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REVIEW

Physiotherapy resources applied in patients submitted to abdominoplasty: a systematic review

Miguel Luciano Rodrigues da Silva Junior[1]*, Adriane Domingas de Morais Alves de Almeida[2], Felipe Soares Macedo[2], Eliane Gouveia de Morais Sanchez[2], Marianne Lucena da Silva[3], Katiane da Costa Cunha[1].

[1]Medicine Course, State of Pará University (UEPA), Pará (PA), Brazil.
[2]Physiotherapy Course, Federal University of Jataí - (UFJ), Jataí, (GO), Brazil.
[3]Department of Public Health, University of Brasília (UnB), Brasília (DF), Brazil.

*Author corresponding

Abstract:

Background: Abdominoplasty surgery is characterized by the removal of excess skin in the abdominal region, providing a desirable visual effect to the body. However, complications from the postoperative period can cause patient dissatisfaction and even risk to health, due to the inflammatory and scarring reaction due to the trauma caused by the surgical procedure. For the control and prevention of these effects, treatment with a physiotherapy professional is recommended, working with several resources. **Objectives:** To investigate the post-surgical interventions most used by physiotherapists in patients in the postoperative period of abdominoplasty, together with the resources used. **Methods:** This is a systematic literature review carried out using a comprehensive strategy in the PubMed, Embase, Cochrane, SCOPUS, Scielo, Web of Science and Google Scholar databases. **Results:** : Five studies, 3 clinical trials and 2 observational trials were carried out. included in the review. Of a total of 456 patients, 447 were female and 9 were male. The average age range was 18 to 67 years. The results showed that the most used resources with physiotherapeutic treatment include US, DML, Lymphotaping. **Conclusion:** It is concluded that the intervention of the physiotherapist is effective for the prevention of adverse symptoms such as hematomas, fibrosis, edema, swelling and inflammation, since the professional acts according to the scarring phases of the postoperative period.

Keywords: Tummy tuck; postoperative; physiotherapist; resources.

BACKGROUND

Abdominoplasty is one of the most performed surgical interventions in the world, representing 7,6% of surgical procedures for aesthetic purposes. However, when it comes to Brazilian statistics, it ranks fourth with 10,4% (on average 155,000 surgeries per year) with a target audience of people aged between 19 and 50 years[1-3].

Abdominoplasty is characterized by the removal of fat located in the lower abdominal region, along with sagging skin around the navel and stretch marks. As the surgical objective is based on an aesthetic or functional correction of the abdominal wall, it is indicated for people with excess skin, such as people who undergo bariatric surgery[4].

It is also indicated for people who have lost too much weight[5], in which the excess skin has impaired the individual's functional capacity, as well as created a social barrier[4, 6, 7], since it reduces skin flaccidity, causing the improvement of curves and the aesthetic appearance of the abdomen[8, 9].

In spite of its attractive visual effect, the abdominoplasty surgery presents in its Post-Surgery (PO) some effects resulting from the surgical trauma, such as tissue fibrosis[10], ecchymosis[11], edema[12], inflammation with swelling, seroma, different types of hematomas, pain, wound dehiscence, tissue adhesions and anesthetic or pathological scars, modification of superficial sensitivity, body asymmetries, contracture in free grafts, necrosis and infection[13].

Corresponding author: Miguel Luciano Rodrigues da Silva Junior
E-mail:
miguel.junior@aluno.uepa.br

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It is known that in this context, the work of physical therapy for the postoperative period has been well recommended in the literature[8-10, 12, 14, 15], as it avoids complications and treats the patient, with the support of different resources, namely: i) lymphatic drainage[2]; ii) functional tissue release[15]; iii) lymphatic taping[11, 16, 17]; iv) electrothermophototherapy resources such as red LED[18] TENS, microcurrent, ILIB (Intravascular Laser Irradiation of Blood)[19].

However, it is not yet known which of these resources are the most used today. For such an understanding, the objective of the study was to investigate the post-surgical interventions most used by physiotherapists in patients in the postoperative period of abdominoplasty, together with the resources used.

METHODS

Study design

The study is a systematic literature review, in which the model proposed by Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[20] was used, ensuring that the study maintains its compliance with the recommendations along with the criteria described on desirable report items for systematic reviews and meta-analysis. This review has been filed with Prospero on PROSPERO (www.crd.york.ac.uk/prospero/) CRD42022383182.

Search strategy

Potential studies were located using a comprehensive search strategy, in which seven databases were consulted, namely: National Library of Medicine National Institutes of Health (PubMed), EMBASE, Cochrane Central Register of Controlled Trials (Cochrane), SCOPUS, Scientific Electronic Library Online (Scielo), Web of Science (Web Science) and Google Scholar, using keywords as shown in the figure below. The Boolean operators used were "AND" and "OR", and the search strategies were developed from August to September 2022 (figure 1).

Data base	Estrategy
Pubmed	((Rehabilitation [MeSH Terms]) OR (((((((Physiotherapy) OR (Physiotherapies)) OR ("Physical Therapy"))) OR (lymphatic taping)) OR (((((("Athletic Tape"[MeSH Terms]) OR (kinesiotapes)) OR ("Kinesio Tape")) OR ("Compression Bandage")) OR ("Compression Wraps")))))) AND ((Abdominoplasty [MeSH Terms]) OR (Lipoabdominoplasty [MeSH Terms])).
Embase	physiotherapy'/exp OR physiotherapy OR rehabilitation OR 'kinesio taping' OR 'compression bandage' and 'abdominoplasty'/exp OR abdominoplasty OR lipoabdominoplasty.
Cochrane	(Rehabilitation OR Physiotherapy OR Physiotherapies OR "Physical Therapy" OR lymphatic taping OR "Athletic Tape" OR kinesiotapes OR "Kinesio Tape" OR "Compression Bandage" OR "Compression Wraps") in All Text AND (Abdominoplasty OR Lipoabdominoplasty) in All Text - (Word variations have been searched).
Scopus	ALL (rehabilitation OR physiotherapy OR physiotherapies OR "Physical Therapy" OR lymphatic OR taping OR "Athletic Tape" OR kinesiotapes OR "Kinesio Tape" OR "Compression Bandage" OR "Compression Wraps") AND ALL (abdominoplasty OR lipoabdominoplasty).
Scielo	(abdominoplastia) AND ((Fisioterapia) OR (Bandagem Funcional) OR (Taping linfático))
Web Science	TS=(rehabilitation OR physiotherapy OR physiotherapies OR "Physical Therapy" OR lymphatic AND taping OR "Athletic Tape" OR kinesiotapes OR "Kinesio Tape" OR "Compression Bandage" OR "Compression Wraps") AND TS=(abdominoplasty OR lipoabdominoplasty)
Google Acadêmico	"Fisioterapia" AND "Abdominoplastia".

Figure 1. Search strategies

Inclusion and exclusion criteria for studies

The inclusion of studies was carried out by randomized studies, case study, clinical case, data collection, retrospective, experimental, controlled clinical trial, with people aged 18/67 years who underwent abdominoplasty surgery and underwent treatment with a physiotherapist in the postoperative period. The articles included were published between the years 2012 to 2022. Portuguese and English languages. Performed in duplicate by two researchers.

All articles that did not have all the desired and complete information were excluded. Articles that were in "perhaps" were excluded because they addressed surgical practices with no participation of the physiotherapist in the postoperative period. Studies published more than 10 years ago, course completion studies such as monographs, theses and dissertations, as well as review articles, were excluded.

Selection of studies

Data extractions were performed using the Rayyan platform, a web application developed by the Qatar Computing Research Institute (QCRI) which helps systematic review authors to perform integrative and scope searches quickly, easily and practically, achieving use the data independently[21]. The use of the tool in the present study started in the identification phase of the studies in order to extract the articles for inclusion, thus, the studies were identified in the databases, later exported to Rayyan for the identification of duplicates.

Next, the screening phase was carried out in two selections: First, the titles were selected according to the research question: What are the post-surgical interventions most used by physiotherapists in patients in the postoperative period of abdominoplasty? Staying in "perhaps" (maybe) the articles that would have doubt of inclusion. Therefore, clinical trials, case studies, observational and case-control studies that addressed the interventions of the physiotherapist in the postoperative period of abdominoplasty were included. Furthermore, studies were included after reading the abstracts and results.

Evaluation of the Quality of Studies

For randomized clinical trials, the RoB 2 tool was used, according to Higgins et al.[22]; in relation to non-randomized clinical trials, the ROBINS-I(22) was used, and for the evaluation of observational studies, the Newcastle-Ottawa scale was applied, according to Wells et al. (2000)[23].

The RoB 2 tool was used to assess each study in six domains: bias arising from the randomization process, bias derived from deviations from intended interventions, bias due to lack of outcome data, bias in measurement of outcomes, bias in selection of reported outcomes and bias in general. Each domain is then ranked according to risk of bias: low risk, few concerns, or high risk.

The ROBINS-I tool evaluates the studies in eight domains: bias due to confounding, bias in the selection of study participants, bias in the classification of interventions, bias due to deviations from the intended interventions, bias due to lack of data, bias in measurement of results, bias in the selection of reported results and bias in general. Domains are also classified according to five categories: low risk of bias, moderate risk of bias, serious risk of bias, critical risk of bias, and no information.

The Newcastle-Ottawa scale uses a star system to judge the risk of bias in the analyzed studies. Three domains are evaluated: the selection of study groups, with a maximum of 3 stars, the comparability of the groups and the description of the results, the latter domains with a maximum of 2 stars. The higher the number of stars, the lower the risk of bias in the evaluated studies and, therefore, the better their methodological quality.

The assessment, in each of the tools, was performed by two researchers, independently, in order to reduce the risk of bias within the analysis itself. Disagreements were resolved through consensus among evaluators.

Extraction of information from texts

The extraction of information from the texts was performed in excel version 2019 in a standardized way based on the following items: study data (authors, journal name, country and place of study, year of publication), methodological characteristics (sample characteristics, size of the sample, stratification of groups, protocol of interventions), results referring to the interventions of the physiotherapist in the postoperative patients of abdominoplasty surgery. Subsequently, the data were recorded in tables 1 and 2.

Table 1 – Summary of localized studies.

Country	M/F	Age	Study tipe	Assessment instruments	Conclusion
Brazil	1/259	18 to 67	Description of data collection type.	Comparison between patients' charts, the type of physiotherapeutic intervention most used in the postoperative period.	The most used postoperative treatment for abdominoplasty patients in the last 6 years was manual lymphatic drainage (100%), followed by ultrasound (100%).
Brazil	8/115	44,6±12,8	Retrospective by medical record analysis.	Length of the dehiscence area measured and recorded photographically with the Pentax® camera positioned 30 cm away from the patient's skin and saved on the computer using the Adobe Photoshop CS4 program.	The prevalence of dehiscence was high, occurring in 9.8% of the patients studied, and all of them had complete closure of the dehiscence through physiotherapeutic treatment performed with high frequency or therapeutic ultrasound.
Brazil	0/10	46,3 (± 2,5)	Uncontrolled clinical trial	Visual assessment Level 0 (N0) to Level three (N3) and assessment of tissue fibrosis was contact thermography.	The time to start the fibrosis treatment interferes with the result after 10 consultations, as Patient 10 started the treatment two years after the surgery and the palpation in the evaluation did not show the same reduction in the fibrotic condition.
Brazil	0/20	20 to 60	Controlled clinical trial	Photodocumentation and VAS.	The control group showed pain while the intervention group did not. The intervention group with the best response to the resolution of the ecchymosis (μ=7.8±4.3), in relation to the control group (μ=17.6±5.0) (p=0.0002).
Saudi Arabia	0/43	35 to 55	Controlled clinical trial	VAS, and abdominal circumference.	There was a significant difference between the groups with regard to visual satisfaction and the decrease in waist circumference, being more positive in the intervention group (B) than in the control group (A).

Note: M, male; F, female; VAS, visual analog pain scale.

Table 2 - Physiotherapeutic intervention protocol in abdominoplasty.

Author /Year	Physiotherapeutic resources	Parameters	Time
Da Silva, etal. (2012)	DPO with manual lymphatic drainage and ultrasound. Treatment between the 5th and 8th PO 45%, 28% until the 4th PO, 12% between 9th and 12th PO, 8% between 13th and 16th PO, 5% between 17th and 20th PO and a smaller portion (2%) above the 21st PO.	(66%) of the patients underwent 11 to 20 sessions of Physiotherapy, while (4%) underwent more than 30 sessions during the postoperative period and the remaining patients underwent 1 to 10 sessions (20%) and 21 to 30 sessions (10%). US with a frequency of 3 MHz were the resources used by all patients and manual drainage in the surgery area.	1 to 3 months
Tacani et al.(2014)	Therapeutic ultrasound and sparking technique, cauterizing electrode..	Therapeutic ultrasound, 3 MHz, pulsed at 50%, intensity 0.5 W/cm², 10 minutes, for 8 sessions. The patients underwent two techniques with high frequency intensity and spark production, from 7 to 19 sessions.	1 to 2 months
Chi et al.(2016)	MLD using the Leduc method throughout the body and lymphotaping in Fan format. From the 7th postoperative day.	Physiotherapeutic treatment, for 10 consultations, with an average duration of 90 minutes each, twice a week, with intervals of 2 or 3 days. 3 MHz ultrasound with effective radiation area of 6 cm2 and power of 18 W each, totaling a power of 54 W/cm2. The protocol used was pre-programmed in the device as late post-surgery (continuous mode, carrier frequency of 1 KHz, current modulation frequency of 50Hz.	20 to 30 days
Chi et al.(2021)	Lymphatic taping in the abdomen and flanks in a "fan" cut. It was placed from the 1st to the 4th day postoperative.	Transoperative treatment with the application of lymphatic taping in the abdomen and flanks. Lymphatic taping is considered when the cut is made in a "fan", that is, with portions cut in its active band and with a base of 3cm to 5cm. Cut into five different portions, being positioned with minimal tension (0 to 20%) on the lateral regions (with the base fixed on the midline of the lateral abdomen or bilateral axillary region) and flanks (with the base on the bilateral coccygeal region).	4 days
Abdelhalim e Samhan (2021)	Group B 21 women used the compression strap (17-20 mmHg pressure) and Compression Therapy Intermittent pneumatics.	Belt compression was gradually inflated from distal to proximal around the abdominal area, and inflation was followed by deflation (in a 3:1 ratio), preserving pressure. The treatment time was 45 minutes, 3 times a week, for 4 weeks (12 sessions).	1 month

Note: PO, Postoperative; MLD, manual lymphatic drainage; POD, Postoperative Day; US, Ultrasound; CM, Centimeters.

RESULTS

Initially, 118 articles were identified in electronic databases, according to pre-established search strategies. Next, the initial screening was performed using the Rayyan® tool, 22 duplicate articles (resolved) being excluded. The remaining 98 articles underwent title and abstract analysis, with the exclusion of 78 studies for not meeting the eligibility criteria.

A full reading of the 20 studies was carried out, in which 8 articles were excluded, as follows: 3 referring to surgical techniques, 3 without data on the reverse interventions of the physiotherapist in the postoperative period of abdominoplasty; 2 off topic. Of the remaining 12, 7 remained in "maybe" as a doubt, as the documents were not found in their entirety, however, after being located, all were excluded because 4 did not have all the necessary information, and 3 were part of unfinished projects. A total of 5 studies were included in the survey (figure 2).

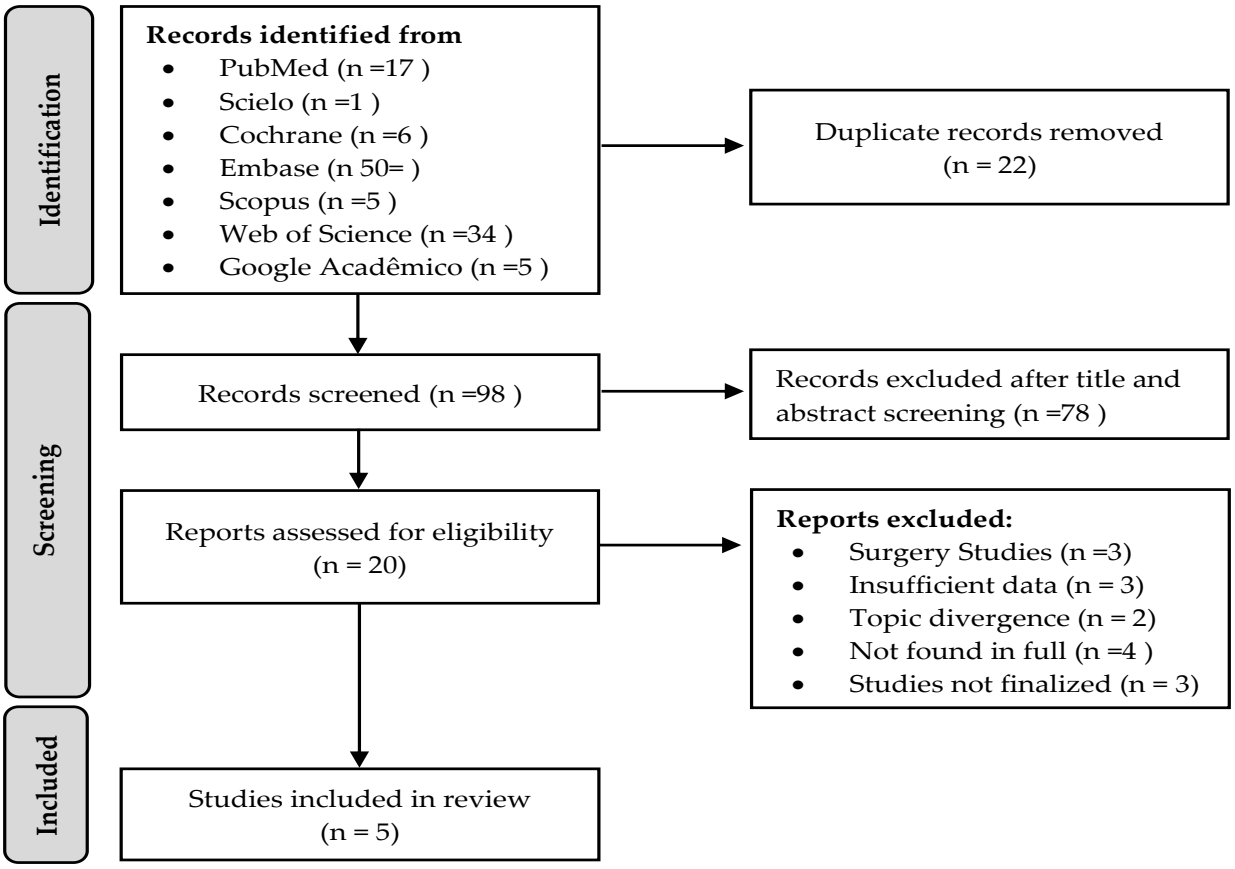

Figure 2 – Study eligibility flowchart, according to Prisma criteria.

Of the five selected studies, one is from Saudi Arabia[24] and four are from Brazil[11, 19, 25, 26]. The total population totaled 456 patients, of which 447 were female and 9 were male. The average age range of the sample was 18 to 67 years old, with a higher prevalence of people aged between 30 and 45 years old. All the studies along with the characteristics of the samples and interventions used by physiotherapists in the post-abdominoplasty surgery are presented below, in which only 2 studies presented a control group[11, 24] (table 1). Furthermore, we can observe a heterogeneity of the resources used and the follow-up time of 1 to 3 months (Table 2).

Risk of bias analysis of selected studies

Risk of bias assessment was performed on all articles included in this review. Articles dealing with randomized clinical trials were evaluated using the Rob 2 tool.

With the individual evaluation of the articles, it is verified that Chi et al.[11] and Abdelhalim and Samhan[24] presented a low risk of bias in the 5 domains evaluated, demonstrating, in general, a low risk of bias (figure 3).

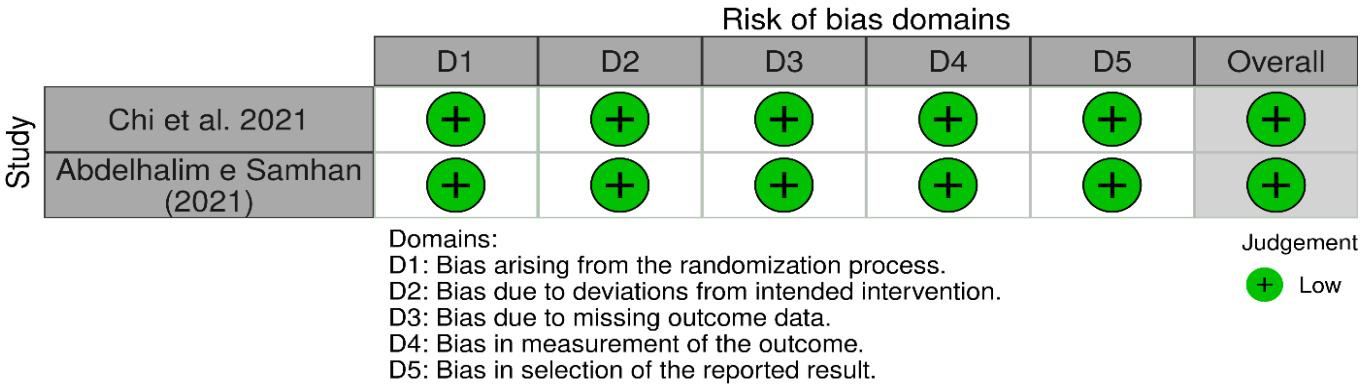

Figure 3 – Risk of bias assessed using RoB 2.

Non-randomized clinical trials were evaluated using the ROBINS-I tool. The article by Chi et al.[26] showed a low risk of bias in all evaluated domains (figure 4).

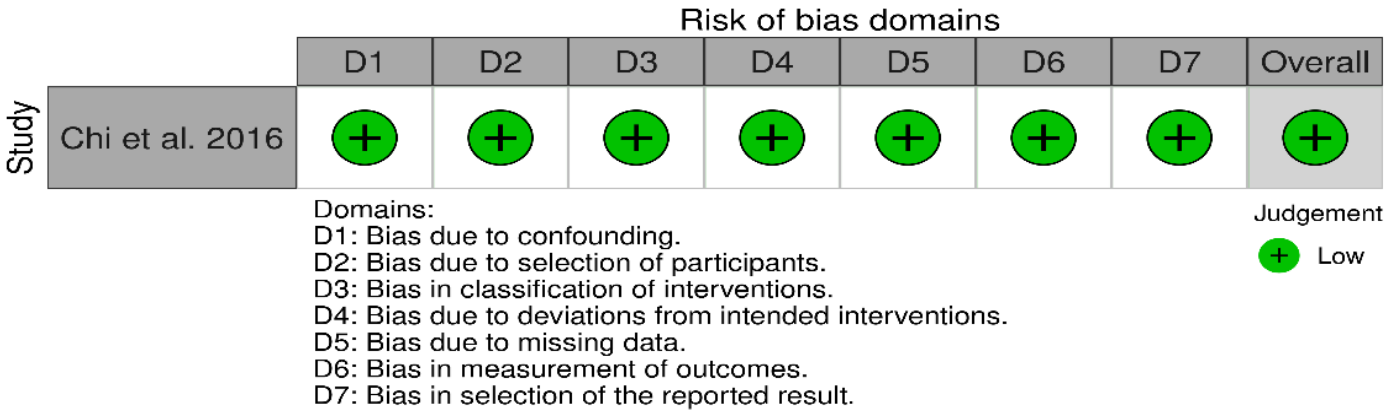

Figure 4 - Risk of bias assessed using the ROBINS-I.

The Newcastle-Ottawa scale was used to assess the quality of each study based on three domains: selection, comparability and outcome. The articles are scored in a star fashion, ranging from zero to nine stars, and the greater the number of stars, the better the quality of the articles. In this study, we chose to represent the scale in absolute numbers. As demonstrated, the observational study with the best methodological quality was by Tacani et al.[25] with a total score of 9. The article by Da Silva et al.[19] obtained a total score of 8 points (Table 3).

Table 3 - Risk of bias assessed using the Newcastle-Ottawa scale.

Author	Representativeness of the sample	Comparability	Outcome	Total score
Da Silva et al. (2012)	5	1	2	8
Tacani et al. (2014)	5	1	3	9

DISCUSSION

The aim of the study was to investigate the most frequent physiotherapeutic interventions in the postoperative period of abdominoplasty. The studies showed heterogeneity of taping, ultrasound, MLD (manual lymphatic drainage), use of compression straps and intermittent pneumatic compression therapy.

It was possible to observe the prevalence of females, due to the greater need to remove excess skin in the abdominal region, caused by pregnancy and weight loss. There was only one study abroad, since the country that most performs cosmetic surgeries is the United States, and in fourth place is Brazil[1].

The studies found presented a follow-up between 1 and 3 months of physiotherapy and only one study reported on the immediate PO[11]. It is known that the healing process requires surgical healing time and healing remodeling time, in which the first occurs in the inflammatory phase in the midst of a release of vasoconstrictor substances, mainly thromboxane A2 and prostaglandins, through cell membranes. Thus, the injured endothelium together with the platelets stimulates the coagulation cascade, together with the neutrophils that join the macrophages after bacterial destruction within a period of up to 24 hours, but the phase can last from 48 to 96 hours[26].

Then, in the remodeling phase, collagen deposition occurs in an organized manner, which is initially thinner than the collagen present in normal skin, having an orientation parallel to the skin, later it is reabsorbed giving rise to thicker collagen, reflecting in the increase of tensile strength of the wound. Phase of reorganization of the new matrix in which fibroblasts and leukocytes secrete collagenases providing lysis of the old matrix[25].

The most frequently used assessments to observe the effect of physiotherapeutic resources were photo documentation and the visual analogue pain scale, VAS. They know that photo documentation is an instrument that demonstrates the action of photographing aesthetic patients, with the objective of showing the patient the results achieved in a given treatment, product or protocol[27]. The VAS scale, in turn, consists of measuring the intensity of pain, being an important instrument for verifying the patient's evolution during treatment in a more reliable way. It is also useful for analyzing whether the treatment is being effective, as well as pointing out which procedure may have the best effect, according to the degree of improvement or worsening of pain[28].

In the study by Da Silva et al.[19], US ultrasound and MLD were used as a therapeutic resource, helping in tissue drainage, combating fibrosis, and helping in the healing process. Myofascial release was used for the reorganization of the collagen bundles and for the appearance of fibrosis, while cicatricial mobilization was used to avoid keloids. In addition, resources such as the modeling belt brought many benefits in reducing edema and fibrosis formation. The authors did not mention any type of limitation to the study.

Niespodzinski and Gassner[28], when carrying out a case study to address the techniques and resources used in the PO treatment of a patient who underwent abdominoplasty, liposuction and mastopexy with prosthesis, used resources such as MLD, kinesiotaping, high frequency, ultrasound, myofascial release, among others. And corroborating the study by Da Silva et al.[19] they showed that among the various resources, the healing time must be respected. Therefore, ultrasound was used as a therapeutic resource, aiding in tissue drainage, combating fibrosis, and helping in the healing process. Myofascial release was used for the reorganization of the collagen bundles and for the appearance of fibrosis, while cicatricial mobilization was used to avoid keloids. In addition, resources such as the modeling belt brought many benefits in reducing edema and fibrosis formation.

Tacani et al.[24] also highlighted the use of therapeutic US as a fundamental option for healing. The authors combined US with the sparking technique, cauterizing electrodes, because, in the retrospective study by analysis of medical records, they aimed to verify the prevalence of surgical wound dehiscence and their respective physiotherapeutic treatment in the PO period. All patients presented complete closure of the dehiscence through physiotherapeutic treatment performed with high frequency or therapeutic ultrasound The limitation of the study occurred in the lack of association of risk factors, surgical technique, perioperative care and costs with the physiotherapeutic treatment of surgical wound dehiscence .

Carvalho and Santos[9] when researching the physiotherapeutic approach in the postoperative period of abdominoplasty in a bibliographic review of the descriptive exploratory type, with a qualitative approach, highlighted the use of high power laser for the treatment of dehiscence.

The authors corroborate that the technique used by Tacani et al.[24] accelerates healing and wound closure. Bessa[29] in addition to corroborating the statement explains the reason for the benefit, when analyzing the physiological phenomena that can occur in the human body when using high frequency in aesthetic and therapeutic procedures.

Through explanatory bibliographic research, it was inferred that high frequency therapy has the ability to accelerate healing, destroy viruses, bacteria and fungi on the skin surface, providing greater oxygenation and nutrition to tissues, promoting analgesia, acting as an anti-inflammatory. inflammatory and facilitating the permeation of actives.

Still dealing with a combined method, Chi et al.[25] used MLD associated with lymphotaping in the proliferative tissue repair phase, and DLM in the remodeling phase, however, associated with combined therapy and lymphotaping.

Chi et al.[11] at the same time, carried out a clinical trial with the application of lymphatic taping in 10 women in the experimental group EG, comparing them to 10 women in the control group GC. The EG showed a better response for the resolution of the ecchymosis (μ=7.8±4.3), in relation to the control group (μ=17.6±5.0) (p=0.0002). The study only had limitations regarding the sample size, requiring further studies to be carried out. Correa, Souza and de Oliveira[16] exemplify, in the midst of a narrative review of the literature, numerous benefits of using lymphatic taping in the PO period of different plastic surgeries, namely: significant improvement in pain, reduction or elimination of ecchymosis formation, helps in the healing process and softens lymphedema by promoting a reduction in edema in the long term. The authors highlighted that the best results are presented when the use is associated with another treatment method.

Another type of treatment found in the present review was presented by a randomized study in which Abdelhalim and Samhan[23], who evaluated the influences of intermittent pneumatic compression therapy (IPPT) on edema resolution and improvement in PO patient satisfaction. As for the limitations, the authors highlighted that the edema was measured using the abdominal circumference, as it is a subjective method. Because, according to the authors, the objective method for evaluating edema should be done by ultrasonography, which was not used due to the lack of highly qualified professionals.

Pontelli, Scialom and Santos-Pontelli[29] defend the use of IPET, since this type of method presents the same efficacy of thromboembolic prophylaxis in abdominoplasty as the pharmacological methods. The authors came to this conclusion after conducting a retrospective study of 563 abdominoplasties, isolated or not, performed between March 2008 and April 2011. The patients received two different thromboembolism prophylaxis protocols, one being pharmacological, using enoxaparin, applied in 357 patients, and the mechanical protocol, with the application of IPET in 206 patients. As a result, they observed that the incidence of complications in the pharmacological group in relation to the mechanical group was: hematoma, 5.6% and 10.7%; infection, 2.2% and 2.4%; dehiscence, 3.1% and 1.9%; seroma, 2.2% and 2.4%; and deep vein thrombosis/pulmonary thromboembolism, 0.6% and 0.5%. Without the presence of any statistically significant complication between the groups.

The literature corroborates the importance of the physiotherapist's intervention in the postoperative period of abdominoplasty, being effective for the prevention of adverse effects, as well as for the late post-surgical treatment, since the physiotherapist has resources and techniques that can be applied at each stage of healing. On the other hand, the limitation of the research was due to the scarcity of primary studies exposed in original articles.

CONCLUSION

In view of the findings in the present study, it was possible to understand that there is a multiplicity of physiotherapy methods applied in the postoperative period of ab-

dominoplasty. The most prominent ones being ultrasound, drainage, taping, compression strapping and intermittent pneumatic compression therapy.

Therefore, it is necessary that studies focused on the quality of life of PO abdominoplasty patients be carried out to identify the various types of interventions that can be used, showing whether or not existing intervention methods are effective. Likewise, comparative studies are necessary, since through them it is possible to measure not only the effectiveness but also enable the choice according to the patient's healing phases, covering the professional's modes of action according to the need for each patient.

It is concluded that the intervention of the physiotherapist is effective for the prevention of adverse symptoms such as hematomas, fibrosis, edema, swelling and inflammation, since the professional acts according to the scarring phases of the postoperative period, even in cases of late periods with more than a year after the surgery was performed.

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