The Effects of Kinesiological Taping and Aerobic Exercise in Women with Primary Dysmenorrhea: A Randomized Single-Blind Controlled Trial

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Research Article

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Abstract

**Purpose:** The purpose of this study was to investigate the effects of KT and AE on pain, attitude, depression, and quality of life in women with dysmenorrhea.

**Methods:** Forty-five women with dysmenorrhea were randomly divided into three groups as KT group (n=15), AE group (n=15) and control group (n=15). In KT Group, 6 sessions of KT were applied, starting on the 14th day of the menstrual cycle and 2 times a week for 3 weeks until the cycle ended. In the AE group, walking and climbing stairs were given during the menstrual cycle, 3 days a week, 45 minutes. No application was made to the control group. All groups were evaluated with Beck Depression Scale (BDS), Mcgill Pain Questionnaire (MPQ), Menstrual Attitude Scale (MAS), and Short Form-36 (SF-36) before and after treatment.

**Results:** A significant difference was found in MAS and SF-36 mental and physical in the KT group (p<0.05). There was a significant decrease in the MPQ in the AE group (p<0.05). No significant result was found in the control group. There were significant differences in MPQ and MAS Time*Group interaction (p<0.05). There was no significant difference between the KT and AE Group in post-hoc tests (p<0.05).

**Conclusion:** In conclusion, KT and AE may decrease pain and improve attitude and quality of life in women with dysmenorrhea.

*retrospectively registered*

Trial registration number (NCT04856280), date of registration (20.04.2021).

Introduction

The term dysmenorrhea originates from Greek and is defined as "monthly bleeding" and "painful menstruation" [1]. Primary dysmenorrhea is menstrual pain that occurs without an underlying pathological cause.

Pain is most common in the abdomen and lumbar region, in the form of cramping and colic in PD. It is generally observed between the first 8-72 hours after the onset of menstrual bleeding. It can be associated with many factors such as being under 30 years of age, body mass index below 20, long bleeding time and cycle, menarche age less than 12, excessive menstrual and irregular flow, excessive sterilization, premenstrual symptoms, and sexual abuse history. Symptoms such as nausea, vomiting, headache, and leg pain may accompany pain [2]. PD can cause a decrease in a person's work efficiency, tension in her social life, and school or work absences.

Attitudes towards dysmenorrhea are affected by many factors, including cultural, ethnic, and religious backgrounds [3]. The negative attitude towards dysmenorrhea increases the severity of dysmenorrhea. Attitudes and behaviors associated with menstruation can be seen as culturally positive or negative [4]. Cultures insist on the attitudes and behaviors associated with menstruation, especially by giving continuous messages about the female body and its functions such as waxing, removing odors, and even how it feels during menstruation. The information of the people about menarche and menstruation determines what they hear, see and react to this event [5]. Additionally, the importance of the relationship between menstruation attitude and gender roles, body image, self-esteem, and sexual attitudes is emphasized in studies [6].

The mood can affect the menstrual cycle [7]. Depression, anxiety, and stress can increase the incidence of PD. It is known that there is a close relationship between pain and depression. While the prevalence of headache and neck-shoulder pain is high in depression, the prevalence of depression is high in patients with chronic pain syndrome [8]. Anxiety and depression levels, which seem to be related to many types of pain, are also thought to be related to dysmenorrhea. Emotional and behavioral problems increase menstrual cycle problems and dysmenorrhea [9].

The symptoms of dysmenorrhea can lead to decreased quality of life (QoL). The activities of daily living (ADL) of people suffering from dysmenorrhea are negatively affected due to unpleasant symptoms accompanying pain [10]. Eryilmaz et al. found that one third of the participants with dysmenorrhea had some problems with their family and friends [11]. Orhan et al. reported that students with severe dysmenorrhea had higher rates of absenteeism than those with mild and moderate dysmenorrhea [12]. Studies on adults report lower perception of QoL among women with dysmenorrhea [13].

There are pharmacological and non-pharmacological treatment methods applied to reduce pain for the treatment of dysmenorrhea. Among the most commonly used non-pharmacological treatment methods are applications such as heat pad, TENS, and kinesiology taping. Kinesiological taping (KT) inhibits pain by stimulating cutaneous mechanoreceptors with positional input, where it provides a positional stimulus when it adheres to the skin. In addition, with its wave-shaped structure, it activates the soft tissue in the painful area. It accelerates lymph and blood circulation by creating a gap between the skin and tissues such as muscle and fascia. The acceleration of these circulation facilitates lymphatic drainage, relaxes the muscles in excessive contraction, relieves pain and improves joint position awareness. AE also slows the stimulation of pain receptors under the skin after this relaxation and increases in circulation and provides the advantage of acting painlessly. KT helps regulate pain sensation, pain intensity, edema, muscle spasms, proprioception and stability through all these mechanisms [14]. In a study conducted by Chaegil Lim et al., it was found that KT was effective in reducing pain in menstruation [15]. In another study it was reported that KT and lifestyle changes can be used to improve quality of life and body awareness and to relieve pain, and also KT is stated as an effective method in reducing pain, anxiety and some menstrual complaints in women with PD [16].

The American Association of Obstetricians and Gynecologists recommends exercise in menstruation [17]. Exercise alleviates the effects of dysmenorrhea by reducing sympathetic system activity [18]. Exercise affects the level of steroids in the circulatory system such as endorphin which is effective in reducing pain [19]. Stress effectively causes contraction in the uterus on the sympathetic system. Exercise is helpful in reducing the symptoms that occur during the menstrual cycle and changing the mood. In a review that examined 2 observational studies and 4 randomized controlled studies, it was concluded that...
exercise reduced symptoms in dysmenorrhea [20]. They also observed that people who exercised more than 3 times a week compared to sedentary patients had fewer symptoms during the menstrual period. In the study of Farideh Vaziri et al., aerobic and stretching exercises were observed to reduce pain in women with PD [21]. Zahra Mohebbi Dehnavi et al. concluded that moderate-intensity regular aerobic exercise can reduce and prevent the appearance of menstruation symptoms in PD [22].

To our knowledge, we would like to state that our study is the first to investigate the effects of kinesiological taping and aerobic exercise on pain, attitude and quality of life in women with primary dysmenorrhea. The purpose of this study was to investigate the effects of kinesiological taping and aerobic exercise on pain, attitude, depression, and quality of life in women with primary dysmenorrhea.

**Methods**

**Study Design**

This study was a randomized, controlled, and single blind (evaluator) trial, registered in ClinicalTrials.gov (NCT04856280). The study was approved by the Institutional Non-Invasive Ethics Committee (Approval number: 10840098-604.01.01).

**Participants**

Participants were recruited among healthy young adults who have dysmenorrhea attending Uskudar, Istanbul, Turkey. This study was concluded between October 2019-March 2020.

Forty five women with dysmenorrhea aged 15-30 years who fulfilled the inclusion criteria were included in the study. The sample size was determined using the G*power sample size calculator [23]. The required sample size was 14 for each group with a 80% power ($\alpha$=0.05, $\beta$=0.20). We aimed to enroll at least 40 participants considering the drop-outs.

Patients who met the inclusion criteria were included in the study. The inclusion criteria defined as being aged between 15-30, being virgin, having started the menstrual cycle and continuing the cycle, taking $\geq$5 points from Visual Analog Scale during menstrual cycle. The exclusion criteria defined as having endometriosis and adenomyosis, myoma uteri and endometrial polyp, having a pelvic infection, using an intrauterine device, having venous congestion in the internal genital organs. All participants had signed a written informed consent form, and the study has been conducted in accordance with the principles of the Declaration of Helsinki.

**Outcome Measurements**

All participants were evaluated before and after the interventions. The evaluations were carried out in a room at the respective institution and involved the collection of information regarding sociodemographic and anthropometric datas, Mcgill Pain Questionnaire (MPQ), Menstrual Attitude Scale (MAS), physical and mental sub parameters of Beck Depression Scale (BDS), and Short Form-36 (SF-36) before and after treatment.

**Demographic Information Form:** Demographic Information Form was prepared to record the sociodemographic characteristics of healthy individuals included in the study.

**Mcgill Pain Questionnaire:** This questionnaire consists of 11 words to determine the sensory state of pain, and 15 words related to the quality of pain in total, consisting of 4 different words to determine its affective aspect. In addition, the pain intensity felt during measurement is measured by Visual analog Scale (VAS), and the total pain intensity assessed is measured by a 6-point Likert-type scale. In this scale, "0" is defined as no pain, "5" is defined as unbearable pain [24]. The validity and reliability of the questionnaire in Turkish was concluded by Yakut et al. [25].

**Menstrual Attitude Scale:** The scale was prepared based on the theory that there may be versatility in menstrual attitudes, positive attitudes may occur as well as negative, and expectations that may occur according to physiological and emotional symptoms before or during menstruation may be effective in the behaviors shown in this period. MAS is a scale developed by applying to high school and university students, can be self-answered, easy to apply, and contains 33 items to measure the positive and negative attitudes of menstruation. MAS has 5 subscales such as the menstruation as a weakening phenomenon (12 no pain, unbearable pain, 32 items), the menstruation as a disturbing phenomenon (6 items), the menstruation as a natural phenomenon (5 items), the predicting/sensing that there will be menstruation (5 items), and the denying the effects of menstruation (7 items). The scale is of 5-point Likert type. The high average score of the subscales shows that the attitude towards menstruation is "positive" [26].

**Beck Depression Scale:** It is a test containing 21 items that the person evaluates himself. It measures the symptoms seen in depression such as emotional, cognitive and motivational. The items determine a behavioral feature related to depression. Items are numbered from 0 to 3. The goal is to objectively break down the degree of symptoms [27].

The total score of all answers is calculated as follows:

- 0 to 9 points: Minimally depressive symptoms
- 10 to 16 points: Mild depressive symptoms
- Between 17 and 29 points: Moderate depressive symptoms
- Between 30 and 63 points: Severe depressive symptoms
**Short Form 36:** SF-36 is a 36-question self-assessment scale consisting of eight subscales. This scale is based on physical function (10 items), role limitations due to physical (4 items) and emotional problems (3 items), pain (2 items), vitality (4 items), social function (2 items), mental health (5 items) and general health (5 items) subscales. Each subscale is scored between 0-100 and "0" indicates the lowest and "100" shows the best quality of life [28].

**Intervention Protocols**

The participants were randomly divided into 3 groups using Microsoft Excel 'RAND(WS)' function as the kinesiological taping (KT) group (n=15), the aerobic exercise (AE) group (n=15) and the control group (n=15). At the beginning of the study, 45 participants were included in the study, but according to exclusion criteria, one woman was excluded from the study. The study was completed with 44 participants. The allocation was shown in CONSORT FlowChart Diagram (Figure 1).

In KT Group, 6 sessions of KT were applied, starting on the 14th day of the menstrual cycle and 2 times a week for 3 weeks until the cycle ended. In the AE group, walking and climbing stairs were given during the menstrual cycle, 3 days a week, 45 minutes. No application was made to the control group.

**Kinesiological Taping Protocol**

6 sessions of taping was applied to the kinesiological taping group, starting on the 14th day of the menstrual cycle and 2 times a week for 3 weeks until the cycle ended. Using the KT ligament technique, it was applied to the supra pubic region with 100% tension in order to reduce contraction in the uterus (Figure 2 and 3).

**Exercise Protocol**

In the AE group, walking and climbing stairs were given during the menstrual cycle, 45 minutes session per day, 3 days a week over 3 weeks. The exercise protocol consists of 5 minute warm up, 35 min AE and 5 minute cool-down exercises. Warm-up and cool-down exercises include an active range of motion (ROM) exercises for upper and lower extremity. Aerobic exercise includes 30 min of moderate walking and climbing stairs. The aerobic exercise was performed in accordance with the definition of moderate-intensity exercise of the World Health Organization; "It was given to the participants that during moderate exercise, the individual should walk with a tempo in a way that he can speak but cannot sing" [29].

**Statistical Analysis**

Statistical Package for Social Sciences Software version 25.0 (SPSS Inc, Chicago, USA) was used for statistical analyses. Descriptive datas were expressed as means and standard deviations, or as number and proportion as appropriate. The normal distribution of the variables was determined by the Kolmogorov-Smirnov Within-group datas were assessed by the Paired-Samples T Test. Two-Way Repeated Measure ANOVA Test was used to assessed between group datas, Time*Group interactions, and Post-Hoc Tests. The significance value was accepted as p<0.05.

**Results**

**Distribution of Demographic Data**

44 participants were included in the study. The average age was 21.92 ± 2.43 in the KT group, the average age was in the 21.20 ± 1.01 AE Group, and the average age was 24 ± 1.73 in the control group. The minimum age was 19, the maximum age was 28. There was a statistically significant difference in terms of age between groups (p<0.05). The average Body Mass Index (BMI) was 2.32 ± 3.23 in KT group, the average BMI was 20.04 ± 3.25 in the AE Group, and the average BMI was 22.01 ± 2.89 in the control group. The minimum BMI was 16.30, the maximum BMI was 29.40. There was no statistically significant difference in terms of BMI between groups (p>0.05). The educational status of the individuals participating in the study is shown in Table 2. There were 5 high school students, 1 university student and 8 working individuals in the KT group. There were 15 university students in the AE group. There were 5 university students and 10 working individuals in the control group. There was a statistically significant difference in terms of education level between groups (p<0.05).

The distribution of demographic datas was shown in Table 1.

**Within Group Findings**

The findings before and after treatment in KT group are given in Table 2. Significant differences were found in terms of MAS, SF-36 physical and mental function in the KT group (p<0.05). The findings before and after treatment in the AE group are given in Table 3. A significant difference was found in terms of MPQ in the AE group (p <0.05). The educational status of the individuals participating in the study is shown in Table 2. There were 5 high school students, 1 university student and 8 working individuals in the KT group. There were 15 university students in the AE group. There were 5 university students and 10 working individuals in the control group. There was a statistically significant difference in terms of education level between groups (p<0.05).

**Between Group Findings**

The findings between groups are shown in Table 5. There was a significant difference between groups in pre-treatment evaluations in terms of SF-36- physical function in favor of KT group (p<0.05). There were significant differences between groups in terms of MAS and SF-36- physical function in favor of KT group (p<0.05). In Time*Group interaction analysis, there were significant differences in terms of MPQ and MAS(p<0.05).

**Post-Hoc Findings**

Post-hoc findings in terms of MPQ and MAS are shown in Table 6. There was no statistically significant difference in terms of MPQ in post-hoc analysis (p>0.05). There was a statistically significant difference in terms of MAS between KT and Control Group in favor of KT Group (p<0.05). There was a
statistically significant difference in terms of MAS between AE and Control Group in favor of AE Group (p<0.05). There was no statistically significant difference in terms of MAS between KT and AE Group (p>0.05).

**Discussion**

The purpose of this study is to investigate the effects of KT and AE on pain, attitude, depression, and quality of life in women with dysmenorrhea. A difference was found in terms of attitude and quality of life in the KT group. There was a decrease in terms of pain in the AE group. No difference was found after the treatment in the control group. There were differences in MPQ and MAS Time*Group interaction, but there was no difference between the KT and AE Group in post-hoc tests. In conclusion, KT and AE may decrease pain and improve attitude in women with dysmenorrhea.

Lower abdominal/pelvic pain is the most salient symptom among women with dysmenorrhea [30]. Despite the excess in the amplitude of the uterine contractions in people with dysmenorrhea, the severity of pain is high in cases where the basal tone rises above 50 mmHg. Alpha adrenergic receptors in uterine contractions are stimulated depending on hormonal and psychogenic factors. Pain in primary dysmenorrhea can be associated with many factors. Examples are being under the age of 30, having a body mass index below 20, a long period of bleeding and a long cycle, a menarche age less than 12, excessive menstrual and irregular flow, excessive sterilization, premenstrual symptoms, and sexual harassment history. In addition, factors such as smoking and alcohol use, obesity, depression, anxiety and stress increase the incidence of dysmenorrhea [10]. Pain in dysmenorrhea contributes significantly to a decrease in mood and quality of life defined as the general well-being of an individual in various physical, mental and social dimensions, including pain, sleep activity, concentration, negative emotions, working capacity, and social relationships [29], [31], [32]. Studies suggest that local application of temperature, maintaining body temperature, hot showers, reducing stress, swimming, walking, sleep regulation, relaxation, and developing a positive attitude towards menstruation may be effective [33]. Clarifying the attitude towards menstruation and changing it if negative is important in reducing the negative effects of dysmenorrhea on quality of life [34]. It was reported that attitude towards menstruation changed due to body pain, general health status, mood, and physical and social functionality, which significantly reduced their quality of life in women with primary dysmenorrhea [32]. In Su and Lindell's study on women with dysmenorrhea, it was reported that applied health education had a positive effect on menstruation [35]. Our findings in MPQ and MAS scores in all groups were in agreement with the studies. We found that the participants in our study had high MPQ values and this was clearly reflected in the MAS, BDS, and SF-36 scores.

KT is an elastic and thin tape with a waterproof and breathable structure that can stay on the skin for three days, supports fascia and soft tissue, assists to increase blood and lymphatic circulation, reduces pain and muscle spasm, and provides kinesthetic awareness [36]. Due to these physiological properties, it is thought that KT may be effective in reducing pain, tender points and uterine contractions [37]. It has been reported that chemotherapy applied to sacral and suprapubic regions with ligament technique in women with menstrual complaints is effective in reducing the level of pain and anxiety and increases the well-being of individuals [38]. In another study investigating the effects of kinesio taping and lifestyle changes on pain, body awareness and quality of life in individuals with primary dysmenorrhea, it has been shown that kinesio taping can be used to increase quality of life and body awareness and reduce pain level [39]. We did not find any study investigating the effect of KT on attitude and QoL in women with PD. Therefore, we would like to state that our study is the first study investigating the effect of KT on attitude and QoL in women with PD. In our study, we applied taping to the supra pubic area with 100% tension to reduce uterine contraction, using the ligament technique, for a total of 6 sessions, 2 times a week for 3 weeks, starting from the 14th day of the menstrual cycle to the KT group until the end of the cycle. We found a significant difference in attitude and quality of life in the KT group. There was a decrease in depression but it was not significant. Due to the physiological effects of KT, we are of the opinion that it provides an improvement in the attitude scale and an increase in the QoL by creating awareness in body perception and interception.

Aerobic exercise refers to the type of repetitive, structured physical activity that requires the body's metabolic system to use oxygen to produce energy [40]. Dehghanzadeh et al., reported that the intensity of pain associated with PD decreases with aerobic exercise [41]. Castelo-Branco et al., supported a significant positive association between high-intensity aerobic exercise and a reduction in the severity of PD symptoms compared to low / medium intensity exercise [42]. Also, the effectiveness of aerobic exercise in managing PD was supported [21]. In a study conducted by Bavil et al., using personal, social and lifestyle questionnaires (nutrition, physical activity, stress, social relationships, inappropriate health behaviors and personal care), over 250 students with and without PD, they investigated lifestyle approaches, nutrition with dysmenorrhea, physical activity, reported that there is a relationship between stress and social relationships [43]. They also mentioned that exercising would act as a non-specific analgesic by improving pelvic blood circulation and increasing beta endorphin release. In a review where two observational and 4 randomized controlled studies were examined, it was concluded that exercise reduced symptoms in dysmenorrhea [20]. In another study, it was reported that people who exercised more than 3 times a week had fewer symptoms during menstruation compared to sedentary people [44]. In a study by Farideh Vaziri et al. in 2014, it was concluded that aerobic and stretching exercises reduced pain in women with PD [21]. As a result of the study conducted by Zahra Mohebb Dehnavi et al. in 2019 on 70 people with PD, it was shown that regular moderate-intensity aerobic exercise can reduce and prevent the emergence of menstrual symptoms [22]. In our study, we applied medium-intensity aerobic exercise, which includes walking and climbing stairs, and active ROM exercises for upper and lower extremity throughout the menstrual cycle, as 45-minute sessions a day, 3 days a week for 3 weeks. We found that intensity aerobic exercise significantly effective in reducing pain. There was a decrease in depression but it was not significant. We think that moderate intensity aerobic exercise, which includes all body movements and is applied regularly for 3 weeks, has an effect on the pain mechanism by accelerating blood flow and increasing well-being.

In the control group in which we did not practice, we found that while the pain and attitude levels of the individuals remained almost constant, their quality of life decreased and their depression levels increased. This proved the accuracy of the literature that primary dysmenorrhea increases depression levels and decreases the quality of life.

Although there were differences in different parameters within the groups, we concluded that there was a difference in pain and attitude scales between the groups. Compared to the control, there were differences between the KT and AE group, but we concluded that the groups had no superiority over each other.
We think that this is due to the fact that both treatment methods have different healing mechanisms. In line with these results, we concluded that the combined use of KT and AE can reduce pain and improve attitude in women with dysmenorrhea.

**Limitations**

The limitations of this study are the inclusion of only virgin women in the study, not taking as a factor how many years women have menstruated, and the inability to measure women's tolerance to pain.

**Conclusion**

In conclusion, KT decreases pain, improves attitude and quality of life, and AE decreases pain in women with primary dysmenorrhoea. Combination of KT and AE in women with primary dysmenorrhea can reduce pain, improve attitude and improve quality of life.

**Declarations**

**Acknowledgements**

The authors would like to thank all participants in the study for their contribution.

**COMPLIANCE WITH ETHICAL STANDARDS**

**Ethical Approval**

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Non-Invasive Ethics Committee of Istanbul Medipol University (Date:11.10.2019 /No: 10840098-604.01.01).

**Funding Details**

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**Conflict of Interest**

The authors declare that they have no conflict of interest.

**Informed Consent**

Written informed consent was obtained from all participants.

**Authors' Contributions**

All authors contributed to the study conception and design. The conception and design of the study, acquisition of data, revising the article critically for important intellectual content, and drafting the article performed by Simge Temizkan. The conception and design of the study, analysis and interpretation of data, and revising the article critically for important intellectual content performed by Miray Budak. All authors read and approved the final manuscript.

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### Tables

#### Table 1. Distribution of demographic findings

<table>
<thead>
<tr>
<th></th>
<th>KT Group (n=14)</th>
<th>AE Group (n=15)</th>
<th>Control Group (n=15)</th>
<th>F value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Avg ± SD)</td>
<td>21.92 ± 2.43</td>
<td>21.20 ± 1.01</td>
<td>24 ± 1.73</td>
<td>9.702</td>
<td>0.000*</td>
</tr>
<tr>
<td>BMI (Avg ± SD)</td>
<td>22.32 ± 3.23</td>
<td>20.04 ± 3.25</td>
<td>22.01 ± 2.89</td>
<td>2.314</td>
<td>0.112</td>
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<tr>
<td>Education level</td>
<td>High-school (n / %)</td>
<td>-</td>
<td>30.01</td>
<td>0.000*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University (n / %)</td>
<td>5 / 7.1</td>
<td>15 / 100</td>
<td>5 / 33.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not student (n / %)</td>
<td>8 / 57.1</td>
<td>-</td>
<td>10 / 66.7</td>
<td></td>
</tr>
</tbody>
</table>

KT: Kinesiological Taping, AE: Aerobic Exercise, BMI: Body Mass Index, Avg: Average, SD: Standard deviation, Min: Minimum, Max: Maximum.*p<0.05

#### Table 2. Within group findings in KT Group

<table>
<thead>
<tr>
<th></th>
<th>pre treatment</th>
<th>post treatment</th>
<th>Mean Difference</th>
<th>Confidence Interval</th>
<th>F</th>
<th>Effect size (d)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg ± SD</td>
<td>Avg ± SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPQ</td>
<td>29.42 ± 11.05</td>
<td>26.92 ± 10.01</td>
<td>2.500</td>
<td>-0.069 to 5.069</td>
<td>4.417</td>
<td>0.254</td>
<td>0.056</td>
</tr>
<tr>
<td>MAS</td>
<td>91.07 ± 6.93</td>
<td>73.57 ± 10.81</td>
<td>17.500</td>
<td>12.617 to 22.382</td>
<td>59.965</td>
<td>0.822</td>
<td>0.000*</td>
</tr>
<tr>
<td>BDS</td>
<td>15.85 ± 6.17</td>
<td>15.42 ± 5.22</td>
<td>0.429</td>
<td>-1.40728 to 2.264</td>
<td>0.254</td>
<td>0.019</td>
<td>0.622</td>
</tr>
<tr>
<td>SF-36 - P</td>
<td>88.92 ± 10.77</td>
<td>93.92 ± 7.38</td>
<td>-5.000</td>
<td>-8.202 to -1.797</td>
<td>11.375</td>
<td>0.467</td>
<td>0.005*</td>
</tr>
<tr>
<td>SF-36 - M</td>
<td>58.00 ± 12.07</td>
<td>64.57 ± 11.35</td>
<td>-6.571</td>
<td>-11.803 to -1.339</td>
<td>7.363</td>
<td>0.362</td>
<td>0.018*</td>
</tr>
</tbody>
</table>

MPQ: McGill Pain Questionnaire, MAS: Menstrual Attitude Scale, BDS: Beck Depression Scale, SF-36 - P: Short Form 36 - Physical Function, SF-36 - M: Short Form 36 Mental function, KT: Kinesiological Taping, AE: Aerobic Exercise, Avg: Average, SD: Standard deviation.*p<0.05

#### Table 3. Within group findings in AE Group
<table>
<thead>
<tr>
<th></th>
<th>pre treatment</th>
<th>post treatment</th>
<th>Mean Difference</th>
<th>Confidence Interval</th>
<th>F</th>
<th>Effect size (d)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MPQ</strong></td>
<td>37.13±14.71</td>
<td>16.10±16.50</td>
<td>20.533</td>
<td>10.745 to 30.321</td>
<td>20.244</td>
<td>0.591</td>
<td>0.000*</td>
</tr>
<tr>
<td><strong>MAS</strong></td>
<td>94.06±15.02</td>
<td>94.06±15.17</td>
<td>-0.600</td>
<td>-4.695 to 3.495</td>
<td>0.099</td>
<td>0.007</td>
<td>0.758</td>
</tr>
<tr>
<td><strong>BDS</strong></td>
<td>19.53±10.63</td>
<td>17.26±13.56</td>
<td>2.267</td>
<td>-2.581 to 7.114</td>
<td>1.006</td>
<td>0.067</td>
<td>0.333</td>
</tr>
<tr>
<td><strong>SF-36 - P</strong></td>
<td>64.66±15.02</td>
<td>68.66±25.45</td>
<td>-4.000</td>
<td>-13.014 to 5.014</td>
<td>0.906</td>
<td>0.061</td>
<td>0.357</td>
</tr>
<tr>
<td><strong>SF-36 - M</strong></td>
<td>52.66±25.10</td>
<td>50.93±24.89</td>
<td>1.733</td>
<td>-3.943 to 7.409</td>
<td>0.429</td>
<td>0.030</td>
<td>0.523</td>
</tr>
</tbody>
</table>

**MPQ:** McGill Pain Questionnaire, **MAS:** Menstrual Attitude Scale, **BDS:** Beck Depression Scale, **SF-36 - P:** Short Form 36 - Physical Function, **SF-36 - M:** Short Form 36 Mental function, **KT:** Kinesiological Taping, **AE:** Aerobic Exercise, **Avg:** Average, **SD:** Standard deviation. *p<0.05

Table 4. Within group findings in Control Group

<table>
<thead>
<tr>
<th></th>
<th>pre treatment</th>
<th>post treatment</th>
<th>Mean difference</th>
<th>Confidence Interval</th>
<th>F</th>
<th>Effect size (d)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MPQ</strong></td>
<td>26.73±9.96</td>
<td>26.33±10.35</td>
<td>0.400</td>
<td>-1.763 to 2.563</td>
<td>0.157</td>
<td>0.011</td>
<td>0.698</td>
</tr>
<tr>
<td><strong>MAS</strong></td>
<td>85.20±8.00</td>
<td>83.33±7.86</td>
<td>1.867</td>
<td>-0.405 to 4.139</td>
<td>3.104</td>
<td>0.181</td>
<td>0.100</td>
</tr>
<tr>
<td><strong>BDS</strong></td>
<td>15.73±6.32</td>
<td>19.53±7.31</td>
<td>-0.800</td>
<td>-2.076 to 0.476</td>
<td>1.806</td>
<td>0.114</td>
<td>0.200</td>
</tr>
<tr>
<td><strong>SF-36 - P</strong></td>
<td>84.00±19.92</td>
<td>82.66±14.74</td>
<td>1.333</td>
<td>-4.250 to 6.917</td>
<td>0.262</td>
<td>0.018</td>
<td>0.617</td>
</tr>
<tr>
<td><strong>SF-36 - M</strong></td>
<td>56.40±19.65</td>
<td>55.06±16.81</td>
<td>1.333</td>
<td>-2.110 to 4.776</td>
<td>0.690</td>
<td>0.047</td>
<td>0.420</td>
</tr>
</tbody>
</table>

**MPQ:** McGill Pain Questionnaire, **MAS:** Menstrual Attitude Scale, **BDS:** Beck Depression Scale, **SF-36 - P:** Short Form 36 - Physical Function, **SF-36 - M:** Short Form 36 Mental function, **KT:** Kinesiological Taping, **AE:** Aerobic Exercise, **Avg:** Average, **SD:** Standard deviation. *p<0.05

Table 5. Between group findings

<table>
<thead>
<tr>
<th></th>
<th>KT Group (n=14)</th>
<th>AE Group (n=15)</th>
<th>Control Group (n=15)</th>
<th>p value</th>
<th>KT Group (n=14)</th>
<th>AE Group (n=15)</th>
<th>Control Group (n=15)</th>
<th>p value</th>
<th><strong>MD</strong></th>
<th><strong>F</strong></th>
<th>Effect size (d)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MPQ</strong></td>
<td>29.42±11.05</td>
<td>37.13±14.71</td>
<td>26.73±9.96</td>
<td>0.062</td>
<td>29.62±10.01</td>
<td>16.60±16.50</td>
<td>26.33±10.35</td>
<td>0.057</td>
<td>7.811</td>
<td>15.427</td>
<td>0.429</td>
<td>0</td>
</tr>
<tr>
<td><strong>MAS</strong></td>
<td>91.07±6.93</td>
<td>94.06±15.02</td>
<td>85.20±8</td>
<td>0.081</td>
<td>73.52±10.81</td>
<td>94.66±15.17</td>
<td>83.33±7.86</td>
<td>0.000*</td>
<td>6.256</td>
<td>29.316</td>
<td>0.588</td>
<td>0</td>
</tr>
<tr>
<td><strong>BDS</strong></td>
<td>15.85±6.17</td>
<td>19.53±10.63</td>
<td>15.73±6.32</td>
<td>0.351</td>
<td>15.42±5.22</td>
<td>17.26±13.56</td>
<td>16.53±7.31</td>
<td>0.872</td>
<td>0.632</td>
<td>1.145</td>
<td>0.053</td>
<td>0</td>
</tr>
<tr>
<td><strong>SF-36 - P</strong></td>
<td>88.92±10.77</td>
<td>64.66±28.81</td>
<td>84.00±19.92</td>
<td>0.009*</td>
<td>93.92±7.38</td>
<td>68.66±25.45</td>
<td>82.66±14.74</td>
<td>0.002*</td>
<td>-2.556</td>
<td>1.266</td>
<td>0.058</td>
<td>0</td>
</tr>
<tr>
<td><strong>SF-36 - M</strong></td>
<td>58.00±12.07</td>
<td>52.66±25.10</td>
<td>56.40±19.65</td>
<td>0.758</td>
<td>64.57±11.35</td>
<td>50.93±24.89</td>
<td>55.06±16.81</td>
<td>0.146*</td>
<td>-1.168</td>
<td>4.182</td>
<td>0.169</td>
<td>0</td>
</tr>
</tbody>
</table>

**MPQ:** McGill Pain Questionnaire, **MAS:** Menstrual Attitude Scale, **BDS:** Beck Depression Scale, **SF-36 - P:** Short Form 36 - Physical Function, **SF-36 - M:** Short Form 36 Mental function, **KT:** Kinesiological Taping, **AE:** Aerobic Exercise, **Avg:** Average, **SD:** Standard deviation. *p<0.05

Table 6. Post-hoc findings
<table>
<thead>
<tr>
<th>Mean difference</th>
<th>Confidence Interval (Lower / Upper)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KT Group</td>
<td>AE Group</td>
<td>1.312 (-9.039 to 11.662)</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td>1.645 (-8.705 to 11.996)</td>
</tr>
<tr>
<td>AE Group</td>
<td>KT Group</td>
<td>-1.645 (-11.996 to 8.705)</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td>-0.333 (-10.504 to 9.837)</td>
</tr>
<tr>
<td>Control Group</td>
<td>AE Group</td>
<td>-1.312 (-11.662 to 9.039)</td>
</tr>
<tr>
<td>KT Group</td>
<td></td>
<td>0.333 (-9.837 to 10.504)</td>
</tr>
<tr>
<td>KT Group</td>
<td>AE Group</td>
<td>-1.945 (-11.839 to 7.948)</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td>-12.045 (-21.939 to -2.151)</td>
</tr>
<tr>
<td>AE Group</td>
<td>KT Group</td>
<td>1.945 (-7.948 to 11.839)</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td>-10.100 (-19.822 to -0.378)</td>
</tr>
<tr>
<td>Control Group</td>
<td>AE Group</td>
<td>12.045 (2.151 to 21.939)</td>
</tr>
<tr>
<td>KT Group</td>
<td></td>
<td>10.100 (0.378 to 19.822)</td>
</tr>
</tbody>
</table>

MPQ: McGill Pain Questionnaire, MAS: Menstrual Attitude Scale. *p<0.05

**Figures**

![Flow Chart](image)

*Figure 1*

Flow Chart
Figure 2

KT Ligament Technique
Figure 3

100% Tension