05 [-1.63, -0.46]	0.001
Posterior Angulations Shoulder Change	-0.061±0.098	0.004±0.075	-2.613	**0.012**	-0.72 [-1.29, -0.15]	0.020
Posterior Angulations Hip Pelvis Change	-0.130±0.169	-0.067±0.149	-1.406	0.166	-0.39 [-0.94, 0.16]	0.166
Lateral Translations Right Head Change	-0.199±0.123	-0.072±0.156	-3.206	**0.002**	-0.91 [-1.48, -0.33]	0.004
Lateral Translations Right Shoulder Change	-0.277±0.183	-0.083±0.186	-3.712	**0.001**	-1.04 [-1.62, -0.45]	0.002
Lateral Translations Right Hip Pelvis Change	-0.209±0.236	-0.075±0.161	-2.320	**0.025**	-0.63 [-1.19, -0.07]	0.034
Lateral Translations Right Knee Change	-0.218±0.172	-0.057±0.121	-3.795	**0.000**	-1.11 [-1.70, -0.52]	0.001
Lateral Angulations Right Head Change	-0.408±0.394	-0.096±0.368	-2.887	**0.006**	-0.78 [-1.34, -0.21]	0.011
Lateral Angulations Right Shoulder Change	-0.268±0.146	-0.071±0.190	-4.131	**0.000**	-1.15 [-1.74, -0.56]	0.001
Lateral Angulations Right Hip Pelvis Change	-0.391±0.690	-0.104±0.233	-1.935	0.059	-0.55 [-1.11, 0.01]	0.072
Lateral Angulations Right Knee Change	-0.326±0.237	-0.075±0.233	-3.771	**0.000**	-1.10 [-1.69, -0.51]	0.001
Lateral Translations Left Head Change	-0.208±0.155	-0.114±0.205	-1.846	0.071	-0.51 [-1.06, 0.05]	0.080
Lateral Translations Left Shoulder Change	-0.281±0.226	-0.089±0.165	-3.411	**0.001**	-0.97 [-1.54, -0.39]	0.002
Lateral Translations Left Hip Pelvis Change	-0.376±0.606	-0.080±0.193	-2.287	**0.027**	-0.66 [-1.22, -0.10]	0.036
Lateral Translations Left Knee Change	-0.201±0.299	-0.075±0.142	-1.886	0.065	-0.53 [-1.09, 0.03]	0.076
Lateral Angulations Left Head Change	-0.301±0.260	-0.083±0.204	-3.274	**0.002**	-0.92 [-1.49, -0.34]	0.005
Lateral Angulations Left Shoulder Change	-0.337±0.376	-0.071±0.192	-3.109	**0.003**	-0.88 [-1.45, -0.30]	0.006
Lateral Angulations Left Hip Pelvis Change	-0.381±0.346	-0.075±0.207	-3.749	**0.000**	-1.06 [-1.64, -0.47]	0.002
Lateral Angulations Left Knee Change	-0.215±0.295	-0.096±0.240	-1.563	0.125	-0.44 [-0.99, 0.12]	0.135

AG: Activator group, CG: Control group, SD: Standard deviation, CI: Confidence interval, p<0.05.

years), we did not perform prespecified age-adjusted or age-stratified analyses; thus, residual age-related heterogeneity may have influenced change scores, and future studies with larger samples should evaluate age as a potential covariate or effect modifier.

Conclusion

This study indicates that spinal manipulation delivered with the Activator Method was associated with improvements in posture, physical quality of life, and work role functioning in office workers who sit for prolonged periods. The results suggest that Activator Method–assisted care may be considered a potentially useful, non-invasive adjunct for addressing postural and musculoskeletal problems associated with sedentary work; however, these findings should be interpreted cautiously given the study limitations.

Disclosures

Ethics Committee Approval: The study was approved by the Gümüşhane University Scientific Research and Publication Ethics Committee (no: 2022/6, date: 26/10/2022).

Informed Consent: Informed consent was obtained from all participants.

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References

1. Thorp AA, Healy GN, Winkler E, Clark BK, Gardiner PA, Owen N, et al. Prolonged sedentary time and physical activity in workplace and non-work contexts: a cross-sectional study of office, customer service and call centre employees. Int J Behav Nutr Phys Act 2012;9:128.
2. Evans RE, Fawole HO, Sheriff SA, Dall PM, Grant PM, Ryan CG. Point-of-choice prompts to reduce sitting time at work: a randomized trial. Am J Prev Med 2012;43(3):293–7.
3. Kendall FP, McCreary EK. Músculos: Pruebas funcionales, postura y dolor. Madrid: Marbán; 2007. [In Spanish]
4. O'Sullivan K, O'Keeffe M, O'Sullivan L, O'Sullivan P, Dankaerts W. Perceptions of sitting posture among members of the community, both with and without non-specific chronic low back pain. Man Ther 2013;18(6):551–6.
5. Nair S, Sagar M, Sollers J 3rd, Consedine N, Broadbent E. Do slumped and upright postures affect stress responses? A randomized trial. Health Psychol 2015;34(6):632–41.
6. Roffey DM, Wai EK, Bishop P, Kwon BK, Dagenais S. Causal assessment of awkward occupational postures and low back pain: results of a systematic review. Spine J 2010;10(1):89–99.
7. Cooperstein R, Perle SM. Chiropractic technique: principles and procedures. In: Haldeman S, editor. Principles and practice of chiropractic. 3rd ed. New York: McGraw-Hill; 2005. p. 283–300.
8. Plaugher G, Lopes MA. The Activator method chiropractic technique. 2nd ed. St. Louis: Mosby; 2001.
9. Haas M, Vavrek D, Peterson D, Polissar N, Neradilek MB. Dose-response and efficacy of spinal manipulation for care of chronic low back pain: a randomized controlled trial. Spine J 2014;14(7):1106–16.
10. Gudavalli MR, Cambron JA, McGregor M, Jedlicka J, Keenum M, Ghanayem AJ, et al. A randomized clinical trial and subgroup analysis to compare flexion-distraction with active exercise for chronic low back pain. Eur Spine J 2006;15(7):1070–82.
11. Abma FI, van der Klink JJ, Bültmann U. The work role functioning questionnaire 2.0 (Dutch version): examination of its reliability, validity and responsiveness in the general working population. J Occup Rehabil 2013;23(1):135–47.
12. Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Med Care.1996;34(3):220–33.
13. Ware JE, et al. User's manual for the SF-12v2 Health Survey. Lincoln (RI): QualityMetric Inc; 2005.
14. Moreira R, Teles A, Fialho R, Baluz R, Santos TC, Goulart-Filho R, et al. Mobile applications for assessing human posture: a systematic literature review. Electronics 2020;9(8):1196.
15. Fuhr AW, Menke JM. Status of activator methods chiropractic technique, theory, and practice. J Manipulative Physiol Ther 2005;28(2):e1–e20.
16. Janwantanakul P, Pensri P, Jiamjarasrangsri V, Sinsongsook T. Prevalence of self-reported musculoskeletal symptoms among office workers. Occup Med (Lond) 2008;58(6):436–8.
17. Walker MJ, Boyles RE, Young BA, Strunce JB, Garber MB, Whitman JM, et al. The effectiveness of manual physical therapy and exercise for mechanical neck pain: a randomized clinical trial. Spine (Phila Pa 1976) 2008;33(22):2371–8.
18. von Heymann WJ, Schloemer P, Timm J, Muehlbauer B. Spinal high-velocity low amplitude manipulation in acute nonspecific low back pain: a double-blinded randomized controlled trial in comparison with diclofenac and placebo. Spine (Phila Pa 1976) 2013;38(7):540–8.
19. Zhou T, Salman D, McGregor AH. Recent clinical practice guidelines for the management of low back pain: a global comparison. BMC Musculoskelet Disord 2024;25(1):344.
20. Abma FI, Bültmann U, Amick Iii BC, Arends I, Dorland HF, Flach PA, et al. The work role functioning questionnaire v2.0 showed consistent factor structure across six working samples. J Occup Rehabil 2018;28(3):465–74.
21. Hopkins BB, Vehrs PR, Fellingham GW, George JD, Hager R, Ridge ST. Validity and reliability of standing posture measurements using a mobile application. J Manipulative Physiol Ther 2019;42(2):132–40.
22. Pickar JG. Neurophysiological effects of spinal manipulation. Spine J 2002;2(5):357–71.
23. Shrestha N, Kukkonen-Harjula KT, Verbeek JH, Ijaz S, Hermans V, Pedisic Z. Workplace interventions for reducing sitting at work. Cochrane Database Syst Rev 2018;12(12):CD010912.
24. Russo F, Papalia GF, Vadalà G, Fontana L, Iavicoli S, Papalia R, et al. The Effects of workplace ınterventions on low back pain in workers: a systematic review and meta-analysis. Int J Environ Res Public Health 2021;18(23):12614.