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## Review Article

# Effect of Compression Garments on Post-Abdominoplasty Outcomes: A systematic Review of the current Evidence

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## ABSTRACT

**Introduction:** It is commonly believed that using abdominal binders or compression garments (CGs) after an abdominoplasty could encourage fluid to drain, which would prevent fluid from building up at the surgical site and reduce the risk of seroma and other similar problems.

**Objective:** To evaluate the effect of the use of abdominal binders or CG on the post-operative outcomes following abdominoplasty.

**Design:** Systematic review

**Method:** Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines were followed to select relevant studies from 2004 to 2024. Data from the included studies were extracted to assess the quality and risk of bias using a modified Jadaad score.

**Main outcome:** Post-operative seroma formation

**Secondary outcome:** Ventilatory function, intra-abdominal pressure (IAP), and subcutaneous edema were the outcomes of interest.

**Results:** Only 5 trials totaling 130 patients were included in this review. Utilizing post-operative CG following abdominoplasty showed a non-significant tendency to decrease seroma development, ven-

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tilatory function, and subcutaneous edema. The limited evidence available also suggested that using post-operative CG increases IAP. *Conclusion:* Weak evidence supports the beneficial use of abdominal binders following abdominoplasty.

*Limitations:* Low-quality scientific evidence available from the scant data and low caliber of the literature support the use of CG post-abdominoplasty. Therefore, unified outcome reporting and rigid randomized clinical trials are necessary to obtain valid data.

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### What is already known on this subject?

- Early post-operative abdominal binder use is considered to be beneficial in reducing seroma formation possibility, along with improving the psychological status and physical functions.
- In most of the literature evaluating abdominal binders or CG, the type of support used is not identified, nor are the material's types, ventilation status, degree of elasticity, sizing technique, height of the binder, degree of compression, and other design-related details described that can significantly affect the outcomes of wearing a binder.

### What do the results of this study add?

- The favorable effects of abdominal CGs on seroma formation, intra-abdominal pressure (IAP), ventilatory function, and quality of life after abdominoplasty were not significantly established in this investigation, in contrast to the widely accepted beliefs and practices.
- Although many trials have been conducted on the use of CG with other types of abdominal surgeries, trials on the effect of CG post-abdominoplasty are still cursory.

### What are the implications of these findings for clinical practice and/or further research?

- Further research is warranted to explore thoroughly the association of the post-operative utilization of abdominal CG post-abdominoplasty to provide scientific support to the available guidelines for their clinical use.
- It is justified to conduct additional research in populations with distinct characteristics.

## Background

Abdominoplasty, also known as tummy tuck surgery, is designed to shape and tone the abdominal region, often entailing liposuction and excision of skin.<sup>1</sup> The popularity of abdominoplasty paints a picture of a growing trend in cosmetic surgery, and according to the American Society for Aesthetic Plastic Surgery statistics for 2019, it was the fourth most common aesthetic surgical procedure performed in the United States, with more than 140,000 surgeries conducted that year.<sup>2</sup> In 2018, the American Society of Plastic Surgeons established 2 joint opinion conferences, "Evidence-based Abdominoplasty" and the second "Ventral Hernia Consensus Conference," leading to the publishing of 16 guidelines with the intention of improving patient safety and surgical results.<sup>3</sup> The elevation of concentration resulted from an improved understanding of the risks of the surgery, increased patient satisfaction, and enhanced psychological health. These are important changes from a physician's viewpoint, providing a clearer indication and better outcome of the surgery.

Often, post-abdominoplasty, there is an unwanted accumulation of fluid in the abdominal cavity, which can amount to 20% to 30% of the volume of fat removed from the abdominal area. This fluid may become serous and, in some cases, hemorrhage into the wound (seroma and hematoma)<sup>4</sup>. Seroma formation is one of the most frequent complications following abdominoplasty, with estimates

ranging from 1% to 38%.<sup>5</sup> Another post-operative outcome usually encountered is the pain levels after abdominoplasty. It found that patients with a higher amount of tissue removed experienced more pain post-surgery.<sup>6</sup>

The treatment approach of these post-operative outcomes depends on their severity. Widely practiced post-operative interventions to optimize clinical and aesthetic outcomes are the post-operative use of an abdominal compression garment (CG) and needle aspiration.<sup>7,8</sup>

A CG or a binder is a specially designed, tight-fitting garment that covers the torso, primarily focusing on the abdomen.<sup>9</sup> The CG compression is believed to help minimize swelling by applying pressure to the surgical area, encouraging excess fluids to drain adequately.<sup>10</sup> The gentle pressure and support of the abdominal muscles from the CG are presumed to alleviate post-surgical pain and discomfort. The CG provides support to the abdominal muscles, which can feel weak or stretched after surgery, helping the patient maintain proper posture and stability and is expected to aid in better tissue adherence and overall healing, contributing to a smoother and more aesthetically pleasing surgical outcome.<sup>11-14</sup>

In the plastic surgery literature, a clinical trial<sup>15</sup> examining CG use after laparoscopic umbilical and epigastric hernia repair, the utilization of a post-operative compression binder showed a substantial reduction in pain and discomfort related to seroma<sup>15</sup>. A significant decrease in pain and seroma production was reported in post-midline laparotomy use of CG.<sup>16</sup> Although there is evidence that a CG can shorten the time required to achieve maximum resolution, several studies provide contradictory results. Patients undergoing inguinal hernia repair with or without a CG<sup>17</sup> did not exhibit a statistically significant difference in the time of seroma resolution.<sup>18</sup> Meanwhile, another study clearly demonstrated that post hernia repair use of an abdominal binder could strengthen the physical condition and treat the wound.<sup>19</sup> The rates of seroma production and diastasis recti (muscle separation) were not significantly different between patients who wore CG and those who did not.<sup>20,21</sup>

The trials mentioned are all explicit in other types of abdominal surgeries, thus exposing a critical lack of large- trials with substantial number of participants in the field of abdominoplasty outcomes with post-surgical use of CG. The significance of these findings, even in other abdominal surgeries, is debatable, and the explanation of these effects remains unclear based on the subpar evidence provided in the literature. Thus, it is still uncertain whether the application of CG versus not using it post-operatively can reduce pain and seroma formation in patients who undergo abdominoplasty.

This lack of strong evidence may lead to a shift in practices and a lack of consensus among plastic surgeons on the effectiveness of CG use post-abdominoplasty. Currently, there is no systematic review of a meta-analysis directly comparing exclusively post-abdominoplasty CG use with no-garment use. Thus, our study aimed to provide clinicians and patients with an analysis of the efficacy of post-operative abdominal CG use by applying an evidence-based approach. This will provide clinicians with valuable information in order to lower the incidence of a seroma following.

The objective of this systematic review was to evaluate the efficacy of the use of a CG post-abdominoplasty toward the prevention of the incidence of seroma and CG role in avoiding post-operative adverse outcomes like ventilatory function, IAP, and subcutaneous edema post-abdominoplasty. This study provides an update of the most recent scientific evidence on the clinical effects of using abdominal binder or CG post-abdominoplasty.

### Research Question

The research questions of this study, as per patient/population, intervention, comparison and outcomes (PICO) format, are as follows: **Patient:** all patients who had undergone any type of abdominoplasty procedure. **Intervention:** post-operative abdominal CG. **Comparison:** not using any type of CG post-operatively. **Outcomes:** the primary outcome of interest was the incidence of seroma formation. Secondary outcomes covered in this study were adverse effects, such as IAP, ventilatory function, and subcutaneous edema post-operative abdominal CG.

Data interpretations and conclusions were focused on trying to answer this research question and to see if the incidence of seroma formation does, in fact, decrease if an abdominal CG is used post-operatively. The conclusions from this study are targeted to influence the construction of a clinical guideline in the field, potentially providing clarity in future practice.

## Methods

This meta-analysis was documented based on the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement. This writing is void of any attempts to obtain unpublished data, there are no alterations to the methodologies reported in the clinical trials being analyzed, and there is no use of individual patient data, thus, no need to obtain informed consent. Prior registration of this study protocol was done with The International Prospective Register of Systematic Reviews (PROSPERO) under the registration number CRD42020197657.

### *Search strategy*

The articles related to seroma, edema, or any other post-operative complications among patients who had undergone abdominoplasty with or without post-operative use of abdominal CGs, were found by conducting searches in various electronic databases and examining the references of relevant articles. To stay updated with the most recent scientific evidence, the search covered the period from 2004 to 2024. The search terms included a combination of MeSH terms and text words such as “abdominoplasty, abdominal CGs, abdominal binder, corset, seroma, edema, hematoma, tummy tuck, post-operative pain, ventilatory function, pulmonary function, psychological distress, physical function, and quality of life.” Cochrane Library and other databases (OVID, Web of Science, and ProQuest) were searched using these MeSH terms, spanning the time frame mentioned. The bibliographies of all relevant articles were reviewed to ensure that no important articles were overlooked. Conclusive decisions on including literature were reached after an initial review of the abstract, and full articles were obtained if the inclusion criterion was met.

### *Inclusion criteria*

Clinical studies of Level I-IV evidence<sup>22</sup>, such as randomized control trials, cohort studies, and prospective investigations, were included to explore the use of CG following abdominoplasty. There was no restriction on language, and translations were used appropriately. In cases where multiple published studies were identified using the same sample, the relevant outcome matching this current review from each publication was selected.

- (1) All patients had to have undergone abdominoplasty. There were no limitations on the type of abdominoplasty, previous body contouring surgery, age, gender, or any medical comorbidities.
- (2) The intervention had to be the use of CG post-operatively. This could either be compared with a group of patients receiving no intervention, or a different form/method of applying a CG.
- (3) The primary outcome studied had to be related to seroma and other outcomes of wound healing recorded by investigative procedures (ultrasound, aspiration, and drainage volume) or clinically symptomatic with a complication.
- (4) A study had to contain data that were able to derive a conclusive statement or calculated statistically. This was defined as having means and standard deviations available for continuous data or having the ability to extract data to calculate these values from other data provided.

### *Exclusion criterion*

Simulation studies and animal studies were excluded, as the focus of this investigation was on the complications related to wound healing in human surgical patients. Technical reports, other reviews, and letters to editors were excluded. Studies in which the use of abdominal CGs was not clearly described were excluded. If the sample was mixed (e.g., maternity, general surgical, and obesity) and results of the post-operative sample could not be extracted, it was excluded.

### *Data collection and analysis*

Data from each study were extracted in the form of evidence tables summarizing the key study characteristics and results. These included study details, study type, sample size, patient demographics, and details of CG use, descriptions of outcome measures, and the key study findings.

### *Quality assessment and risk of bias*

Quality and risk of bias of each included article were assessed using the modified form of the Jadad scale,<sup>23</sup> which involved assigning a score out of 8 based on the description of randomization, blinding, inclusion/exclusion analysis, dropouts, withdrawals, bias in outcome reports, and description of statistical analysis. Studies with a score of 3 or more (indicative of acceptable quality) were included. Any study that had poor methodological quality was excluded based on the results of these assessments. The contains tabular description of this assessment.

## **Results**

### *Search and selection of studies*

Figure 1 is illustrative of the search method and procedure which adheres to the preferred reporting of systematic and meta-analysis guidelines (PRISMA)<sup>24</sup> with the PRISMA flow chart.<sup>25</sup> Based on predetermined criteria, this study identified 35 articles, of 30 publications were eliminated after applying the preset eligibility criteria for inclusion in the review. Five prospective trials on post-abdominoplasty use of abdominal CG with 130 patients were evaluated in the study.<sup>26–30</sup> Summarized observations of included studies are presented in Table 3. None of the studies were unified in their post-operative outcome reporting, and this wide variety of post-operative outcomes restricted this study from being processed as a meta-analysis.

### *Patient demographics*

Table 2 presents patient characteristics of the 130 female patients who underwent abdominoplasty. The age of the patients ranged from 19<sup>29</sup> to 50<sup>30</sup> years, and the body mass index (BMI) ranged from 19<sup>29</sup> to 27.1<sup>30</sup> kg/m<sup>2</sup>.

### *Quality assessment*

The modified Jadad scale (Table 1) was applied to evaluate the quality of the selected studies. A total score of 1–2 defined low quality, 3–6 acceptable, and 7–8 defined a high-quality study. Sixty percent of the studies were of acceptable quality to be included in this review. They lacked a description of the double blinding in conducting the trials. Forty percent of the studies were of just acceptable quality as they lacked the randomization and double-blinding descriptions in their reports.

### *Primary outcome*

#### *Incidence of seroma*

Only one study with 34 participants reported the post-operative incidence of seroma using the post-operative CG.<sup>27</sup> This study concluded that post-abdominoplasty seroma production could not be prevented by wearing abdominal binders post-operatively. This clearly points out a critical lack of high-quality randomized trials to provide evidence of the effect of using a CG post-abdominoplasty.

### *Secondary outcomes*

#### *Ventilatory function*

Only one study examined ventilatory function post-abdominoplasty with 34 participants.<sup>30</sup> This study assessed intergroup comparisons between the garment group and the no-garment group. It re-

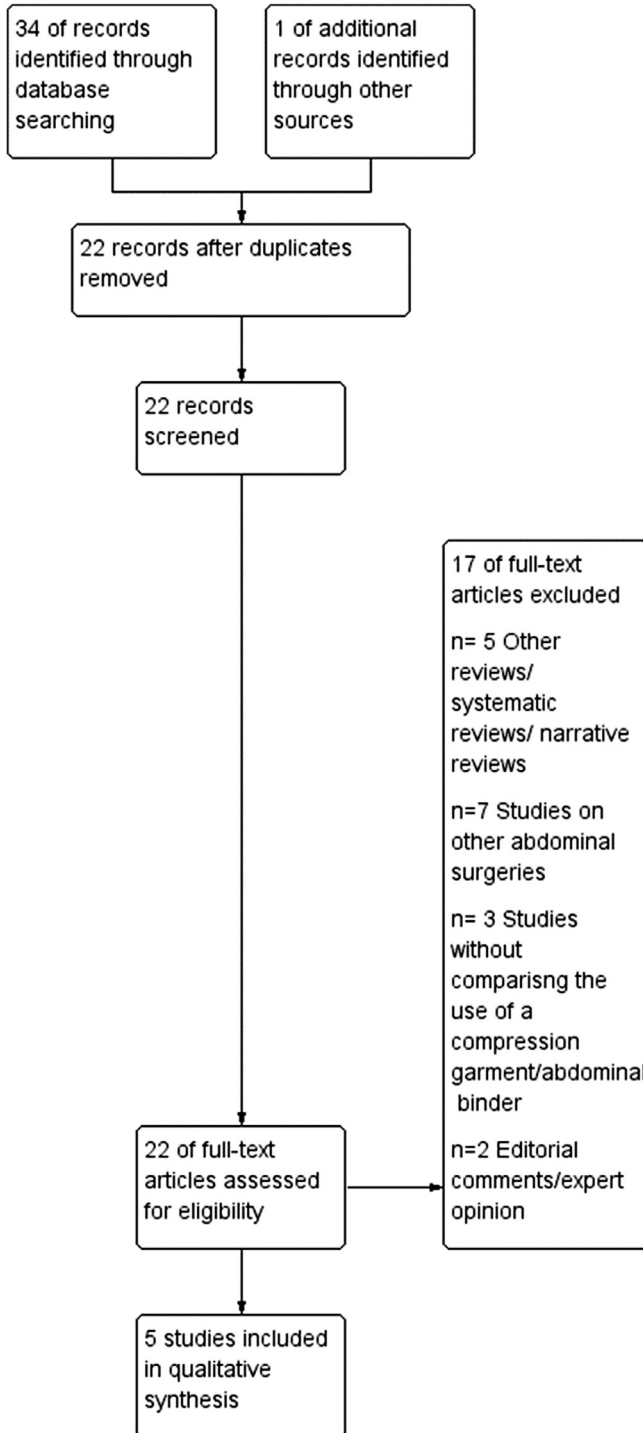


Figure 1. PRISMA flow chart adopted in the search and inclusion of studies.

**Table 1**

The modified Jadad score applied to evaluate the methodological quality of the included studies.

	Huang et al. <sup>26</sup> 2007	Rodrigues et al. <sup>27</sup> 2013	Martins et al. <sup>28</sup> 2022	Moraes et al. <sup>29</sup> 2022	Kosloski et al. <sup>30</sup> 2024
Was the study described as randomized?	-	-	1	1	1
Was the method of randomization described and appropriate?	-	-	1	1	1
Was the study described as double-blinded?	-	-	-	-	-
Was the double blinding method described and appropriate?	-	-	-	-	-
Was there a description of withdrawals and dropouts?	-	-	1	1	1
Were there clearly set inclusion/exclusion criteria?	1	1	1	1	1
Bias in outcome reports	1	1	1	1	1
Were the methods of statistical analysis described?	1	1	1	1	1
Score	3	3	6	6	6

**Table 2**

Demographic characteristics of the study participants.

Patient characteristics n=130			
Characteristics	SD	Standard deviation	P value
Age, years	34.7	12.7	0.01
BMI	29.5	3.1	0.05
Number of pregnancies	1.9	1.89	0.01
Abdominal deformities	4	1.33	0.03
Comorbidities	3.3	1.6	0.05

BMI, Body mass index; SD, standard deviation; t-test (statistical significance:  $P \leq .05$ ).

vealed that the forced expiratory volume in one second (FEV1) was lower in the no-garment group. When slow vital capacity was assessed, there were no discernible differences between the groups. In the CG group, this study reported a decrease in inspiratory capacity, which indicates ventilatory restriction. It is challenging to accept evidence with such limited resources; hence, there is no proof that abdominal CG enhances or lessens ventilatory function following abdominoplasty.

### *Intra-abdominal pressure (IAP)*

Two studies with a total of 20 participants explored the effect of the post-operative use of an abdominal CG following abdominoplasty.<sup>26,27</sup> The use of post-abdominoplasty CGs was linked to a statistically significant rise in pressure (2.63 mm Hg without a binder versus 4.5 mm Hg with a binder placed;  $p = 0.004$ ) as per one study.<sup>26</sup> This study further highlights that the utilization of abdominal CG as a risk factor for increasing IAP during abdominoplasty needs further investigation. According to the study findings, spirometry readings significantly decreased during surgery, and wearing CG post-abdominoplasty raised the IAP.<sup>26</sup> Overall, there is minimal data to conclude that abdominal CG can increase IAP.

### *Subcutaneous edema*

Only one study<sup>29</sup> with 34 participants reported post-operative incidence of subcutaneous edema using the post-operative CG. This study summarizes that post 24 days following abdominoplasty, patients who did not wear a CG developed less subcutaneous edema than those who did.

**Table 3**

Summary of the evaluation results from the included studies.

Study	Country	Type of Surgical Procedure	Design	Level Of evidence	Patients, n			Post operative CG use	Quality assessment score	Post op CG use	Seroma formation	Ventilatory function	Intra-abdominal pressure(IAP)	Subcutaneous edema
					CG	No CG	Total							
Huang et al. <sup>26</sup> 2007	USA	Abdominoplasty 12 and 10 breast reduction	Prospective study	II	12	10 (breast r reduction group)	12	1 day post op	3/8	Intermittent from the first day	-	-	Increase in the CG group	-
Rodrigues <sup>27</sup> et al. 2013	Brazil	Abdominoplasty	Prospective study	III	NA	NA	18	2 days post	3/8	NA	-	-	Increase in the CG group	-
Martins et al. <sup>28</sup> 2022	Brazil	Abdominoplasty	Prospective study	II	16	18	34	30 days post op	6/8	30 days after surgery	CG use was not effective in preventing seroma formation	-	-	-
Moraes et al. <sup>29</sup> 2022	Brazil	Abdominoplasty	Prospective study	IV	16	16	32	30 days post op	6/8	30 days after surgery	-	-	-	Less among the non CG group compared to the CG group
Kosloski et al. <sup>30</sup> 2024	Brazil	Abdominoplasty	Prospective study	IV	18	16	34	30 days post op	6/8	30 days after surgery	-	Impairs ventilatory function with the CG users	-	-

CG, compression garment; NA, not available.



## Discussion

Although the main goal of an abdominoplasty is to provide aesthetic outcomes, it is also considered in treating abdominal wall laxity, hernias, and urine incontinence.<sup>31,32,33</sup> Although the evidence is minimal, the current research indicates that abdominal CG may prevent seroma formation but risks raising IAP following abdominoplasty. Data from studies investigating the use of post-operative abdominal binders after other types of abdominal procedures highlight the subjective beneficial effect of wearing the binder; however, it is not specifically related to abdominoplasty.

The lack of well-designed studies with enough quality and power to investigate the therapeutic effect of CG usage accounts for the absence of compelling evidence to support the use of CG post-abdominoplasty. Therefore, it is hard to underscore whether the use of an abdominal binder would have prevented the development of seroma in patients post-abdominoplasty in particular.

### Limitations

This systematic review has certain limitations, e.g., the selected studies were substantially heterogeneous (various surgical techniques, outcomes, analgesic treatments, statistical descriptions, etc.), often of low quality, and frequently underpowered. None of the included studies had a high quality or full score from the quality assessment in this review.

### Future research implications

Future research should be method-specific, randomized, well-designed, and double-blinded. Potential future outcomes to be considered in assessing the effect of post-abdominoplasty use of abdominal CG include physical function and patients' satisfaction with aesthetics. Research could also consider designing tailor-made abdominal CGs specifically for each patient. Potential future trials can be directed to assessing the true effect of a CG considering the different types of binders, the pressure imparted by each type, as well as ethnical, gender, age-related factors, and determining the ideal time frame for CG use.

## Conclusions

Minimal evidence suggests that using abdominal CG after major abdominal surgery might reduce seroma formation but increases IAP. There is insignificant evidence of comparison between subcutaneous edema formation and the impact of ventilatory function. Divergent views exist about different post-operative care approaches after abdominoplasty. Regarding the impact of post-abdominoplasty use of CGs on seroma formation, ventilatory function, IAP, and subcutaneous edema, the current systematic review determined the need for more randomized trials to confirm the advantageous use of CG.

### Ethical Approval:

This study is a systematic review that contains data from published articles and waives the requirement for ethical approval by the institutional review board.

### Funding:

No funding was received for this study.

### Conflict of Interest:

The author has no conflict of interest to disclose

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