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The acute effect of Bowen therapy on pressure pain thresholds and postural sway in healthy subjects

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ABSTRACT

Objective: The purpose of the study is to determine the immediate effect of Bowen Therapy in pressure pain threshold and postural sway of healthy individuals.
Design: Crossover, randomized, and double blinded study.
Setting: University.
Participants: Participants aged 18 years old or over, naïve to Bowen therapy were recruited among university students. An a priori sample size calculation determined that 34 participants were needed.
Methods: Each participant attended two sessions and received Bowen Therapy and a sham procedure. The order in which Bowen or the sham procedure were administered was randomized. All participants had their postural control and pressure pain thresholds assessed in sessions 1 and 2 both at baseline and at the end of the session.
Main outcome measurements: Postural control was assessed using a force plate and centre of pressure antero-posterior and medio-lateral displacement, velocity and total sway area were calculated. Pressure pain threshold was measured at 10 different body sites on the paraspinal muscles from C1 to S1 using an electronic algometer.
Result: The results showed a significant increase in the anteroposterior displacement ($p = 0.04$) and a significantly lower decrease in the mean velocity ($p = 0.01$) of the centre of pressure and a significant increase in the pressure pain thresholds of two (out of ten; $p \leq 0.04$) body sites in the group receiving Bowen Therapy compared to the group receiving the sham. No other significant differences were found.
Conclusions: The findings suggest that Bowen Therapy has inconsistent immediate effects on postural control and pain threshold in healthy subjects. Further studies are needed using symptomatic participants.

1. Introduction

The fascia is a continuous viscoelastic connective tissue that forms a three-dimensional net of functional collagen that supports, suspends, protects and connects muscle, skeletal, nervous, circulatory and visceral components (Tozzi et al., 2011). It is virtually inseparable from all other body structures and maintains continuity between tissues, supporting and facilitating their function (Kumka and Bonar, 2012). The connective tissue and, in particular, the fascia are richly innervated (van der Wal, 2009; Willard et al., 2012). Studies with electronic microscopy and contrast procedures have demonstrated that the fascia has both free nerve endings and encapsulated nerve endings (Benjamin, 2009; Kumka and Bonar, 2012; Willard et al., 2012) suggesting that it may have an important role in proprioception and nociception.

The fascia has been implicated in several pathologies, such as compartmental syndromes, fibromyalgia or Dupuytran contracture (Benjamin, 2009) and low back pain (Schilder et al., 2014). Changes in fascial tissue can include the formation of fibrosis and adhesions associated with immobilization or abnormal movement patterns, tissue discontinuities, chronic inflammation and/or changes in sensitivity due to neuroplastic changes of the nerve endings (Corey et al., 2011; Langevin et al., 2011; van der Wal, 2009).

Myofascial therapies are designed to free the points of tension or decreased fascial mobility, decrease pain and restore function.

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The proposed mechanisms of action are based on the plastic, viscoelastic and piezoelectric changes in fascia (Fratzl, 2008). One of the myofascial therapies is Bowen Therapy, which is a dynamic fascial and muscle release approach, consisting of gentle cross-fiber movements applied to the fascia, muscles, tendons, muscle insertions, muscle septa, ligaments and viscera (Black and Murray, 2005; Carter, 2002a,b; Duncan et al., 2011; Marr et al., 2011; Whitaker et al., 1997). The cross-fiber procedure is called the Bowen movement and is considered the active principle of Bowen Therapy. The Bowen movements are applied at specific body regions in precise sequences, separated by a 2 minute rest and aims to induce smooth fascial stretching (Black and Murray, 2005; Carter, 2002a,b; Duncan et al., 2011; Marr et al., 2011; Whitaker et al., 1997; Baker, 2013). The Bowen Therapy was developed in the 50's by Tom Bowen in Australia (Chaitow and Baker, 2014). Studies investigating the effects of Bowen Therapy are scarce. A search in Pubmed performed on January 2016 using the words "Bowen Therapy" retrieved 5 studies related to Tom Bowen's work. Among these 5 references is a systematic review (Hansen and Taylor-Piliae, 2011), which reports to have found 1 randomized clinical trial and two quasi-experimental trials. These findings highlight the need for more research investigating the effects of Bowen Therapy. For this reason we decided to conduct a double-blind, placebo-controlled and randomized crossover trial to evaluate the acute effect of Bowen Therapy on pressure pain thresholds (PPT) and on postural control in healthy individuals. A sample of healthy individuals was chosen to inform future studies on Bowen's Therapy and evaluate any potential risks related to the procedure.

2. Methods

Data was collected in the Human Movement Lab at the School of Health Sciences, Aveiro University. Each participant attended two sessions between June and July 2014, and received Bowen Therapy in one session and a placebo procedure in the other session. The study was approved by the Ethics Committee of the Social and Health Sciences Department, Faculty of Medicine, Porto University, March 2014. Before data collection, all participants gave their written informed consent.

2.1. Participants

A total of 34 healthy participants, recruited among the students at the University of Aveiro were invited to participate in the study by one of the researchers. The sample size was calculated a priori using the GPower software version 3.1 (Faul, Erdfelder, Lang, & Buchner, Kiel), based on an $\alpha = 0.05$, power of 80% and a medium effect size (0.5).

To enter the study, participants had to be 18 years old or more and naïve to Bowen Therapy. Participants were excluded if they, report pain in the cervical, dorsal or lumbar spine, spine, trunk and/or limbs surgery, major structural changes (congenital or acquired) in the spine and/or upper and lower limbs, severe postural changes, pregnancy, previous injuries in the vestibular system, uncorrected visual changes, major musculoskeletal, neurological or cardiac pathology or consumption of alcoholic beverages or other substances that may alter the balance in the 24 h prior to data collection (Fernandez-de-Las-Penas et al., 2008; Jones, 2004).

2.2. Measurement procedures

Demographic, anthropometric, PPT and postural control data were collected. Measurement procedures are specified below. Postural control measurements were performed by an assessor (the laboratory technician that operates the Nexus software version 1.8, Vicon, Oxford) and PPT measurements by another assessor (a psychology student appropriately trained by the 1st author), both were blind to the intervention, before and immediately after the intervention. Participants were not told whether they were receiving the intervention or the placebo procedure and advised not to talk about the intervention with the assessors.

2.3. Randomization and allocation concealment

Each participant attended two sessions and received Bowen Therapy in one session and a placebo procedure in the other session. The procedure received in session 1 (Bowen Therapy or placebo) was randomized using a blocked sequence of single numbers (either 1 or 2) generated using the research randomizer software (www.randomizer.org). Before generating the sequence, it was defined that number 1 would represent Bowen Therapy and number 2 the placebo procedure. Randomization was blocked so that each procedure was applied in session 1 for the same number of participants (see Fig. 1). The information on the procedure that each participant would receive was inserted into a sealed opaque envelope with the participant number written on the front (34 individual envelopes). Envelopes were prepared by a researcher not involved neither in the assessment of participants nor in the delivery of the intervention/placebo and handed to the therapist delivering it just before application of the Bowen Therapy/placebo.

2.4. Bowen therapy and placebo

Bowen Therapy consisted on the application of sequences 1, 4, 2, hamstrings (movements 1–6) and sacrum sequences in the prone position, and hamstrings sequence (7–18 movements) and 3 in the supine position, according to ISBT Bowen Therapy® (Black and Murray, 2005). This sequences included Bowen movements in the scalenes, trapezius, all erector spinae, sacro-iliac joint ligaments, gluteus maximus and medius, tensor fasciae latae, hamstrings and gastrocnemius (Black and Murray, 2005).

The placebo consisted of placing the hands on the skin on the exact same anatomical points used for the application and with the same moments of pause of Bowen Therapy, including the change of position, but without applying Bowen movement, which is considered the active principle of this technique.

The intervention (Bowen Therapy and placebo) took around 40 min to be applied. The intervention was performed by a physiotherapist with 8 years of experience, who is a certified Bowen Therapist by the International School of Bowen Therapy, and has applied Bowen Therapy in clinical practice for the last 6 years.

In session two, with a minimum interval of five days, individuals who have been applied Bowen Therapy in the first session received the placebo procedure and vice versa.

2.5. Assessment of postural control

Postural control was measured in static standing using a force plate (AMTI MSA-6). Data were collected using the Nexus software version 1.8 (Vicon, Oxford), and processed using Matlab version R2014a (MathWorks, Natick) to compute: total sway area, anteroposterior and mediolateral centre of pressure (COP) displacement and mean COP velocity. Participants were instructed to stand on the platform, barefoot, eyes closed, with both feet together, arms at their side and to remain in this position as quiet as possible for 90s. Data were collected at a frequency of 1000 Hz and measurements were repeated 3 times. Between measurements, subjects were instructed to walk around the lab for 15 s. These procedures are in line with international recommendations and aim to increase the reliability of data collection (Ruhe et al., 2010). The force platform is

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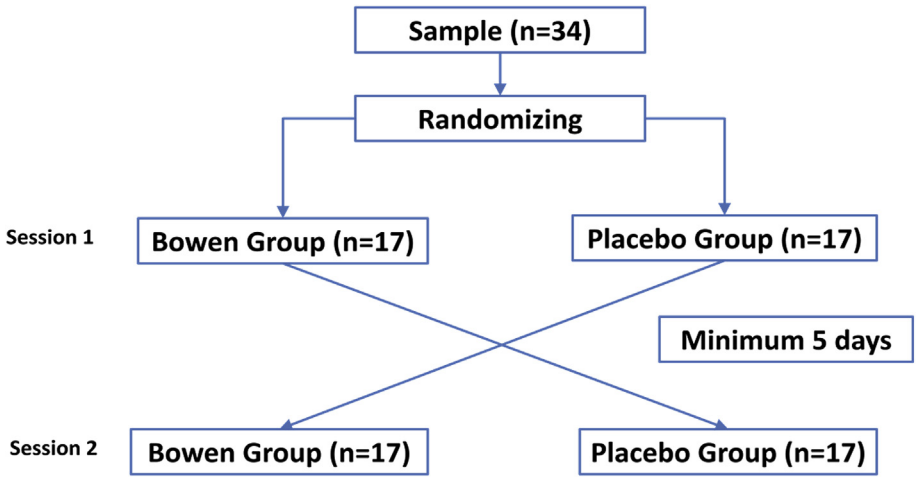

Fig. 1. Study flowchart.

considered the gold standard for postural control measurements (Clark et al., 2010; Ruhe et al., 2010).

2.6. Pressure pain threshold assessment

The PPT was measured at 10 anatomical points with an electronic pressure algometer (Commander of JTECH Medical) attached to a rubber tip with 1 cm^2 diameter. Measurements were performed in the prone position and sequentially in the following anatomical segments: i) 1 cm above and 1.5 cm lateral (left and right) to the spinous process of C2, ii) 1.5 cm lateral to the spinous process of T1 (left and right), iii) 2 cm lateral to the spinous process of T8 (left and right), iv) 2 cm lateral to the spinous process of L1 (left and right) and v) 2 cm lateral to the spinous process of S1 (left and right). These points were identified via palpation, based on the spinous process of C2 (the first palpable spinous process caudal to the occipital), T8 (which is at the level of the inferior angle of the scapulae), and S1 (which is located one level above the posterior superior iliac spines) (Muscolino, 2008). Points were marked on the skin to minimise differences in the location where PPTs were measured before and after the application of both the Bowen Therapy and the placebo procedure. Measurements were made directly on the skin, vertically to the anatomical points, with a pressure progression of 5 N/s and an interval of 20s between measurements. PPT were measured 3 times at each anatomical point. The evaluator underwent familiarization training with the algometer before the study. The first measurement of pain threshold was held in the anterior region of the hand in order to familiarize the participant with the procedure. The participant was asked to say "pain" when the pressure first changed to pain. These procedures are in line with international recommendations and aim to increase the reliability of data (Chesterton et al., 2007; Frank et al., 2013; Lacourt et al., 2013). The pressure algometer is valid for the measurement of pressure when compared to a force platform ($r = 0.99$) (Kinser et al., 2009). The pressure algometer is also reliable with values for intra reliability between 0.91 and 0.99 (Vaughan et al., 2007).

Postural control and PPT were evaluated before and after the application of the intervention/placebo in both session 1 and session 2.

2.7. Data analysis

Data were analyzed using the Statistical Package for Social Sciences version 22 (IBM, New York). Descriptive statistics as the mean and standard deviation were used for continuous variables and frequency was used for ordinal and nominal variables. Data normality was tested with the Shapiro-Wilk test and, like most of the variables showed a normal distribution ($p > 0.05$) we used parametric statistics. Thus, an independent *t*-test was used to compare postural control and PPTs at baseline between session 1 and session 2. A paired samples *t*-test was used to investigate differences between placebo and Bowen Therapy for both postural control and PPT variables. As recommended in the literature for cross-over studies (Kirkwood and Sterne, 2003), we subtracted the baseline measurement to the post intervention/placebo measurements and used the difference in the statistical analysis. Statistical significance was set at $p < 0.05$.

3. Results

A total of 34 participants, 18 females (52.9%) and 16 males (47.1%), with a mean (±SD) age of 22.0 (±2.2) years, a mean (±SD) height of 168.0 (±10.3) cm and a mean (±SD) weight of 65.9 (±13.3) kg entered the study.

No statistically significant differences were found for baseline measurements between session 1 and session 2 ($p > 0.05$). These results indicate that both groups were similar in terms of postural control and PPTs in session 1 and session 2 and suggest that receiving Bowen in session 1 did not affect measurements taken in session 2 (see Table 1).

3.1. Bowen therapy effect on postural control and pressure pain threshold

Mean differences for postural control and PPTs before and after the intervention are shown in Table 2. The results showed a statistically significant increase in the antero-posterior displacement of the COP after Bowen Therapy compared with placebo ($p = 0.04$) and a significantly lower decrease in the COP velocity in the Bowen Therapy group ($p = 0.01$) compared to the placebo group. Regarding pain, a significant increase was found for PPTs after Bowen Therapy compared to placebo at C1 bilaterally (left: $p = 0.02$; right: $p = 0.04$). No statistically significant differences were found for the remaining comparisons, despite a trend towards the increase of PPTs after Bowen Therapy in all the remaining 8 body sites (suggesting a potential hipoalgesic effect of Bowen Therapy).

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Table 1
Comparison between baseline session 1 and session 2.

	Variable	Baseline Bowen S1	Baseline placebo S1	*p* value	Baseline Bowen S2	Baseline placebo S2	*p* value
		Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
Postural Sway	COPx (cm)	3,24 ± 0,81	3,61 ± 0,90	0,25	3,68 ± 0,67	3,75 ± 0,93	0,81
	COPy (cm)	3,54 ± 0,94	4,19 ± 0,95	0,07	3,85 ± 0,92	3,56 ± 0,77	0,37
	VelCOP (cm/s)	1,76 ± 0,54	1,95 ± 0,71	0,34	1,85 ± 0,36	1,89 ± 0,75	0,83
	ÁreaCOP (cm^2)	6,12 ± 2,65	7,48 ± 3,16	0,21	7,29 ± 2,80	6,90 ± 3,03	0,73
Pressure Pain Threshold	C1L (N/cm^2)	13,82 ± 5,62	16,58 ± 6,87	0,14	14,94 ± 5,33	13,25 ± 4,52	0,25
	C1R (N/cm^2)	12,67 ± 6,25	14,54 ± 6,41	0,41	14,00 ± 5,21	12,53 ± 5,16	0,38
	T1L (N/cm^2)	27,40 ± 11,06	32,34 ± 12,30	0,15	28,04 ± 10,94	26,07 ± 11,16	0,54
	T1R (N/cm^2)	29,08 ± 14,32	31,78 ± 12,99	0,49	27,60 ± 11,54	24,97 ± 10,97	0,43
	T8L (N/cm^2)	33,81 ± 19,13	36,30 ± 17,26	0,64	32,95 ± 13,01	28,90 ± 11,72	0,27
	T8R (N/cm^2)	32,10 ± 12,80	33,35 ± 9,98	0,73	31,60 ± 11,85	26,85 ± 8,99	0,15
	L1L (N/cm^2)	34,76 ± 15,37	35,17 ± 11,39	0,92	32,24 ± 12,79	31,44 ± 14,21	0,86
	L1R (N/cm^2)	33,40 ± 14,32	35,57 ± 10,09	0,57	33,73 ± 12,24	31,50 ± 11,92	0,45
	S1L (N/cm^2)	35,05 ± 14,35	35,41 ± 10,59	0,92	30,15 ± 12,84	34,72 ± 15,09	0,37
	S1R (N/cm^2)	37,47 ± 15,08	37,94 ± 12,02	0,90	34,03 ± 16,34	34,63 ± 12,80	0,90

Postural Sway: COPx – Centre of pressure medio-lateral displacement. COPy – Centre of pressure antero-posterior displacement. VelCOP – Centre of pressure mean velocity displacement. AreaCOP – Centre of pressure displacement area. Pressure pain threshold: C1L – At C1 level left side. C1R – At C1 level right side. T1L – At T1 level left side. T1dta – At T1 level right side. T8L – At T8 level left side. T8R – At T8 level right side. L1L – At L1 level left side. L1R – At L1 level right side. S1L – At S1 level left side. S1R – At S1 level right side.

Table 2
Means difference between Bowen and placebo groups.

	Variable	Bowen (After-Before)	Placebo (After-Before)	*p* value
		Mean ± SD	Mean ± SD	
Postural Sway	COPy (cm)	0.51 ± 0.76	0.20 ± 0.64	0.04
	COPx (cm)	0.17 ± 0.69	−0.03 ± 0.62	0.21
	VelCOP (cm/s)	−0.01 ± 0.25	−0.19 ± 0.32	0.01
	AreaCOP (cm^2)	1.44 ± 2.35	0.57 ± 2.32	0.10
Pressure Pain Threshold	C1L (N/cm^2)	2.92 ± 4.04	0.92 ± 4.36	0.02
	C1R (N/cm^2)	1.83 ± 3.95	0.27 ± 3.80	0.04
	T1L (N/cm^2)	3.64 ± 6.76	2.65 ± 6.01	0.53
	T1R (N/cm^2)	3.85 ± 5.57	1.76 ± 5.24	0.10
	T8L (N/cm^2)	3.89 ± 8.72	1.54 ± 6.79	0.21
	T8R (N/cm^2)	3.31 ± 7.60	1.66 ± 5.42	0.31
	L1L (N/cm^2)	5.16 ± 7.49	2.26 ± 7.36	0.08
	L1R (N/cm^2)	4.40 ± 5.34	2.35 ± 7.70	0.12
	S1L (N/cm^2)	7.53 ± 10.76	3.79 ± 9.21	0.12
	S1R (N/cm^2)	5.18 ± 8.82	2.61 ± 11.07	0.26

Postural Sway: COPx – Centre of pressure displacement. COPy – Centre of pressure antero-posterior displacement. VelCOP – Centre of pressure mean velocity displacement. AreaCOP – Centre of pressure displacement area. Pressure pain threshold: C1L – At C1 level left side. C1R – At C1 level right side. T1L – At T1 level left side. T1dta – At T1 level right side. T8L – At T8 level left side. T8R – At T8 level right side. L1L – At L1 level left side. L1R – At L1 level right side. S1L – At S1 level left side. S1R – At S1 level right side.

4. Discussion

To our knowledge this is the first study investigating the acute effect of Bowen Therapy on postural control and PPTs. The results show a significant increase in the anteroposterior displacement of the COP and **a** significantly lower decrease in the COP velocity, and an increase in the PPTs at two (out of 10) body sites after Bowen Therapy compared to placebo.

The general lack of statistically significant differences for PPTs after the application of Bowen Therapy compared to placebo may be due to the fact that participants were healthy volunteers. To our knowledge, the effect of Bowen Therapy on PPT has not been studied. Previous studies applying other manual therapy techniques in pain-free subjects show conflicting results. Hamilton et al. (2007) found no effect of cervical spine manipulation and muscle energy techniques on PPT and Soon et al. (2010) reported no significant effects of a grade III unilateral posteroanterior mobilization technique on the C5/6 motion segment on PPT. In contrast, Ruiz-Saez et al. (2007) found a trend toward an increase of the PPT when comparing the effect of applying unilateral manipulation at C3–C4 against placebo assessed at trigger points in the ipsilateral trapezius. Similarly, Fernandez-de-Las-Penas et al. (2008) reported that manipulation of C7-T1 increased PPT at C5–C6 zygapophyseal joints when compared to placebo. It is possible that differences in the intervention and study procedures might explain the different study results. Nevertheless, the trend towards an increase in PPT after Bowen Therapy application found in the present study, suggests that it may have some hipoalgesic effect, and further research using larger samples of both symptomatic and asymptomatic participants are recommended. The few studies that evaluated the effects of Bowen Therapy on pain used pain intensity scales and symptomatic individuals. The authors of these studies state that Bowen Therapy is effective in reducing pain intensity in individuals with pain (Dicker, 2005; Carter, 2002b; Whitaker et al., 1997). Nevertheless, these studies lack a control group against which to compare Bowen Therapy effects.

The increase in the anterior-posterior displacement of the centre of pressure, usually associated with a lower postural control (Ruhe et al., 2013), after application of Bowen Therapy may be due to a neurophysiologic change in the fascial network consequent to Bowen Therapy that require time to be integrated (Tozzi et al., 2011; van der Wal, 2009). The clinical practice of Bowen Therapy suggests

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that the body undergoes changes up to five days after treatment and that these changes are stronger in the first two days. Thus, it is possible that the Bowen Therapy promotes an immediate new proprioceptive standard that has to be integrated into the body schema. It is also possible that bipedal stance (the position used for postural control measurements) was not challenging enough to detect the effect of Bowen Therapy as this is the only variable (out of 4) showing a negative effect of Bowen Therapy. The effect of Bowen Therapy on postural control needs to be further investigated in more challenging positions (e.g. unipodal stance, dynamic tasks). Therefore, no firm conclusion can be made on the effects of Bowen Therapy on postural control for the following reasons: i) a significant effect was only found for 2 out of 4 variables; ii) the direction of the effect on these 2 variables is inconsistent (while the increase in the AP displacement in the Bowen group compared with the placebo group, suggests a negative effect on postural control in the Bowen group, the COP velocity mean value shows a decrease in both groups, and a decrease in COP velocity is usually considered to be associated with an improvement in postural control (Ruhe et al., 2011). Nevertheless, the increase in the AP displacement of the COP may indicate a possible compromise of postural control immediately after the application of Bowen Therapy. This should bring the Bowen therapists to instruct their patients that their postural control may be altered after treatment and should take special care in fall risk situations.

As for PPT and to the best of our knowledge, the effect of the Bowen Therapy on postural control has not been studied. Studies investigating the acute effect of other manual therapies on postural control in healthy individuals suggest that manual therapy does not significantly alter postural control in healthy individuals. A systematic review of Ruhe et al. (2013) concluded that there was no evidence that manual interventions lead to a change in postural sway in healthy individuals. Furthermore, the authors suggest that changes in postural control in symptomatic individuals may be a consequence of changes in pain intensity rather than a direct consequence of manual therapy on postural control.

In this study, a protocol of 6 sequences of ISBT Bowen Therapy (sequences 1, 4, 2, sacrum, hamstrings and 3) was chosen a priori, which differs from clinical practice where the choice of the sequences applied depends on the assessment of the patient. Nevertheless, in this study there was a need to standardize the application of Bowen Therapy. For this reason, it was decided to apply the sequences that address the scalenes, trapezius, all erector spinae, sacro-iliac joint ligaments, gluteus maximus and medius, tensor fasciae latae, hamstrings and gastrocnemius bilaterally as, anecdotally, this is believed to be one of the most used Bowen sequences in clinical practice. A similar sequence was also used by Marr et al. (2011) and Yadav (2013), when investigating the effect of Bowen Therapy on the flexibility of the hamstrings and Hansen (2012) who investigated the effect of Bowen Therapy on the upper limb recovery after breast cancer (Yadav, 2013; Hansen, 2012; Hamilton et al., 2007; Soon et al., 2010; Ruiz-Saez et al., 2007; Fernandez-de-Las-Penas et al., 2008).

4.1. Limitations of the study and future research

This study has some limitations. In particular, failure to use participants with pain limits the clinical usefulness of this study. However and due to the small number of studies on Bowen Therapy, it was chosen an asymptomatic sample to characterise Bowen effect and to serve as a comparison for future studies using symptomatic participants. A potential compromise of the assessor blinding as the application of Bowen Therapy leads to flushing of the skin (what did not happen with the placebo). The participants weren't asked if they knew which intervention was applied and therefore, a potential breach to participants' blinding was not assessed. Bowen's Therapy potential side and long term effects weren't investigated. These limitations should be considered when designing future studies on Bowen Therapy.

Nevertheless, this study also has some strengths, particularly the use of reliable procedures for the assessment of postural control and PPT, the attempt to blind both the assessors and the participants and the use of a placebo procedure that attempted to mimic Bowen Therapy except for the Bowen movements, which is believe to be the active principle of the technique.

5. Conclusion

This study results suggest that Bowen Therapy has no consistent effects on both postural control and PPT for healthy participants immediately after its application and when compared to placebo. Further rigorous studies with larger samples and symptomatic individuals should be conducted.

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