

The Effectiveness of Dry Cupping and Hot Pack in Pain Relief and Reduce Functional Disability on Non-specific Low Back Pain

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Abstract: The objective of this study was to identify the effectiveness of dry cupping and hot pack on pain relief and reduce functional disability for patients with non-specific low back pain. A total of 39 patients with non-specific low back pain from Sultan Idris Education University, Malaysia who fulfilled the inclusion criteria were chosen as participants using purposive sampling methods. The participants were randomly assigned equally (N=13) into dry cupping group, hot pack group and control group. Dry cupping group received a session of treatment in a week, hot pack group received twice a week of treatment session and control group had no treatment, but the participants were allowed to continue their previous treatment. Numerical Pain Rating Scale (NPRS) was used to measure pain intensity and Oswestry Disability Index (ODI) was used to measure functional disability before and after the intervention for all three groups. Data was analyzed using one-way ANOVA with significant level was predetermined at $p < 0.025$ prior to study. The study findings indicated that both dry cupping group and hot pack group showed significant improvement on pain relief ($p = 0.001$) and functional disability ($p = 0.001$) after completing the interventions when compared to control group. Therefore, both dry cupping and hot pack were found to be effective interventions for pain relief and reduce functional disability among patients with non-specific low back pain. Health professional practice are suggested to include dry cupping therapy as another choice of treatment in treating patients with non-specific low back pain.

Keywords : Low Back Pain, Hot Pack, Dry Cupping, Pain, Functional Disability

1. Introduction

Low back pain is a major health problem worldwide with well-recognized disabling consequences. It is the leading cause of disability in high income countries in almost all Latin American, Asian, and Middle Eastern countries [1]. The chronic low back pain patients have large number of difficulties in their activity daily living (ADL) compared to patients with other musculoskeletal diseases [2].

The acute stage of low back pain usually has a good prognosis with better improvement within the first six weeks. However, most people may take their first episode lightly with little expectation of recurrence. Therefore, 60 percent of recurrence low back pain is due to the

increase level of pain and functional disability [3,4]. Furthermore, if low back pain remains past six weeks, the subsequent healing is likely to be delayed [3]. This condition will lead to chronic stage with the pain is attribute to non-specific low back pain.

Recently, cupping has gained immense popularity as the element of pleasure and relaxation with therapeutic values for relieving pain and discomfort on patients with low back pain [5, 6, 7]. Moreover, cupping therapy has been popular in sports setting as noted from London, 2012 and Rio Olympics, 2016 where athletes were seen with cupping marks on their bodies drawing media attention. Infact, a study conducted by Murray, D. & Clarkson, C. (2019) stated that cupping therapy able to boost sport performance [8].

In Saudi Arabia, after spiritual healing and herbal medicine, cupping therapy is the third most common traditional practice [5]. The World Health Organization in 2019 stated that in 2017, more than 400 cupping practitioners and more than 20 cupping clinics were licensed in Saudi Arabia. Previously, Far East countries such as Brunei, Malaysia, Cambodia and Bangladesh practiced dry cupping compared to Middle East and Eastern Europe nations that prefer to practice wet cupping therapy [9]. The WHO Global Report on Traditional and Complementary Medicine (TCM) in 2019 stated that Brunei, Malaysia and Singapore have listed both dry and wet cupping therapy under its list of services in the TCM category. However, its usage frequency is not known. Besides, the physiotherapists in Bahrain noticed that their patients are likely to combine physiotherapy treatment with cupping methods as the patients gave feedback on their success or failure in managing their low back pain symptoms during physiotherapy consultations [10]. It same goes to patients in Malaysia who often try complementary methods after the main treatments unsuccessfully give relief.

The study conducted by Markowski et al. (2014) stated that dry cupping was giving benefit for low back rehabilitation by lessen pain with improvise muscle guarding of superficial muscles, improved range of motion, activated postural muscles and promoted functional based training [11]. The dry cupping may be a less risk with economically, short time and cost effective for low back rehabilitation either subacute or chronic pain. In addition, cupping is not typically used in western medicine but has started to be used more in the physiotherapy profession in order to relieve musculoskeletal pain and help to increase blood flow to the site of injury to fasten the healing process [10, 12].

The study for cupping therapy on patients with non-specific low back pain is limited since it is complementary way whereby many of researchers stated that it is better alternatives for low back pain [13,14,15]. In contrast, the general practitioner in hospital will refer patients with non-specific low back pain to physiotherapy for conservative treatment.

The physiotherapist will use therapeutic modalities which been categorized either physical agent or electrotherapeutic for pain management and improve functional ability. The therapeutic modalities had been a core usage in physiotherapy practice since the establishment of profession and it remained in physiotherapy curriculum [16, 17, 18]. Therefore, hot pack which categorized in physical agent of therapeutic modalities is being used frequently in physiotherapy setting [19]. Infact, a study conducted by Nadler et al. (2002) revealed that the patients with non-specific low

back pain successfully treated with heat wrap therapy compared to acetaminophen and ibuprofen which were oral analgesics [20].

Even though many researchers said that hot pack is one of the effective treatments in conservative way with no surgical procedure and medication given, many patients continuously looking for cupping therapy to treat their non-specific low back pain. The researcher compared dry cupping with hot pack because both treatments are easily installed even from home, inexpensive and safe.

Therefore, the researcher wants to determine which treatments; either complementary or conservative is more effective to reduce pain and functional disability among patients with non-specific low back pain. Furthermore, there were no previous studies that have explored the effects of dry cupping and hot pack in a single study for treating patients with non-specific low back pain.

2. Research Method

This Randomized Controlled Trial design study was conducted in Sultan Idris Education University. The sampling method used was purposive sampling. The participants were recruited through the advertisement and initially screened via a standardized telephone interview. Then, the potential participants were seen by a study physician, who took their medical histories and performed the physical examinations. The pain score of participants must be at least 4/10 on Numerical Pain Rating Scale (NPRS) and functional disability score of Oswestry Disability Index (ODI) must be more than 21 percent. After participants signed the inform consent, they were randomly inserted into dry cupping group, hot pack group and control group by means of sequentially numbered, sealed opaque envelopes. The randomisation process was prepared by the independent researcher, who will not participate in other study procedures in order to avoid bias. During collecting data, the schedule for treatments will be different so that there did not contacting between groups. In addition, the participants were agreeing to continue their lifestyle as usual without doing intense exercises and taking extra caffeine, processes meat and fast food as it will affecting the healing process. The participants also were prohibited to use hot shower, sauna or any other hot equipment as it will affect the final outcomes.

The inclusion criteria were male and female, 18 years old and above, diagnosed with non-specific low back pain by the general practitioner for at least the previous three months. The treatment was conducted by the researcher who is the physiotherapist with certificate in cupping. Most important, the researcher ensured that full efforts were invested in each session and closer supervision on treatment progress was given. The exclusion criteria were the participants had red flags with specific causes of low back pain including spinal canal stenosis, prolapsed disc, previous back surgery, severe or progressive neurological deficits, sciatica pain equal to or greater than back pain, hyper or hyposensitive to heat, open wounds, bleeding disorder, circulatory problem, undergo cupping therapy or heat pack previously.

Sample Size Calculation

The sample size was calculated using G-Power software© [21]. The test family was set as F-test: ANOVA. Fixed effects, omnibus, one way. In order to get the estimated sample size, the effect size was set at 0.025, which provides moderate effect [22]. Most of previous studies stated that dry cupping treatment and hot pack treatment gave benefit by their effectiveness. Therefore, the researcher chose the effect size was 0.25 instead of 0.5. The number of groups was set as three, as this study aims to compare between dry cupping group, hot pack group and control group. The α was set at 0.05, which is a general α value for the social sciences and desired power was set at 0.80 to yield sufficient power to detect meaningful difference between groups. Power analysis found that the total sample size calculation of 39 participants was sufficient to provide moderate effect. Thus, there were 13 participants in each group (n=13).

Intervention

Dry cupping group received a session of treatment a week, hot pack group received twice a week of treatment session and control group had no treatment but the participants able to continue their previous treatment without adding new interventions for three weeks. The reason of dry cupping being done once a week because of red marks will disappear 3-5 days or more, depends on the body condition.

Dry Cupping Therapy: In each dry cupping session, bilateral bladder meridian was selected as the points for dry cupping. It was covering all lumbar area which was (BL): BL22, BL23, BL24, BL25 and BL26. The treatment points are located regarding to the WHO Guideline for Acupuncture Point Locations [23, 24]. According to Kim et al. (2011), they chose BL23, BL24 and BL25 for treatment points because these points are located in the low back. Moreover, back pain patients usually feel discomfort at these points because it is painful area [3].

The sterilized Sannora cups from Korea were used. Firstly, the olive oil was applied to lower back skin and moving cupping was done along lumbar area. Then, all four glasses of cup were applied to the meridian, and suction was created inside the cup within the prone lying position. The amounts of suction depend on patient's tolerance, usually with one and half of hand pump. This technique called as dry cupping. All four cups were letting it for 15 minutes to pull the tissue underlying the skin and lead the capillaries to vasodilate and potentially will rupture [25, 26, 27]. After that, the cups were removed, and low back area was wiped with the olive oil. The participants had residual marking and it disappeared within 3-5 days (Refer Table 1)

Table 1: Procedure of Dry Cupping Therapy

No	Step of Dry Cupping	Diagram
1.	<p>Step 1: Moving Cupping</p> <ul style="list-style-type: none"> -Patient in prone lying on bed -Apply olive oil on lower back area. - A partial suction created inside the cup. - The cup will be move around low back area until the skin become reddish. 	
2.	<p>Step 2: Dry Cupping</p> <ul style="list-style-type: none"> -4 cups of Sannora be applied on lobar back covering meridian BL 22- 26. - Left it for 15 minutes to vacuum the skin. 	
3.	<p>The patients will have residual marking after the wet cupping therapy and it will disappear 3-5 days.</p>	

Hot Pack: For second experimental group, the participants received moist hot pack around lumbar region of torso in prone lying. Hot pack also called as hydrocollator packs, were kept in water at 170°F (76.7°C). The hot pack was taken from hydrocollator and a minimum of six layers of towels (or its equivalent) was used to cover hot pack as well as to retain the heat between the packs and skin for 20 minutes. The layers of towel were added based on participants' comfortable. Approximately 7-10 minutes, the hot pack reached its hottest point into the treatment. In order to avoid skin burning, the participants were prohibited to lie on the pack. The mode of heat transfer was conduction (Refer Table 2).

Table 2: Procedure of Hot Pack Application

No	Step of Hot Pack	Diagram
1.	Hot pack also called hydrocollator packs, are kept in water at 170°F (76.7°C) will be taken out.	
2.	<ul style="list-style-type: none"> - A minimum of six layers of toweling (or its equivalent) is used between the packs and the skin; more are added according to patient's comfort. - The pack will be left for 20 minutes. - The hot pack will be inserted back into hydrocollator. 	

Outcome measures

Primary outcome: The changes in Numerical Pain Rating Scale (NPRS) score for level of pain from baseline to end of the third week of treatment period was recorded by the researcher. The participants were asked to choose NPRS by rating on a pain scale ranging from zero to 10, where zero represented “no pain” and 10 represented “extreme pain”. So, it had single 11-point numerical pain scale.

Secondary outcome: The Oswestry Disability Index (ODI) used for functional disability. The ODI has ten sections of questions which consisted of pain intensity, lifting, personal care, walking, sitting, standing, sleeping, sex life (if applicable), social life and travelling. Each section contains six statements to be marked by the participants with the score from 0-5 points. The 5 point is the most severe in relating to a particular activity. The total raw score will be calculated and multiply by two to provide a percentage of disability.

Data analysis

The data collected from this study was analyzed by using Statistical Package for Social Science (SPSS) version 20. The level of significance was prior to the value of 0.025 ($p \leq 0.025$). All outcome measures were analyzed based on the intention-to-treat population. The descriptor of one-way ANOVA indicated a two-dimensional analysis, involving three independent variables which were dry cupping group, hot pack group and control group whereas the two dependent variables were NPRS for level of pain and ODI for functional disability. Most multiple

comparison procedures between these three groups were classified as post hoc because specific comparisons of interest were decided after the ANOVA is completed. These are considered unplanned comparisons; in that they are based on exploration of the outcome. The researcher chose Tukey's honestly significant for the study because it is the simplest multiple comparison procedures. Tukey's procedure sets a family-wise error rate. The α in Tukey's procedure able to identify the falsely declared significant of one or more probability of the pair wise comparisons. Therefore, Tukey's procedure provides generous protection against Type I error [28].

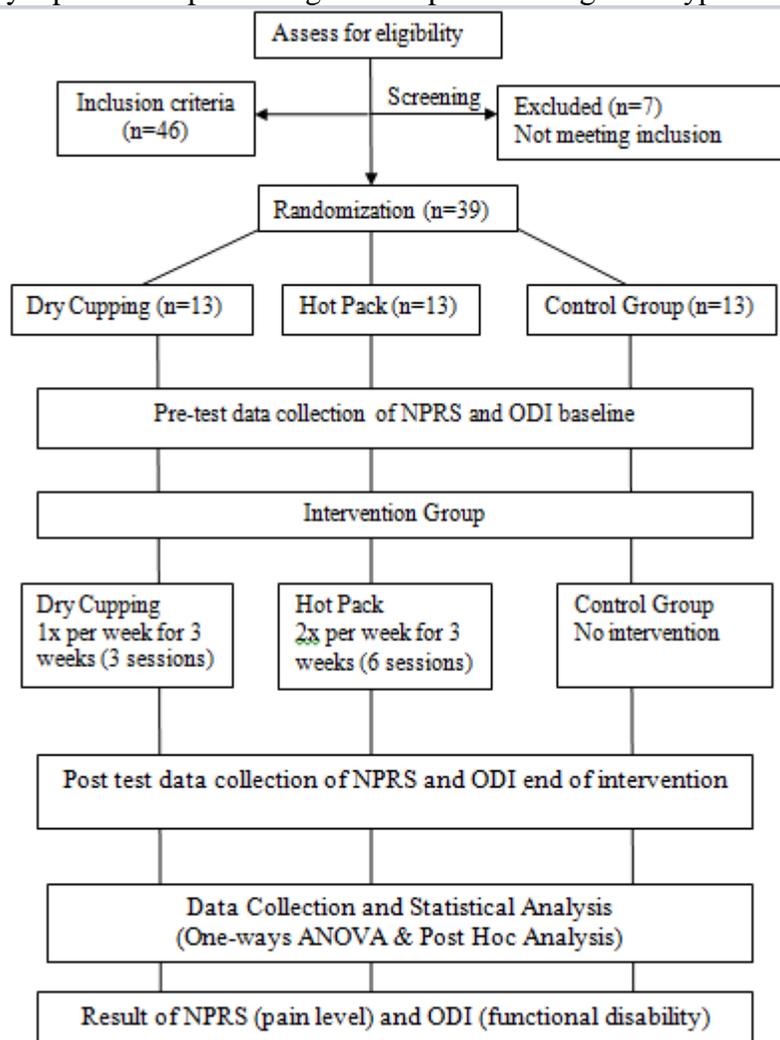


Figure 1: The flow chart of recruitment and study conditions.

3. Results

A total of 39 participants who met all the inclusion and exclusion criteria were invited to participate and completed the study. Table 3 illustrates the baseline descriptive data for both experimental group and control group. As shown, the experimental groups and control group were quite similar mean (\pm standard deviation) in gender, age, weight, height and BMI.

Table 3: Demography of Participants (Mean \pm SD)

Group / Criteria	Dry Cupping	Hot Pack	Control
	N=14		
Gender % (n)	Male : 53.8% (7) Female : 46.2% (6)	Male : 61.5% (8) Female: 38.5% (5)	Male : 61.5% (8) Female : 38.5% (5)
Age (years)	22.62 \pm 2.18 (19-26)	24.08 \pm 2.02 (22-28)	23.54 \pm 1.98 (20-26)
Weight (kg)	63.31 \pm 11.83 (42-80)	55.92 \pm 8.05 (48-75)	60.69 \pm 7.86 (48-71)
Height (cm)	164.43 \pm 12.19 (149-185)	160.85 \pm 7.03 (149-178)	166.38 \pm 9.12 (152-178)
BMI (kg.m ²)	23.30 \pm 2.16 (18.18-26.12)	21.51 \pm 1.41 (19.23-23.88)	21.83 \pm 1.09 (20.24-23.53)

Pain

In the score of NPRS, pre-test of dry cupping group, hot pack group and control group were classified under moderate pain (6/10). After three weeks of intervention, mean of pain intensity in dry cupping group was reduced to 3 (3.31 \pm 1.60), hot pack group was reduced to 4 (3.85 \pm 1.07) and control group remained 6 (6.15 \pm 0.69). One-way ANOVA revealed that there was significant improvement in pain relief using NPRS between dry cupping group, hot pack group and control group [F (21.331) p=0.001] (Refer Table 4 and Figure 2). Tukey's post hoc test was used for deciding which pair wise comparisons (dry cupping group, hot pack group or control group) indicated significant difference. Thus, the result revealed that dry cupping group and hot pack group were equally effective in pain relief for patients with non-specific low back pain when compared with control group.

Table 4: The Mean of Pain Level, F-test and p-value for Pre-Test and Post-Test on NPRS in Pain Relief

Group (n=13)	Dry Cupping (mean \pm SD) (level)	Hot pack (mean \pm SD) (level)	Control (mean \pm SD) (level)	F	Sig.
Pre-NPRS	6.15 \pm 0.69 (moderate)	6.08 \pm 0.76 (moderate)	5.95 \pm 0.80 (moderate)	0.591	0.559
Post-NPRS	3.31 \pm 1.60 (minimal)	3.85 \pm 1.07 (moderate)	6.15 \pm 0.69 (moderate)	21.331	0.001*

*Result is significant when $p < 0.025$.

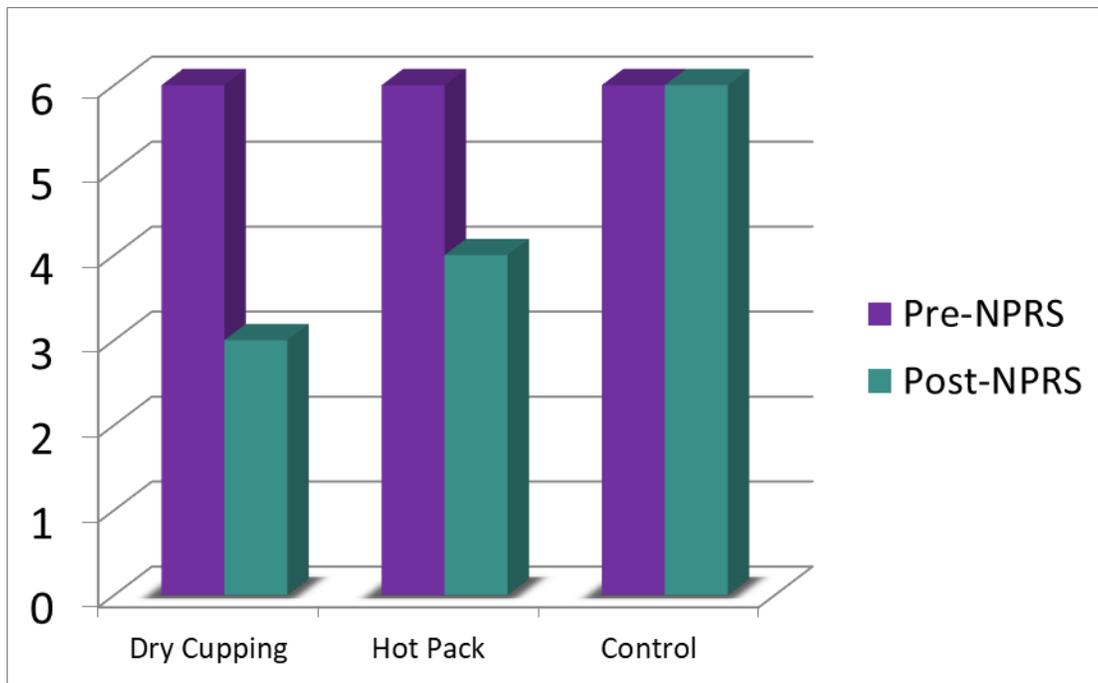


Figure 2: The Mean Score of NPRS for Pre-Test and Post-Test on Pain Intensity

Functional Disability

Out of 100 percent in the score of ODI, pre-test mean and SD of dry cupping group was 35.56 ± 5.37 , hot pack group was 33.16 ± 5.91 and control group was 32.31 ± 7.78 , which all were classified under moderate disability. After three weeks of intervention, the post-test mean and SD of dry cupping group was 16.92 ± 6.82 , which indicated that functional disability was minimal, hot pack group was 20.0 ± 6.15 , which indicated that functional disability was minimal, and control group was 34.87 ± 10.71 , which remained in moderate functional disability (Refer Table

4.8 and Figure 4.2). According to ANOVA result in post-test ODI for functional disability, there was significant difference on functional disability between dry cupping group, hot pack group and control group on patients with non-specific low back pain after three weeks of intervention [F (18.046) p= 0.001] (Refer Table 5 and Figure 3). Tukey's post hoc test showed that there was no significant difference (p=0.605) on functional disability between dry cupping group and hot pack group. Therefore, dry cupping and hot pack are equally appropriate to be used in reducing functional disability for patients with non-specific low back pain compared to control group.

Table 5: Mean, SD Disability Category, F-value and p-value of Pre-Test and Post-Test ODI

<i>Group</i> (n=13)	Dry Cupping Mean ± SD (disability level)	Hot pack Mean ± SD (disability level)	Control Mean ± SD (disability level)	<i>F</i>	<i>P-value</i>
Pre-ODI	35.56 ± 5.37 (moderate)	33.16 ± 5.91 (moderate)	32.31 ± 7.78 (moderate)	0.889	0.420
Post-ODI	16.92 ± 6.82 (minimal)	20.00 ± 6.15 (minimal)	34.87 ± 10.71 (moderate)	18.04	0.001*

*Result is significant when $p \leq 0.025$.

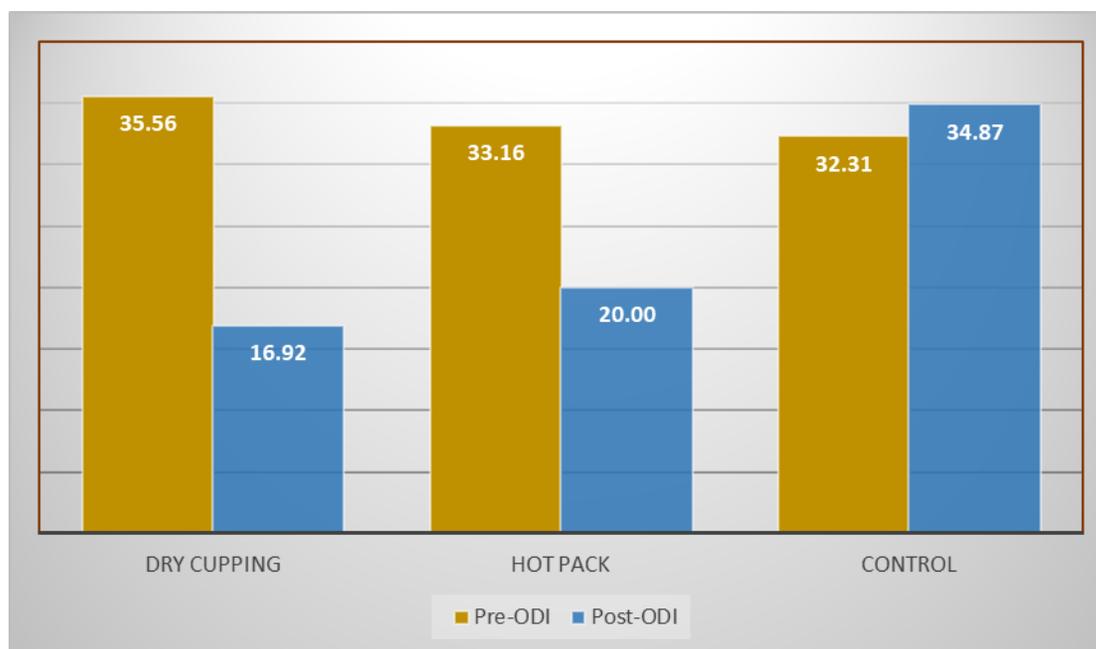


Figure 3: Mean Score of ODI for Pre-Test and Post-Test on Functional Disability

4. Discussion

Upon completion of study, the participants who had received dry cupping and hot pack interventions showed a significant improvement in pain relief and functional disability compared to participants in control group. These results of dry cupping were similar to Wang et al. (2020),

Markowski et al. (2014) and Akbarzadeh et al. (2012) who suggested that dry cupping aid in relieving low back pain, reduce muscle tenderness, and increase range of motion [29, 11, 30]. The result of hot pack was similar to Nadler et al. (2002) and Lloyd et al. (2004) who stated that heat wrap therapy was effective for patients with non-specific low back pain compared to paracetamol and ibuprofen [20, 31]. The control group showed no improvement may because they did not follow any treatment session but remained in usual exercise and analgesic intake.

The term of Minimal Clinically Important Difference (MCID) was frequently used to interpret the clinical significance of results from a clinical study. The MCID indicated that dry cupping group was found as the most effective intervention for pain relief among these three groups with pain relief score 6/10 (NPRS moderate level) reduced to 3/10 (NPRS minimal level) and this study result revealed clinically significance. The patients may consider pain relief rate using NPRS in dry cupping group reduced from moderate to minimal worthwhile because once pain was triggered, even a minimal pain reduction was giving benefit to patients with non-specific low back pain.

A plausible reason why dry cupping clinically significance in enhance pain reduction during non-specific low back pain treatment compared to hot pack is the prolong effect of cupping. The bruising that is caused by dry cupping therapy needs multiple days to dissipate. Therefore, there will be a constant stimulation on increases blood flow and nutrients in the affected bruising area [32]. The healing of bruise continues the process of keeping the fascia malleable and healthy. This is unlike hot pack which applied in short duration and after removal, there is no continuing stimulation on affected low back area to reduce pain and functional disability.

From physiological perspective, dry cupping and hot pack have been shown to give symptomatic relief for patients with non-specific low back pain with different mechanisms. When the suction created inside the cup during dry cupping, the skin gradually increases in size to upward because of viscoelastic nature of the skin. Thus, the application of suction creates negative pressure inside the cups and decrease local pressure (Boyle 's law) around capillaries [33]. As the skin is uplifted, it will increase blood flow and capillary filtration which then improve vasodilation. Therefore, local metabolites and toxins are flushed out from dry cupping area. Then, dilution of chemical substances, inflammatory mediators, and nociceptive substances which act as an analgesic will improve oxygenated blood to the affected site. The reoxygenated blood will cause pain relief, reduce stiffness, improve range of motion and breakage of tissue adhesion around lumbar area [27, 34].

In contrast, for mechanism of hot pack, it prone to the effects of thermal therapy on muscle tissue. Immediate vasodilation cause blood flow to increase, make the muscle tissue warmer which therefore facilitates healing recovery [11]. Hot pack stimulates receptor beneath the skin to decrease transmission of pain signal to brain which lead to decrease perception of pain [35]. Muscle spasm is secondary effect, developed after pain. Later, the secondary afferents of muscle are responsible for tonic phenomenon. Tonic phenomenon is referred to the continuous muscle contractions and relatively smooth movement is involved in secondary muscle spasm [36]. Thus, muscle spasm will decrease after the secondary afferents is slowing their nerve firing when heated with hot pack.

Moreover, the application of hot pack may reduce the muscle spasm through direct and indirect reflex effects of golgi tendon organs. The roles of golgi tendon organs are to inhibit muscle contraction which is doing by tonic phenomenon. During superficial heating of hot pack on the skin, golgi tendon organs will increase their nerve firing and decrease activity of gamma fibers through reflex effects. Gamma fiber is the efferent component of the muscle spindle [37]. Thus, muscle spasm will be subsided because the muscle contraction becoming more smoother [38]. When muscle spasm reduced, the ability to do movements will be easier and the pain will progressively be being slower.

In addition, dry cupping group and hot pack group reduced the score of Oswestry Disability Index from moderate disability to minimal disability was worthwhile because the patients with non-specific low back pain was able return to work with less absenteeism and improve their activity daily living (ADL). The significant improvement in functional disability of both dry cupping group and hot pack group may be due to the therapeutic vasodilation effects in muscle tissues. These two interventions alter the viscoelastic properties, increased muscle flexibility and decreased articular stiffness. The elongation of soft tissue on the lower back gives further relaxation at muscular level [34, 39]. Thus, the movement and functional disability being improved which lead to better quality of life.

5. Conclusion

On the basis of study findings, the initial attempts of study were comparing the effectiveness between dry cupping and hot pack on pain relief and functional disability. However, the conclusions can be drawn that both dry cupping and hot pack are equally effective to reduce pain and functional disability on patients with non-specific low back pain when compared with control group. Health professional practice are suggested to include dry cupping therapy as another choice of treatment in treating patients with non-specific low back pain.

6. Recommendation

Further study should be examined on long term follow up. In addition, it may use wet cupping techniques with withdraw the blood since it stated more effective due to waste product and toxins removal from the blood capillary. Our study just did dry cupping because it is noninvasive whereas wet cupping may tend to have high transmission of infectious disease. It should use sterile methods (sterile surgical blade and disposable cup) to avoid infection to the patients.

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