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Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2019 16(2): 1174-1180. **OPEN ACCESS**

Secondary upper limb lymphedema following mastectomy responses to kinesio taping application: A pilot study

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It is observed that upper extremity lymphedema is one of the most prevalent complications following breast cancer surgery which prompts functional impairment, psychological disaster and social problems. The purpose of the study was to investigate the effect of Kinesio taping on secondary lymphedema of the upper extremity following mastectomy after breast cancer. In this experimental study, 7 women with lymphedema following mastectomy received Kinesio taping (KT). The KT application was 2 times per week for 3 weeks. The patients were evaluated to record the changes of the limb circumference, at baseline and end of intervention.Sum of limb circumferences was significantly improved after treatment as compared with before treatment (P<0.05).Kinesio Taping is an advanced therapeutic approach in the treatment of subjects with lymphedema after mastectomy that has problems with other modalities.

Keywords: Kinesio taping; lymphedema; Mastectomy; Physiotherapy; Cancer

INTRODUCTION

Breast cancer remains the most common form of cancer found among women worldwide and the number is increasing every day. Despite advances in breast cancer treatment, for example, chemotherapy, radiotherapy, and surgical treatment to decrease breast cancer related death rates, such treatment can lead to dangerous hazards as lymphedema (Didem et al., 2005; Jemal et al., 2009).

Lymphedema is the collection of protein rich fluid that causes constant swelling of the influenced body part, as it deters the stream of fluid in the lymphatic framework (Kazanoglu& Basaran, 2009). In oncology, the most widely recognized reasons for lymphedema are radiotherapy sessions and dissection of the lymph nodes in patients with breast cancer. Furthermore, the risk factors of lymphedema include broad axillary disease, obesity, and previous cancer in axillary lymph nodes (Pyszora& Krajnik 2010; Bąk-Sosnowska et al., 2013; Harris et al., 2001).

The incidence of the lymphedema in the upper limb is 24-59% of the patients with total mastectomy, 2.4-49% of the patients with a dissection of the lymph node and about 38% of the individuals who likewise experience radiation treatment (Demark-Wahnefried et al., 2012; Shah et al., 2012; McKenzie& Kalda, 2003).

Women with cancer related lymphedema feel heaviness and stiffness in their upper limbs. Also, dryness, hardness, or thickness of the swelling areas, which lead to infection and skin troubles. They may feel pain or discomfort, and difficulty to use their arms, affecting on psychological, functional and physical status on many aspects of their life (Fu& Rosedale, 2009; Towers et al., 2010).

Breast cancer related lymphedema can be treated conservatively by pressure garments,

bandaging, manual lymphatic drainage, exercise, and laser therapy. Physiotherapy intervention is important in the treatment of post-surgical breast lymphedema. Early physiotherapy intervention for the treatment of secondary lymphedema significantly improves treatment outcomes. Likewise, referral to physiotherapy management for at least a year significantly prevents the development of secondary lymphedema among women with cancer breast including axillary lymph nodes dissection (Lacomba et al., 2010).

The development of new treatment techniques to relieve the symptoms of upper limb edema, including pain and sensory abnormalities has resulted in discovering techniques that will significantly reduce the symptoms. One of an important techniques being used is Kinesio taping. Kinesio taping was developed by Dr. Kineso Kase in 1973 and it is an extension of the Japanese Kinesioslogy Taping. The concept involves the application of a tape which is attached to the skin. The applied tape is more elastic and thinner than the conventional tape by 120 to 140% (Castro-Sánchez et al., 2012).

The material used for the Kinesio tape is 100% acrylic, latex free and heat-activated. It is made up of 100% cotton to allow for evaporating and quicken the drying the process. This allows the patient the freedom to wear it even when taking a shower without the need for reapplication. The recommended time to wear the tape is approximately 3-4 days (Thelen et al., 2008).

Generally, the function of taping in the field of rehabilitation is essentially providing support during movement and prevention of sports-related injuries. The application of the kinesiology tape has been used for several years and has been initially identified with soft tissue injuries in sports-related activities (Halseth et al., 2004).

Kase et al., reported that the effects of Kinesio taping were primarily brought about by facilitating myofascial release, including the re-absorption of lymphatic fluid in the surrounding tissues. Kinesio taping enables the upper layers of the skin to be pulled allowing more space between the dermis and the muscle. Through this action, pressure exerted on the lymphatic vessels and channels is relieved enhancing lymphatic flow resulting in better lymphatic drainage in the affected area. When the lymphatic vessels are obstructed or restricted, lymphatic fluids accumulate behind the congested area, resulting in soft tissue swelling decreases the space located between the muscle tissues and the skin (Kase et al., 2003).

Nowadays, Kinesio taping treatment effects specifically on the reduction of pain (Tantawy& kamel, 2016; Tantawy& Kamel, 2015) and the reduction in tissue swelling has been recognized by physical therapists in treating lymphedema. The following physiological effects are produced when Kinesio taping is properly applied to decrease pain or abnormal sensation supports the movement of muscles, correcting misalignment of joints, and removing accumulated lymphatic fluid. Other noted effects of Kinesio taping include sensory stimulation, decrease adhesions and contractures, skin softening, improvement of pliability and reduction of scar formation (Pop et al., 2014).

Henceforth, lymphedema is one of the fundamental issues after breast cancer surgeries. It is critical to look for choices for its lessening and control. The effects of Kinesio taping remains controversial in the application of post-surgical lymphedema after mastectomy.

MATERIALS AND METHODS

Objectives

This study aimed to investigate the effects of Kinesio taping on secondary lymphedema of the upper extremity following mastectomy after breast cancer.

Methodology

The current study was done according to the declaration of Helsinki principles, and an informed consent form was signed by each patient before beginning the study. Thirty three women with unilateral breast cancer related to lymphedema (stage II and III) for at least for 6 months were invited to participate in the study. Lymphedema was more than 2 cm in arm circumference or less than 8 cm at any level in comparison with the other side. The participants were received Kinesio taping (KT)

The exclusion criteria were any active disease which leads to swelling, medications, especially diuretics, allergy, infection, pregnancy, heart and kidney diseases, bilateral lymphedema, skin diseases and cellulitis.

Assessment

All patients were evaluated to record the changes of the limb circumference. From the clinical point of view, measurement of arm circumference is the most commonly used technique to identify and monitor lymphedema (Czerniec et al., 2011). The measurement of the circumference is reliable and expressed as an

intra-class correlation, went from 0.96 to 0.99 for both surgical and non-surgical upper limbs, and the measurement standard error was 0.09 cm to 0.20 cm (Karges, 1996**)** .

The upper Limbs circumferences were measured by using a tape measure with the patient in prone lying position, elbows were straight and arms were relaxed at sides. The limb circumferences were measured each 3 cm starting on the ulnar styloid process and proceeding with 45 cm proximal, and in addition at the metacarpal bones and mid-hand. The tape measure was put around the limb so that there was no slack yet, but additionally so there was no space in the tissue. The total circumference of the sound limb was ascertained similarly. The two measurement difference was identified by "circumference difference" (McKenzie& Kalda, 2003; Kaviani et al., 2006).

$\Sigma^{CL}_{affected} - \Sigma^{CL}_{normal} = CD$

$CD_n - CD_0 = TRC$

Where:

$CL_{affected}$ Circumference of affected side at each six anatomical points

CL_{normal} Circumference of normal limb at each six anatomical points,

CD Circumference difference of two limbs at each point

CD_n Circumference differences at each follow up session,

CD_0 Circumference difference at pre-treatment session,

TRC Total reduction in circumference

The measurements was assessed by a qualified and experienced physiotherapist not included in the study.

Intervention

The patients received home exercise program in the form of range of motion (ROM) exercises involving shoulder flexion and extension, abduction, elevation up to 180 degrees, external rotation/horizontal abduction, elbow flexion and extension, wall walking and cane stretching. The printed exercise program was given to the women in both groups after showing them how to do these exercises.

All patients instructed to perform the exercise program three times daily with 10 repetitions every time. They were making a request to do these exercises 10 repetitions twice a day. The patients were addressed about whether they were doing their exercises consistently or not at each visit to make sure that they followed the instructions.

The KT was applied by the author (certified Kinesio taping practitioner) on cleaned and dried skin by an experienced physiotherapist twice per week for three weeks. The Kinesio taping application consisted of one fan shape for the chest (5 straps) and two fan shapes for the upper arm (4 straps), two for forearm (4 straps), and one fane shape for wrist (2 straps).

For the chest, the patient was positioned to stand upright, with the affected shoulder being externally rotated. The anchor was placed without tension at the anterior axilla of the sound side extended by five straps of a fan tape to the chest toward the affected axilla with 15–20% tension.

For the upper arm, the position of the patient was standing upright with extended and externally rotated shoulder; the first fan shape was applied by placing the anchor on the axilla without tension and extended by 5 tails with 15-25% tension to the anterior, lateral and medial aspects of the upper arm. The second fan shape was applied with the patient in an upright standing position with extended shoulder and elbow, the anchor was applied without tension on the lateral end of the clavicle and extended by five tails to the posterior aspect of the arm.

For applying Kinesio taping to the forearm, the patient was standing upright with extended elbow and wrist; the anchor of the first fan was applied on the medial epicondyle of the humerus without tension and ended by 5 tails straps on the anterior, medial and lateral aspect of the forearm with 15-25% tension. From the same position, the second fan started from the lateral epicondyle of the humerus without tension and extended by 5 straps to the posterior aspect of the forearm with 15-25% tension.

For the hand, two fan shapes with two straps each were used. The first anchor was applied from the styloid process of the ulna while the other anchor from the styloid process of the radius without tension, then the wrist was flexed, and the tails were applied on the dorsal surface of the hand with two straps to the medial and lateral aspect of the proximal interphalangeal joints respectively with 15–25% tension.

Statistical Analysis

Descriptive statistics were applied in the form of mean and standard deviation. Inferential statistics analyzed all measurement changes paired *t*-test was used to measure changes within group pre and post intervention, analysis was done using SPSS version 20.0 (SPSS, Chicago, IL) with statistical significance at *p*-value ≤ 0.05.

RESULTS

The demographic and clinical characteristics of the participating patients are demonstrated in table 1.

Table 1 Demographic data and clinical characteristics of patients

Variable	
Demographic Data	
Number of patients	7
Age (years)	52.7± 3.7
Height (cm)	164± 4.3
Weight (kg)	76.6± 5.2
BMI (kg/m^2)	27.7± 2.9
Clinical Characteristics	
Duration after mastectomy (Months)	6.9± 1.6
Sum of limb circumferences (cm)	174.8± 14.8
Type of surgery (mastectomy) n(%)	
Partial mastectomy	2 (28.57)
Partial+ Axillary mastectomy	1 (14.3)
Radical+ Axillary mastectomy	1 (14.3)
Modified/radical+ Axillary mastectomy	3 (42.85)
Types of treatment n (%)	
Chemotherapy	4 (576.14)
Chemotherapy+ Radiotherapy	3 (42.85)

Abbreviations**:** KT, Kinesio taping; pre, before intervention; post, after intervention

Table 2: Statistical analysis of limb circumference pre- and post- intervention

Variables	Pre	Post	P-value
Sum of limb circumferences (cm)	174.8± 14.8	155.6± 10.3	0.02 *

Notes: Data is presented as mean ± standard deviation; *P≤ 0.05, significant

The findings of this study showed that the sum of the limb circumference was statistically significantly decreased at the end of the intervention ($p<0.05$) as presented in table 2.

Discussion

Lymph looks milky white in color which is activated by all physical activities. It is transported by the contraction and relaxation of muscles. The flow can be affected by the disturbance of lymphatic tissues. Observation of lymphedema subjects shows that any method that can change the contour of extremities may increase the lymph flow (Shim et al., 2003). Subjects who have lymphedema after mastectomy have to be under special care, because the subjects with breast cancer usually have reduced physical activity which may exacerbate the symptoms (Winters-Stone et al., 2008; Fialka-Moser et al., 2003). Reduced physical activity leads to reduced muscle activity which secondarily leads to reduced lymph circulation and the cycle continues repeatedly. Post lymphedema again reduces the normal physical activity of the subjects which adversely affects the quality of life (Smoot et al., 2010; Chachaj et al., 2010). Subjects with post mastectomy lymphedema commonly complained about pain, discomfort, reduced hand grip strength and joint movements in the related extremity. Occasionally the sensation of “tissue burst” may leads to secondary edema and increase the limb circumference (Smoot et al., 2010; Dawes et al., 2008; Rietman, 2006).

This can occur at any time after the surgery, that is, immediately or at any time after surgery (Wójcik, 2007). This affects the function of skin, fascia, muscle and joints and reduces the overall quality of life (Białoszewski et al., 2009). Hence, it is necessary to provide proper medical care and early physical therapy for these subjects.

Recently, physical therapists following the latest concepts such as Kinesio taping (KT) for draining lymphatic fluid. The real contribution of each technique and procedures of application was unclear in post lymphedema following mastectomy which makes the application difficult.

Kinesio taping (KT) is a method of application introduced in 1973 for lymphedema subjects. This

technique is commonly used in the treatment of lymphedema reduction in mastectomy subjects, even though we don't have evidences for the mechanism of its action (Kase et al., 2003; Santambrogio et al., 2010). It is believed that KT will be helpful to decrease pain, lymph volume, increase hand grip strength, mobilize the joints and improve overall quality of life which is proved by our study. Regardless of the type of application, KT shows significant changes in limb circumference in the affected subjects (Campolo et al., 2013; Kalron& Bar-Sela, 2013, Tantawy& Kamel 2016; Tantawy& Kamel 2015).

KT increases the gap between the connective tissues such as skin and fascia, fascia and muscles and skin and muscles, which enhances the fluid movement in the body (Campolo et al., 2013; Kalron& Bar-Sela, 2013). It has its own advantage that is; the subjects can tolerate the application of tape for about 1-3 days or more. Moreover the water proof property of KT does not need to take the bandage off before or during the wash. Generally the character of the condition of lymphedema following mastectomy progress slowly, hence the ultimate effect of KT depends on the stage of the condition and the method of application (Pop et al., 2014).

The results of our study showed clinical and statistical significance of KT on the lymphedema when compared to pre application. The KT continuously facilitates the lymph circulation through making the space in the skin and other connective tissues. This enhances the circulation and lymph flow in lymph capillaries to the blood capillaries which also leads to regeneration (Zajt-Kwiatkowska et al., 2005).

The results of the current study supported by Bialoszewski et al. who found that KT application is more effective than massage in edema reduction after ilizarov method (Białoszewski et al., 2009).

Limitations:

The limitations of this study were the small sample size and lack of regular follow up period. Future study can be done with large samples and finding the long term effect of KT application in post mastectomy subjects with lymphedema.

Clinical significance:

Kinesio taping is an effective method with more comfort to the patient. It can also be advised to apply for 3-5 days without changing in the tension.

CONCLUSION

Finally, KT is the advanced therapeutic approach in the treatment of subjects with lymphedema after mastectomy that has problems in other modalities. It is also an alternative procedure for other techniques. It also suggests that KT tape is similar to the properties of skin and widely accepted method of application in lymphedema.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

The authors thank all patients who participated in this study.

AUTHOR CONTRIBUTIONS

SAT designed, performed the experiment, data analysis and wrote the manuscript. Furthermore, SAT reviewed the manuscript and approved the final version.

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