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Effect of kinesio tape application on the lymphatic system during knee arthroscopy surgery

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Introduction: To control edema, physical therapy employs several techniques, such as elastic bandages application - Kinesio tape (KT) - to block or drain subcutaneous body fluids, due to the secondary effects of its elastic properties. **Objective:** To evaluate the effect kinesio tape application on the lymphatic system during knee arthroscopy surgery. **Methods:** Controlled clinical trial, with 28 patients, alternately divided into two groups (intervention and control) referred to arthroscopic surgical treatment of anterior cruciate ligament and meniscus injuries. Patients were evaluated in the preoperative and, on the 1st postoperative day, while the intervention group received KT application for the lymphatic system in the intraoperative period. **Results:** The intervention group showed statistically significant results in the non-formation of edema, according to perimetric (Point 2: $p=0.010$, Point 3: $p\leq0.001$ and Point 4: $p\leq0.001$) and ultrasound ($p=0.007$) analyses when compared to the control group. On the other hand, pain ($p=0.056$) did not present a significant difference, but in the intragroup comparison pre and postoperative, a considerable reduction ($p=0.002$) was observed. **Conclusion:** KT application for the lymphatic system in the intraoperative period of knee arthroscopy effectively minimized edema formation and reduced pain.

Keywords: edema; arthroscopy; knee; athletic tape.

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INTRODUCTION

Although arthroscopy is a less invasive treatment for knee injuries, it can present some post-operative clinical symptoms such as edema, pain, and functional limitation. Postoperative (PO) edema exposes the patient to a series of risks, such as delayed resolution of the primary condition, infection, tissue rupture, and cell damage[1-4].

To control edema and post-operative pain, physiotherapy has a technique that consists of applying an elastic bandage – kinesio tape (KT)[4], because the elastic properties of the bandage are believed to elevate the skin, favoring the occurrence of tension and surface traction capable of draining body fluids towards a less congested area (via the lymphatic pathway or to intact lymph nodes), facilitating blood and lymphatic circulation and eliminating edema[4,5].

This process is further optimized during the movement, as it provides a directional stretch in the skin that displaces the anchorage and facilitates superficial lymphatic drainage, also

acting on the muscle, improving the efficiency of the deep lymphatic system and allowing maximum muscle contraction and relaxation[4,6].

Despite being widely publicized and used in clinical practice, there is little research to substantiate the evidence on the effects of KT. Some of the few studies that mention that the use of KT in knee arthroscopies results in reduction in edema[7], pain[7,8], or no results at all[9,10].

In this context, it was considered that the timing and technique of KT application could perhaps influence the results, so this study aimed to evaluate the effect of KT application to the lymphatic system, applied in the operating room, immediately after knee arthroscopy.

METHODS

This study was a controlled clinical trial, carried out at the Campos Gerais Regional University Hospital, from March to September 2018, approved by the Research Ethics Committee under the number 80323017.2.0000.0105, and registered under the number RBR-88d9kg in the Brazilian registry of clinical trials (ReBEC). The sample consisted of patients with total rupture of the anterior cruciate ligament and/or meniscus injury who had undergone arthroscopic surgery, aged between 18 and 60 years, who agreed to take part in the study by signing an informed consent form.

The exclusion criteria adopted were: peripheral venous insufficiency; III-IV heart failure; renal insufficiency; infectious disease present, not cured; skin lesions in the area where the tapes would be applied; undergoing physiotherapy during data collection; and presence of lymphedema before surgery.

The number of participants was determined by calculating the sample on the Epidemiology and Statistics Laboratory website. (http://lee.dante.br/), assuming a type I error (α) of 5%, test power of 80%, and an n of 14 subjects. The participants were divided alternately into two groups, the control group and the intervention group. The evaluation was carried out by the same trained examiner at T0 (preoperative) and T1 (first postoperative day).

Initially, personal and physical data was collected. To diagnose edema, two ultrasounds were performed, one at T0 and one at T1, using the Toshiba Xario 200® device, which measured the subcutaneous thickness above the patellar tendon at a distance of one centimeter from the lower edge of the patella. The diagnosis of edema using ultrasound has already been consolidated in the scientific literature, according to the review carried out by Yau et al.[11] Perimetry was carried out using a tape measure at five points, taking the apex of the patella as a reference (Point 3), taking two measurements below the bony accident and two measurements above it every 7 cm[12] (Figure 1).

The numerical pain scale was used to measure the participants' pain and the values were recorded according to the participants' reports, among the classifications: absence of pain (0), mild (1-4), moderate (5-7) and severe (8-10)[13].

The intervention group received a Kinesiosport® elastic bandage in the trans-operative period, in other words, immediately after the end of the surgery, before the post-surgical dressing was applied, and all applications were made by the same physiotherapist trained in the technique.

Fan-cut strips were applied, consisting of a tail with five strips and an anchor. The anchors were fixed in the lateral and medial distal thigh region without any tension, and the tails were fixed transversely across the entire surface of the knee, with 10% tension (paper off), as illustrated in Figure 2.

The surgical incisions were diverted and covered with a sterile micropore as a dressing after the KT was applied. Participants in the intervention group received the application of the tapes only once on the affected limb, which remained on the patient's skin until the second assessment (T1) when they were duly removed to enable ultrasound on the 1st postoperative day.

It is worth noting that the orthopedic service's post-operative drug prescription protocol is: hydration, non-steroidal analgesics and opioids, and cephalosporin class antibiotics.

After analyzing the distribution of the sample data using the Shapiro-Wilk test, descriptive statistics were carried out, presented in absolute and relative frequencies, and measures of central tendency and dispersion. As for inferential statistics, except for age, the data did not follow a normal distribution, so the non-parametric Wilcoxon test was used for paired data, and the Mann-Whitney U test for independent samples. The significance level adopted for the statistical tests was 5% with a 95% confidence interval and the software used was GraphPad Prism® version 5.01 for Windows, GraphPad Software (San Diego, California, USA).

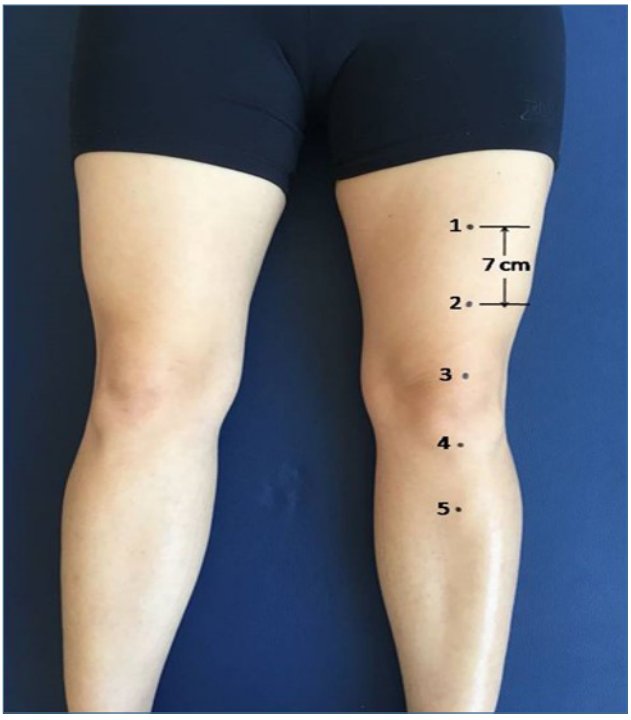

Figure 1: Diagram of the perimetry points.

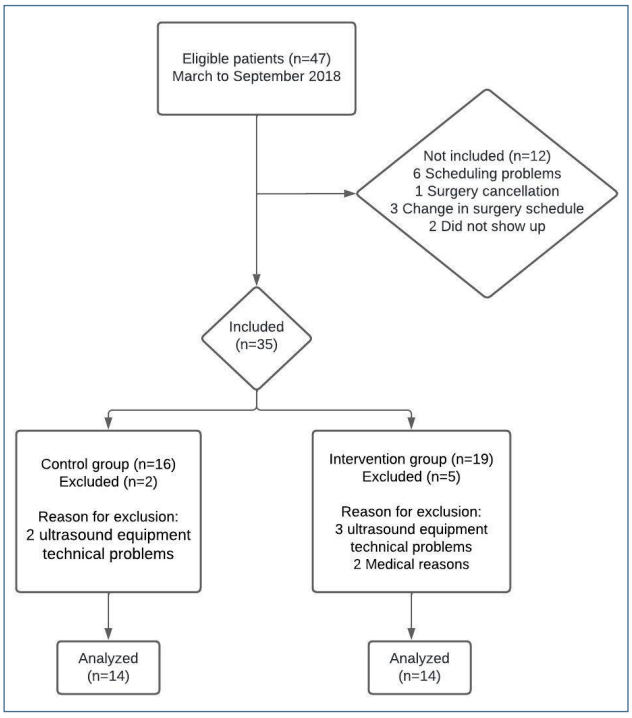

Figure 2: Application of Kinesio tape to the lymphatic system of the intervention group: (A) Measuring the length of the tape; (B) Fixing the anchor; (C) Beginning of the application; (D) Arrangement of the subsequent tails; (E) End of the application.

RESULTS

Thirty-five volunteers were included in the study, but due to losses during follow-up, each group consisted of 14 patients. Patient recruitment and the outcome of the groups are described in Figure 3.

The characteristics of the sample and the surgical intervention are described in Table 1. Initially (T0), the groups were similar in all variables ($p>0.05$) (Table 1). The results of the T0 and T1 evaluations, as well as their comparisons, can be seen in Table 2.

In the locations of Points 1 and 5, the most distal regions of the operated knee, no changes were found between T0 and T1 in either group. At Points 2 and 4, there was a significant increase in the T1 measurement when compared to T0 in the control group; however, this increase was not seen in the intervention group. At Point 3 of the perimetry, the point closest to the surgical site, both groups showed a significant increase in measurement when comparing T0 and T1. When the groups were compared, the differences were statistically significant at Points 2, 3, and 4.

The results of the ultrasound scans showed a significant increase in subcutaneous measurements when comparing T0 and T1 in the control (more than 2 mm) and intervention (less than 0.5 mm) groups. However, when comparing the groups, the control group showed a significant increase compared to the intervention group.

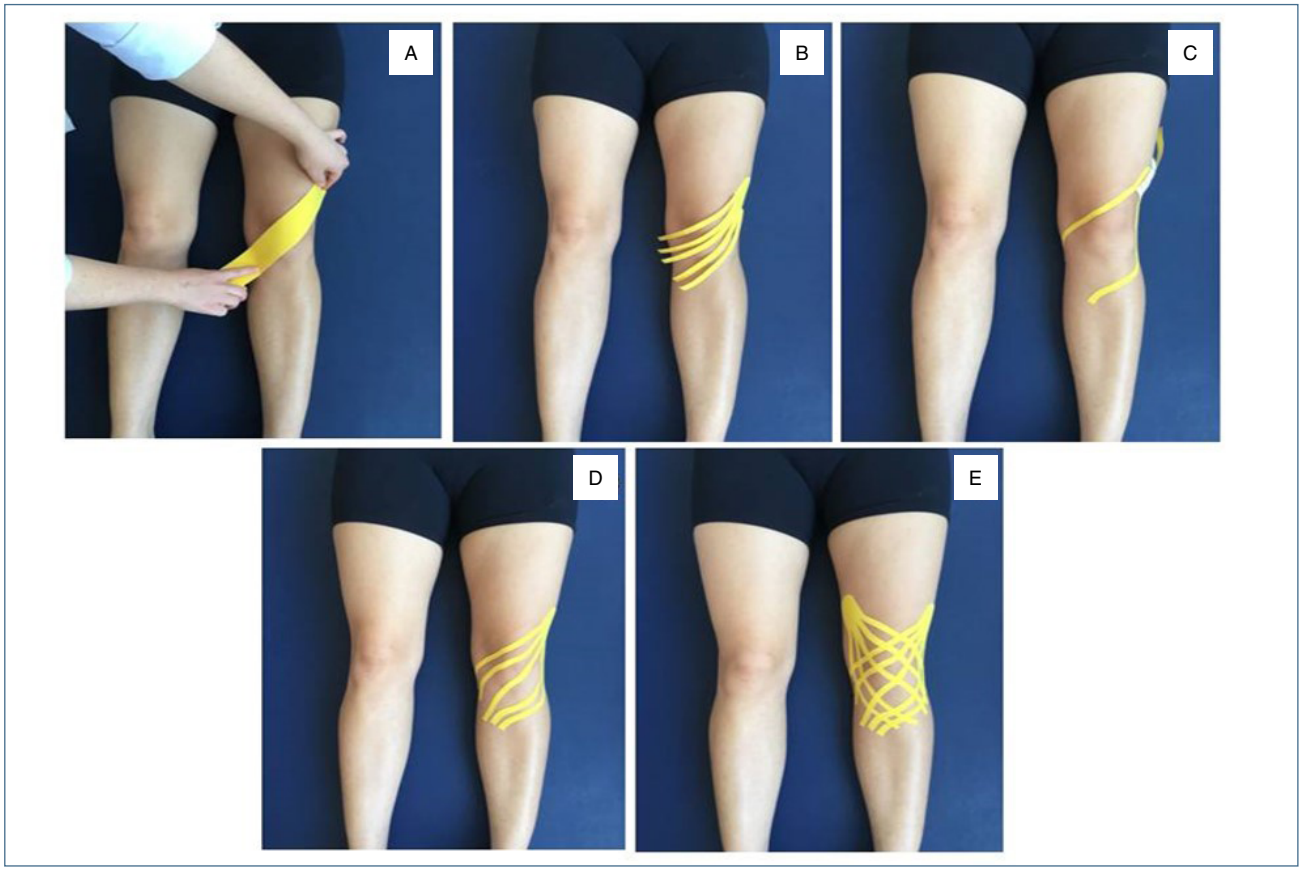

Figure 3: Diagram of group recruitment and outcome.

When assessing pain, the control group had mild pain at T0, which decreased at T1, while the intervention group reported moderate pain at T0, which became mild at T1. In the control group, no significant differences were found between the T0 and T1 assessments; in the intervention group, the reduction was significant. However, no statistical differences were obtained when comparing the groups.

DISCUSSION

According to the results obtained from perimetry and ultrasound, it can be seen that in this study KT for the lymphatic system was effective in preventing postoperative edema. In the literature searches, no articles were found that reported the effect of KT on the lymphatic system, applied inside the operating room shortly after orthopedic surgeries, to prevent edema, or using ultrasound for evaluation. However, a controlled clinical trial with patients undergoing preoperative abdominoplasty and/or abdominal liposuction reported that the application of KT in fan format with 0-15% tension, while still in the operating room, reduced local perimetry on the fourth postoperative day; however, it is worth noting that in this study other techniques were associated, such as the use of nutricosmetics and containment foams[14].

Regarding the application of KT in knee surgery, a study of patients undergoing knee arthroscopy showed that patients who received KT with the Y (moderate tension) and fan (light tension) techniques on the second postoperative day did not show a significant increase in knee perimetry when compared to the preoperative period[9]. Corroborating this, a randomized clinical trial with patients undergoing total knee replacement found that the application of KT in the fan format with paper-off tension, applied on the second postoperative day, showed a significant difference between the intervention and control groups in knee perimetry[15].

A double-blind study[7] aimed at evaluating the effect of KT applied on the fourth postoperative day of ACL reconstruction, using Y-tapes (25-35% tension) and fan tapes (15% tension), found a significant reduction in edema around the patella on the fifth and tenth postoperative days. In addition, a study16 aimed at evaluating the effect of KT on rehabilitation in patients undergoing ACL reconstruction found that the application of Y and I tapes, both without tension, significantly reduced edema in all evaluations, especially at the beginning of rehabilitation. A single randomized controlled study with patients undergoing ACL reconstruction found that the application of KT, in the same format and tension as this study, applied one week and 14 days after surgery, did not show significant results on edema[8]. This unsatisfactory result may be due to the later application of KT, which further reinforces the proposal to apply KT in the operating room.

The intervention group showed a significant reduction in pain when comparing T0 and T1, while the control group did not. This result is different from that obtained in the study by Laborie et al.[10], in which the intervention group received KT using the fan technique with 0-15% tension, the same used in this study, in the immediate postoperative period while still in the operating room, and was maintained for three days. Pain was assessed in the immediate postoperative period and on the third postoperative day, and no significant results were obtained. Gulenç et al.[9], in their study of patients

Table 1: Characteristics of the participants.

Features	Control n=14	Intervention n=14	p
Sex			
Male	10	11	0.769
Female	4	3	
Age (years)	35.5 (± 9.57)	37.5 (± 10.23)	0.597
BMI (kg/m²)	28.15 (2.97)	26.74 (3.85)	0.112
Dominant limb			
Right	8	9	>0.999
Left	6	5	
Affected limb			
Right	5	9	0.210
Left	9	5	
Structures operated			
ACL	5	6	
Medial meniscus	4	3	
Lateral meniscus	2	0	0.769
ACL+MM	1	2	
ACL +ML	2	2	
ACL +MM+ML	0	1	
Tourniquet time (min)	71.79 (34.84)	68.93 (36.96)	0.357

F - Female. M - Male. BMI - Body mass index. ACL - Anterior cruciate ligament. ML - Lateral meniscus. MM - Medial meniscus. D - Right. E - Left. Age is expressed as mean and standard deviation (t-test). BMI and tourniquet time are expressed as mean and standard deviation (Mann-Whitney U-test). Statistical significance p<0.05

Table 2: Edema and pain.

Variable	Control n=14				Intervention n=14				p[b]
	T0	T1	Diff	*p*[a]	T0	T1	Diff	*p*[a]	
Point 1 (cm)	50.57 (5.49)	51.07 (5.34)	0.50 (1.34)	0.250	50.04 (4.61)	50.04 (4.61)	0.00 (0.00)	1.000	0.222
Point 2 (cm)	44.75 (4.53)	45.43 (4.26)	0.68 (0.91)	*0.016*	44.86 (3.98)	44.89 (3.98)	0.03 (0.13)	1.000	*0.010*
Point 3 (cm)	40.32 (3.32)	41.86 (3.65)	1.54 (1.08)	*0.003*	40.86 (3.27)	41.14 (3.42)	0.28 (0.37)	*0.031*	*<0.001*
Point 4 (cm)	36.00 (2.70)	37.46 (3.27)	1.46 (1.03)	*<0.001*	37.39 (2.50)	37.64 (2.66)	0.25 (0.43)	0.125	*<0.001*
Point 5 (cm)	37.25 (3.14)	37.43 (2.85)	0.18 (0.61)	0.500	36.36 (2.90)	36.36 (2.90)	0.00 (0.00)	1.000	0.751
Ultrasound (mm)	3.95 (0.65)	5.89 (1.66)	2.23 (1.93)	*0.002*	3.57 (0.75)	4.17 (0.97)	0.60 (0.72)	*0.008*	*0.007*
Pain	3.42 (3.08)	2.36 (3.39)	1.07 (3.36)	0.308	5.07 (3.30)	1.30 (1.41)	2.50 (2.47)	*0.002*	0.056

T0 - Preoperative evaluation (Mann Whitney U test). T1 - Evaluation in the first postoperative period. Diff - Variation between T0 and T1. Values are expressed as mean and standard deviation. [a]Pairwise comparison between T0 and T1 (Wilcoxon test). [b]Pairwise comparison between the control group and intervention group in the variations between T0 and T1. Statistical significance p< 0.05.

undergoing knee arthroscopy, randomized into control and intervention, also assessed pain and found no significant results.

On the other hand, the study by Chi et al.[14], which carried out an intervention to assess pain in the trans-operative period, obtained positive results: the intervention group had no pain, while the control group had an average of 5.5, as did Boguszewski et al.[16] in their double-blind study to assess the effect of KT on rehabilitation in patients undergoing ACL reconstruction, in their study to assess the effect of KT on rehabilitation in patients undergoing ACL reconstruction, and Balki et al.[7], in their double-blind study to assess the effect of KT applied on the fourth postoperative day of ACL reconstruction, who obtained positive results in assessing pain. The effectiveness of applying KT to the lymphatic system was also pointed out by a systematic review comparing the effects of KT with McConnell tape in the conservative treatment of patients with patellofemoral pain syndrome, which showed that KT had positive results in terms of pain[17].

The difference in this study was that KT was applied while still in the operating room. It is believed that the scarcity of studies with trans-operative interventions is due to resistance on the part of surgeons, out of concern for post-operative complications such as infection, since there is no possibility of sterilizing the tapes. Although it was not one of our objectives, it is worth noting that the doctors reported that none of the patients had a post-operative infection. With these findings, the technique appears to be safe for application immediately after suturing.

Although this study had several limitations, such as not being a double-blind randomized study and consisting of a single reassessment, making it impossible to measure the effects of KT in the medium and long term, the results of its application while still in the operating room seem promising for patient recovery, and its application is indicated for those undergoing knee arthroscopy.

Conclusion

KT for the lymphatic system, in fan techniques and 10% tension, applied transoperatively, was effective in minimizing edema formation and reducing postoperative pain in patients after knee arthroscopy.

REFERENCES

1. Järvinen TLN, Guyatt GH. Surgery: Falling out of love with knee arthroscopy. Nat Rev Rheumatol. 2017;13(9):515-6. https://doi.org/10.1038/nrrheum.2017.106

2. Martimbianco ALC, Silva BNG, Carvalho APV, Silva V, Torloni MR, Peccin MS. Effectiveness and safety of cryotherapy after arthroscopic anterior cruciate ligament reconstruction. A systematic review of the literature. Phys Ther Sport. 2014;15(4):261-8. https://doi.org/10.1016/j.ptsp.2014.02.008

3. Pichonnaz C, Bassin JP, Lécureux E, Christe G, Currat D, Aminian K, *et al*. Effect of Manual Lymphatic Drainage after Total Knee Arthroplasty: A Randomized Controlled Trial. Arch Phys Med Rehabil. 2016;97(5):674-82. https://doi.org/10.1016/j.apmr.2016.01.006

4. Villeco JP. Edema: A silent but important factor. J Hand Ther. 2012;25(2):153-62. https://doi.org/10.1016/j.jht.2011.09.008

5. Pivetta HMF, Petter GN, Penna GB, Martins TNO, Santos LF, Pautz ACG. Efeitos do kinesio taping sobre o edema linfático. Fisioter Bras. 2017;18(3);382-90. https://doi.org/10.33233/fb.v18i3.1067

6. Pekyavaş NÖ, Tunay VB, Akbayrak T, Kaya S, Karataş M. Complex decongestive therapy and taping for patients with postmastectomy lymphedema: A randomized controlled study. Eur J Oncol Nurs. 2014;18(6):585-90. https://doi.org/10.1016/j.ejon.2014.06.010

7. Balki S, Göktaş HE, Öztemur Z. Kinesio taping as a treatment method in the acute phase of ACL reconstruction: A double-blind, placebo-controlled study. Acta Orthop Traumatol Turc. 2016;50(6):628-34. https://doi.org/10.1016/j.aott.2016.03.005

8. Chan MC, Wee JW, Lim MH. Does Kinesiology taping improve the early postoperative outcomes in anterior cruciate ligament reconstruction? A randomized controlled study. Clin J Sport Med. 2017;27(3):260-5. https://doi.org/10.1097/JSM.0000000000000345

9. Gülenç B, Kuyucu E, Biçer H, Genç SG, Yalçin S, Erdil M. Kinesiotaping reduces knee diameter but does not affect differences in pain and edema following knee arthroscopy. Acta Chir Orthop Traumatol Cech. 2018;(4):285-90.

10. Laborie M, Klouche S, Herman S, Gerometta A, Lefevre N, Bohu Y. Inefficacy of Kinesio-Taping® on early postoperative pain after ACL reconstruction: prospective comparative study. Orthop Traumatol Surg Res. 2015;101(8):963-7. https://doi.org/10.1016/j.otsr.2015.09.025

11. Yau LK, Henry FU, Hong CM, Amy C, Vincent CWK, Keung CP, et al. Swelling assessment after total knee Arthroplasty. J Orthop Surg (Hong Kong). 2022;30(3):10225536221127668. https://doi.org/ 10.1177/10225536221127668

12. Delgado A, Rattes C, Abreu MES, Xavier MAO, Araújo DLQ, Silva RCB, *et al*. Efeitos da Drenagem Linfática Manual na diminuição do edema de membros inferiores em gestantes. Pleiade. 2019;13(28):49-59. https://doi.org/0.32915/pleiade.v13i28.545

13. Calil AM, Pimenta CAM. Intensidade da dor e adequação de analgesia. Rev Latino-Am Enfermagem. 2005;13(5):692-9. https://doi.org/10.1590/S0104-11692005000500013

14. Chi A, Lange A, Guimarães MVTN, Santos CB. Prevenção e tratamento de equimose, edema e fibrose no pré, trans e pós-operatório de cirurgias plásticas. Rev Bras Cir Plast. 2018;33(3):343-54. https://doi.org/10.5935/2177-1235.2018RBCP0147

15. Donec V, Kriščiūnas A. The effectiveness of Kinesio Taping® after total knee replacement in early postoperative rehabilitation period. A randomized controlled trial. Eur J Phys Rehabil Med. 2014;50(4):363-71.

16. Boguszewski D, Tomaszewska I, Adamczyk JG, Białoszewski D. Evaluation of the effectiveness of kinesiology taping as an adjunct to rehabilitation following anterior cruciate ligament reconstruction. Preliminary report. Ortop Traumatol Rehabil. 2013;15(5):469-78. https://doi.org/10.5604/15093492.1084361

17. Chang WD, Chen FC, Lee CL, Lin HY, Lai PT. Effects of Kinesio Taping versus McConnell Taping for Patellofemoral Pain Syndrome: A Systematic Review and Meta-Analysis. Evid Based Complement Alternat Med. 2015;2015:471208. https://doi.org/10.1155/2015/471208