

Comparative Effectiveness of Taping Therapy versus Compression Stocking on Edema, Pain, and Fatigue in the Lower Extremities of Hospital Nurses

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Abstract

Compression stockings were tested and taping therapy was conducted in this study which targeted hospital nurses. Effects on edema, pain in the lower extremities, and fatigue were investigated to complete the assessment. This study is a cross-over design and the participants were 20 hospital nurses. Experimental data were collected three times in a control group and two experimental groups. A two-week break was implemented between each experimental treatment to prevent the experimental effects. The results showed that taping therapy was effective in reducing pain in the lower extremities of hospital nurses. Compression stocking was partially effective in reducing edema in the lower extremities of hospital nurses. However, fatigue was not significantly different. Therefore, it is recommended that the method be used in clinical practice as an effective nursing intervention for lower extremities among hospital nurses.

Keywords: Edema, Fatigue, Nurse, Pain, Therapeutics

1. Introduction

Due to the nature of nurses' work, they are placed under stress caused by high strain. It has been reported that their muscles, blood vessels, and nerve tissues in the neck, shoulders, arms, hands, back, waist, legs, knees, and feet are affected or damaged because of the strain placed on their feet, body ache from holding the patients' arms, and postural changes due to working on the computer for a long time¹. In particular, it has been shown that nurses who experience pains in the musculoskeletal system of the legs or feet account for 40.6 %, which is the highest². For this reason, edema and pain in the lower extremities are reported to be the most common health problems associated with nurses' work. If edema and pain in the lower extremities occurring among nurses persist, job performance is diminished and the quality of health care is reduced. If their health problems persist for a long time, vascula diseases such as varicose veins may result³. Furthermore, in the fatigue realization study for nurses working in hospitals, it was stated that the

response "the legs feel heavy" scored the highest in the area of physical symptoms⁴. Fatigue is a biological response caused by physical, psychological, neurological, and sensory labor load, leading to decreasing motivation and distracted attention. Hence it causes a change in biological function, which reduces living abilities. Therefore fatigue caused by work is a biological attitude that is responding to physical, psychological, and neurological labor overload and is not a disease but can be said to be a reversible biological change or a form of warning reaction pointing to health disorders⁵. Furthermore, fatigue will not only decrease productivity but can be a factor for disaster and disease so it has great significance in labor production. Therefore, fatigue experienced by the nurse does not only affect the individual nurse but also affects the organization the nurse belongs to. Hence it is a highly important challenge for not only the individual's living quality and career development, but also for nursing quality and effective manpower management⁶.

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Recent supplementary therapies such as aromatherapy, taping therapy, chiropractic, electroacupuncture therapy, etc. are utilized for musculoskeletal disorders. Out of these methods, taping therapy is an effective alternative supplementary therapy that can address edema and pain in the lower extremities which occur when standing for a long period of time. Usually, edema in the lower extremities is a symptom that occurs because lymph and blood circulation are not functioning properly and when taping therapy is applied at this time, edema subsides quickly and is a great help in the mitigation of pain in the lower extremities⁷.

Foot reflexology massage and the application of elastic compression stocking are used as interventions in many studies associated with edema, pain in the lower extremities, and fatigue among nurses. The two methods above are proven to be effective in the reduction of problems associated with the low extremities of nurses.

However, in the case of foot reflexology massage, there were subjects who could not handle the pain caused by deep stimulation⁸. In the case of applying elastic compression stocking, there were disadvantages such as discomfort in wearing, pain caused by the tightening of the band, perspiration accumulated because of the lack of ventilation, heat during summer, slipping because of inappropriate size, etc.,³. Even if taping therapy is effective in reducing edema in the low extremities and relieve pain in that area, not many studies on taping therapy are conducted.

Therefore, the purpose of this study is to confirm the effect of taping therapy application in comparison to elastic compression stocking on edema, pain in the lower extremities, and fatigue among nurses who are subject to long periods of work and standing. The symptoms related to edema, pain in the lower extremities, and fatigue for the nurses are mitigated through the result, promoting the enhancement of health and ultimately contributing to nursing quality.

1.1 Study Hypothesis

- 1) 1st Hypothesis: There will be a difference in edema in the lower extremities in the contrast period before and after the handling of the experiment applying taping therapy and wearing of elastic compression stocking.
- 2) 2nd Hypothesis: There will be a difference in pain in the lower extremities in the contrast period before and after the handling of the experiment applying taping

- therapy and wearing of elastic compression stocking.
- 3) 3rd Hypothesis: There will be a difference in fatigue in the contrast period before and after the handling of the experiment applying taping therapy and wearing of elastic compression stocking.

2. Methodology

2.1 Study Design and Ethical Consideration

This is a cross-over design study to compare the effect of taping therapy and elastic compression stocking on edema, pain in the lower extremity, and fatigue among nurses.

| Group | Pre - test | Treatment | Post - test |
|----------------------|------------|-----------|-------------|
| Taping therapy | Ya1 | X1 | Ya2 |
| Control | Yb1 | X2 | Yb2 |
| Compression stocking | Yc1 | X3 | Yc2 |

Figure 1. Research model

Ya1: general characteristics, edema, and pain in the lower extremities, fatigue (before work)

Yb1, Yc1: edema, pain in the lower extremities, fatigue (before work)

Ya2, Yb2, Yc2: edema and pain in the lower extremities, fatigue (after work)

X1: application of taping therapy, X2: no treatment, X3: application of compression stocking

The participants of this study were 20 nurses in neurosurgery in K General Hospital located in Seoul. The subjects did not have particular diseases such as open wound, skin disorders, or vascular diseases in the feet or lower extremities and they did not have any recent experience in pregnancy and labor. In addition, they did not undergo taping therapy and they signed an informed consent form to participate in this study after they have understood the purpose of this study.

This study has received the approval of the Research Ethics Committee of K General Hospital (IRB approval number: KUH1070008). After the researcher explained the purpose and method of the study, the study was executed after a written consent was received regarding participation in the study.

2.2 Materials and Methods

1) Edema in the lower extremities: Edema in the lower extremities was measured with the use of a fiberglass tape (MK-311 S-ron tape measure 1.5m, Moeum Co.).

2) Pains in the lower extremities: Pains in the lower extremities were measured with the use of the Visual Analog Scale (VAS) by Cline et. al,⁹.

3) Fatigue: Lee¹⁰ modified the subjective symptom of the fatigue test standardized by the Industrial Fatigue Research Committee of the Japan Society of Industrial Health. Fatigue was measured using this tool. The questions to measure the short term fatigue recovery in the contrast period via applying taping therapy and wearing of elastic compression stocking were organized into 10 questions for physical symptoms, 2 questions for psychological symptoms, and 5 questions for sensory nervous symptoms, totaling 17 questions. Each question's response was transposed into a Likert scale of "not at all" with 1 point, "yes, a little" with 2 points, "usually yes" with 3 points, and "yes, a lot" with 4 points. The range of fatigue was 17-68 points. Higher points imply higher fatigue. The reliability of this tool was .69 for Chronbach's α in Lee's¹⁰ study. The internal reliability range of the prior and post fatigue was Chronbach's α .91-.94) and this study applied taping therapy and wearing of elastic compression stocking for three days.

2.3 Method of Data Analysis

In this study, application of taping therapy, wearing of elastic compression stockings with comparison periods in 20 subjects were repeatedly measured with time difference. They were randomly divided into three groups and three items were applied to avoid the effects caused by the sequence of treatment.

When subjects work daytime three times in a row and they were not treated, circumference, pain, and fatigue in the lower extremities were measured 10 minutes ahead of the start of work and the end of work. Furthermore, for the handling of the experiment, when wearing the elastic compression stocking, the lower extremities' circumference, pain, and fatigue were measured before work and right after work for 3 days. During this time the elastic compression stocking was worn 10 minutes before work and was taken off before the measurement after work. The nurses were instructed to not take the stocking off during work. Lastly, when the taping therapy was applied, the circumference and pain in the lower extremities and

fatigue for 3 consecutive days were measured before day-time work and at the end of work time. At this point, the taping therapy was applied 10 minutes before work and was removed before measurement after work. The nurses were told not to take the tape off during work.

2.4 Method of Data Analysis

This study's data analysis was performed through the SPSS WIN 20.0 statistics program.

1) The general characteristics of the subject were measured in real numbers and percentages.

2) Kolmogorov-Smirnov test was used to verify the normal distribution of dependent variables related to edema, pain in the lower extremities, and fatigue.

3) The hypothesis testing for the subjects' edema, pain in the lower extremities, and fatigue before and after the handling of the experiment utilized mean and standard deviation, independent sample t-test, and one-way analysis of variance. Post-verification utilized the Turkey test.

3. Findings

3.1 General Characteristics of the Subjects

Four-year college course attainment, a height of 160-169 cm and a weight of 50-59 kg accounted for 70.0%, 55.0%, and 60.0% of the subjects, respectively. For clinical experience, those who had an experience of 3 years or less and 50-59 working hours accounted for 45.0% and 60.0%, respectively.

3.2 Hypothesis Testing

3.2.1 1st Hypothesis

The difference before and after the experiment in the contrast period for the edema in the lower extremities upon applying taping therapy and wearing elastic compression stocking as a result of analyzing the measurement value before and after handing the experiment to test the 1st hypothesis is as follows. The circumference of the right calf revealed 0.39 ± 0.95 cm, 0.26 ± 0.53 cm, and 0.93 ± 0.59 cm in each period, revealing significant differences ($F=4.91$, $p=.011$), and the circumference of the left calf revealed 0.50 ± 0.47 cm, 0.22 ± 0.56 cm, and 0.89 ± 0.63 cm to also show a significant difference ($F=7.30$, $p=.002$). Additionally, the circumference of both ankles did not show significant

Table 1. General characteristics

| Variable | Frequency | Percentage (%) | |
|----------------------|------------|----------------|-------|
| Age (years) | 20-25 | 2 | 10.0 |
| | 26-30 | 16 | 80.0 |
| | 31-35 | 2 | 10.0 |
| Marital status | Single | 20 | 100.0 |
| | Married | 0 | 0.0 |
| Education | College | 6 | 30.0 |
| | University | 14 | 70.0 |
| Height (cm) | 150-159 | 9 | 45.0 |
| | 160-169 | 11 | 55.0 |
| Weight (kg) | 30-39 | 1 | 5.0 |
| | 40-49 | 7 | 35.0 |
| | 50-59 | 12 | 60.0 |
| Career (years) | < 3 | 9 | 45.0 |
| | 3-5 | 7 | 35.0 |
| | 5-10 | 4 | 20.0 |
| Working week (hours) | 30-39 | 2 | 10.0 |
| | 40-49 | 9 | 45.0 |
| | 50-59 | 9 | 45.0 |

After executing the Kolmogorov-Smirnov test to verify if the subject's edema, pain in the lower extremities, and fatigue satisfied the basic assumption of the parametric statistical method that there was a normal distribution, it was revealed that all formed normal distribution.

Table 2. Normality of distributions by Kolmogorov-Smirnov test

| Variable | Z | p | |
|----------|-----------|------|------|
| Edema | Rt. calf | .17 | .119 |
| | Lt. calf | .16 | .187 |
| | Rt. ankle | .13 | .200 |
| | Lt. ankle | .200 | .200 |
| Pain | .13 | .200 | |
| Fatigue | .15 | .200 | |

difference in each period. (Rt. ankle: $F=1.16$, $p=.321$, Lt. ankle: $F=0.55$, $p=.582$). Therefore the 1st hypothesis was supported partially. Post-test results revealed difference of degree in edema in the lower extremities between

wearing elastic compression stocking and the contrast period. It was also revealed that there was no difference between the wearing of elastic compression stocking and applying taping therapy.

3.2.2 2nd Hypothesis

By analyzing the difference of pain in the lower extremities before and after the handling of the experiment to verify the 2nd hypothesis, applying taping therapy revealed 2.14 ± 1.67 points, applying elastic compression stocking revealed 3.29 ± 1.64 points, and contrast period revealed 3.77 ± 1.93 points to reveal a statistically significant difference between the three groups, ($F=4.60$, $p=.014$) supporting the 2nd Hypothesis. Post-test results revealed a difference in the pain in the lower extremities with taping therapy application and contrast period. Wearing of elastic compression stocking and contrast period did not reveal a difference to verify that the application of taping therapy was effective in the pain adjustment of the lower extremities.

3.2.3 3rd Hypothesis

To verify the 3rd Hypothesis, the fatigue value measured before and after handling the experiment each revealed 4.20 ± 7.12 points, 6.41 ± 5.54 points, and 5.03 ± 6.77 points upon applying taping therapy and wearing of elastic compression stocking to reveal that the value of fatigue did not have significant difference ($F=0.59$, $p=.557$) among the three groups, dismissing the 3rd Hypothesis.

4. Discussion

Due to the nature of nurses' work, they work on their feet for a long time or they often repeat walking or running. Due to these repetitive tasks, the smooth circulation of blood in the body is disturbed and it stays in the

Table 3. Differences of mean difference in the lower extremities' edema, pain, and fatigue among taping therapy, compression stocking, and control group

| Variable | Group | | Pre-test | Post test | Difference | F | p | Turkey |
|-----------|-----------------------|-----------------------|-------------------|------------------|-----------------|------|-------|--------|
| | | | M \pm SD | M \pm SD | M \pm SD | | | |
| Edema | Rt. calf | Taping ^a | 33.42 \pm 1.79 | 33.81 \pm 2.08 | 0.39 \pm 0.95 | 4.91 | .011 | b < c |
| | | Stocking ^b | 33.00 \pm 1.89 | 33.27 \pm 1.94 | 0.26 \pm 0.53 | | | |
| | | Control ^c | 33.06 \pm 2.30 | 33.98 \pm 2.47 | 0.93 \pm 0.59 | | | |
| | Lt. calf | Taping ^a | 33.39 \pm 2.03 | 33.90 \pm 2.11 | 0.50 \pm 0.47 | 7.30 | .002 | b < c |
| | | Stocking ^b | 32.96 \pm 2.01 | 33.18 \pm 1.97 | 0.22 \pm 0.56 | | | |
| | | Control ^c | 33.10 \pm 2.34 | 33.99 \pm 2.48 | 0.89 \pm 0.63 | | | |
| | Rt. ankle | Taping | 19.69 \pm 2.05 | 20.35 \pm 1.32 | 0.65 \pm 1.30 | 1.16 | .321 | |
| | | Stocking | 20.05 \pm 1.20 | 20.32 \pm 1.20 | 0.27 \pm 0.32 | | | |
| | | Control | 20.07 \pm 1.35 | 20.48 \pm 1.36 | 0.40 \pm 0.33 | | | |
| Lt. ankle | Taping | 20.03 \pm 1.26 | 20.30 \pm 1.26 | 0.27 \pm 0.28 | 0.55 | .582 | | |
| | Stocking | 20.28 \pm 1.42 | 20.39 \pm 1.18 | 0.10 \pm 0.95 | | | | |
| | Control | 20.10 \pm 1.30 | 20.38 \pm 1.29 | 0.28 \pm 0.28 | | | | |
| Pain | Taping ^a | 1.89 \pm 1.56 | 4.02 \pm 2.21 | 2.14 \pm 1.67 | 4.60 | .014 | a < c | |
| | Stocking ^b | 2.17 \pm 1.67 | 5.45 \pm 1.63 | 3.29 \pm 1.64 | | | | |
| | Control ^c | 1.80 \pm 1.47 | 5.57 \pm 2.09 | 3.77 \pm 1.93 | | | | |
| Fatigue | Taping | 26.22 \pm 7.21 | 30.42 \pm 10.46 | 4.20 \pm 7.12 | 0.59 | .557 | | |
| | Stocking | 28.12 \pm 8.45 | 34.53 \pm 8.07 | 6.41 \pm 5.54 | | | | |
| | Control | 27.85 \pm 7.69 | 32.88 \pm 10.00 | 5.03 \pm 6.77 | | | | |

lower extremities due to gravity. Thus, circulation disorders are caused and physical and mental problems such as edema, pain in the lower extremities and fatigues occur. This study is performed to examine the effects of taping therapy and seek the effective nursing interventions which can reduce edema, pain in the lower extremities and fatigue among nurses by comparing and analyzing the results with wearing elastic compression stockings in order to prevent the problems stated above.

In this study, applying taping therapy and wearing elastic compression stocking compared to the contrast period of before and after the experiment revealed a significant difference in the increase of edema in the lower extremities with the circumference of both calves. The circumference of both ankles did not reveal a significant difference among the three groups. This is a result that is partially similar to Kim and Lee's³ result studying the effect of wearing elastic compression stocking on edema and pain in the lower extremities when worn by nurses during work, which stated that the wearers of the elastic compression stocking and the contrast group did not reveal a statistically significant difference in ankle circumference. In the case of the degree of pain in the lower extremities when applying taping therapy, wearing elastic compression stocking, and the contrast period before and after the experiment, the taping therapy application and contrast period revealed a difference in the degree of pain in the lower extremities. Wearing elastic compression stocking and the contrast period did not reveal a difference, hence it was verified that the taping therapy was effective in the adjustment of the pain in the lower extremities. Although it was not the same region, there were various studies that proved that the application of taping therapy was effective in mitigating pain. A study of balance taping therapy's effect on lower back pain patients by Park, Ryoo, and Choi¹¹ revealed that backache was reduced 1 hour after applying the tape. The study of the effect of balance taping on degenerative arthritis patients' leg pain and daily activity disability by Hyun and Park¹² revealed that when applying the tape to degenerative arthritis patients, the pain reduced after 1 to 24 hours. Furthermore, Host¹³ did a case study where a patient complained about shoulder pain for 8 months after incurring damage in the frontal shoulder and the treatment was taping the cylinder to the scapula. After a pain course exercise program and applying scapula taping, the patient was able to perform sports activities generally without pain.

Generally, the situation is that nurses are wearing elastic compression stocking to mitigate the problem related to the lower extremities. However, as a disadvantage of the elastic compression stocking, the nurses have stated that it is uncomfortable to wear and take off, it is hot during the summer, it itches, it causes pain around the band area, and it creates frustration. Furthermore it leads to profuse perspiration because of the lack of ventilation, adherence to the pants, the elastic compression stocking slipping down, and the issue of the effect being maintained when the elastic compression stocking is worn³. In addition, the elastic compression stocking sold in the market is standardized into 3 sizes and the size is supposed to be decided in proportion to the wearer's height and weight, but even when the same size of elastic compression stocking is applied the stage pressure applied to each individual is different, and it is difficult to receive an accurate effect because of this reason. In comparison, taping therapy can be attached appropriately based on the subject's weight and height, ventilates well, and does not create pain through pressuring a specific region in the lower extremities. Furthermore, considering that the maintained period after executing taping therapy was in average 3 days, there is the advantage that the effect persists while maintaining the taping. The results of this study show that wearing elastic compression stockings is effective in reducing edema in the lower extremities. It is known that taping therapy is more effective in relieving pains in the lower extremities of nurses who complain mainly of pains in that area rather than wearing elastic compression stockings. The results of this study contribute to the promotion of evidence-based nursing practice by providing the evidence of pain intervention which is the main concept in the clinical nursing practice.

5. References

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