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RESEARCH ARTICLE

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PHOTOBIMODULATION APPLIED IN POST-SURGICAL FEMALE-TO-MALE SURGERY- CASE REPORT

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ABSTRACT

Photobiomodulation (PBM) is an emerging medical technology with therapeutic effects that reduce or inhibit inflammatory mediators and cytokines, decreasing pain and local edema. However, the number of papers reporting the application of PBM in the post-surgical period is still scarce. This case report aims to evaluate the action of PBM applied after bilateral mastectomy with free nipple grafts regarding collateral effects such as pain, edema and hematoma. Patients underwent breast surgery with free nipples grafts. PBM sessions were applied 5, 24, 48 and 72 hours after surgery using a diode laser Platinum 4 equipment with four wavelengths (650, 810, 915 and 980 nm). Total energy applied was 1080 Joules distributed in six minutes of laser application over lymph node areas and the suture region. Both patients (A and B) related pain relief after PBM sessions (5, 24, 48 and 72 hours) after surgery. Also nipple sensitivity and overflow of reddish-color were reduced after 72h. The application of PBM reduced pain intensity and nipples hypersensitivity, suggesting reduction of inflammatory process. The benefits reported in this study suggest the indication of this complementary therapy to cosmetic procedures for transgender people.

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INTRODUCTION

Transgender and gender non-conforming individuals (TGNC) have gained visibility, and considerable strides have been made toward addressing their health care disparities and needs (Stroumsa et al., 2020). Herman et al., 2017, estimated that 0.7% of adults aged 18 to 24 identify as transgender, whereas 0.6% of adults aged 25 to 64 and 0.5% of adults aged 65 and older identify as transgender in USA. In female-to-male (FTM) patients who are in the process of transitioning to a male identity, subcutaneous mastectomy is often the first surgical step in sexual gender affirmation, and sometimes the only procedure performed (Schlosshauer et al., 2020). There is no single best surgical approach due to significant variance in preoperative patient anatomy (Naidas et al., 2021). Several factors are involved with the reconstruction technique and the transareolar technique is the best choice for smaller breasts, while the double-incision mastectomy

technique was indicated for larger. The subcutaneous mastectomy aims to provide esthetic contour of the thorax by removing breast tissue and excess skin, reducing and repositioning the nipple-areola complex, and minimizing scars on the chest wall (Wolf et al., 2021). Gallagher et al., 2019, reviewed the results of the experience of a single surgeon with a non-draining technique called "masculoplasty" in the period from December 2015 to May 2018. The mean follow-up was nine months for patients, and the results showed one patient (0.3%) with hematoma, seven (2%) with infections, and three (1%) with wound dehiscence. All these complications happened in obese patients. Two masculoplasties (0.7%) presented partial nipple necrosis. Pain at discharge from the recovery room was also assessed using a visual analogue pain scale, obtaining a mean score of 4/10. Naidas et al., 2021, revised the rates of major and minor complications following double incision mastectomy, and they concluded that the double incision with free nipple grafting technique

provides low complication rates. Major complications were hematomas, infection, shortness of breath, and pain. Minor complications included seromas, delayed wound healing, and hypertrophic scars. Photobiomodulation (PBM) is an emerging medical technology with therapeutic effects. PBM reduces or inhibits the production of inflammatory mediators and cytokines, decreasing pain and local edema. PBM also promotes neutrophil recruitment, accelerating tissue healing (Lopes-Martins *et al.*, 2020). Several studies have related the effectiveness of light on tissues, providing energy to maintain viable cell metabolism in dentistry (Pessoa *et al.*, 2018), on chronic wounds in diabetic foot ulcers (das Neves *et al.*, 2020), on muscle activity in chronic post-stroke patients (Gonzaga *et al.*, 2018), and in postsurgical of cardiac surgery (Cronshaw *et al.*, 2020). However, the number of papers reporting the application of PBM in the post-surgical period is still scarce. This case report aims to evaluate the action of PBM applied after bilateral mastectomy with free nipple grafts regarding collateral effects such as pain, edema, and hematoma.

CASE REPORT

Patients were identified as A and B to protect their identity. Both underwent bilateral mastectomy with free nipple grafts. PBM sessions were applied five, 24, 48, and 72 hours after FTM surgery using a Platinum 4 diode laser equipment (Summus Medical Laser - USA) with four wavelengths: 650 nm, 810 nm, 915 nm, and 980 nm. The parameters used were 6 Watts peak power and 3 Watts average power using 4 lasers at the same time, with the following wavelengths: 650, 810, 915, and 980 nm, 100 Hz frequency, and 0.6W/cm² intensity. The total energy applied was 1080 Joules distributed in 6 minutes of laser application divided into 25 seconds on each of the four lymph node areas (totaling 1 minute), 2 minutes on the sides (1 per side), and the remaining 3 minutes over the mastectomy region. The clinical protocol included the application of a questionnaire regarding the general health status and presence of comorbidities (diabetes, hypertension, cancer, and healing disorders, among other questions). The aspects of the regions around the neck and chest were evaluated macroscopically before each session, looking for edema, hematoma, and/or bleeding resulting from the surgical procedures. Pain was accomplished before and after each PBM session through the visual analog scale (VAS), a one-dimensional scale widely used to assess pain intensity. The patient chooses the numeral that corresponds to pain intensity, where 0 means no pain and 10 means unbearable pain. Digital photographs were taken 7 inches away from the suture in both the frontal and lateral positions, with the apposition of a disposable ruler to measure the total length of the suture. The PBM was applied with a 5 cm² tip, 1 cm away from the suture. Phototherapy started at the subclavian and axillary lymph node region (right and left, 25 seconds on each side), followed by the lateral chest regions (right and left, 1 minute on each side), and finally along the entire length of the suture for 3 minutes, scanning the area (Figure 1).

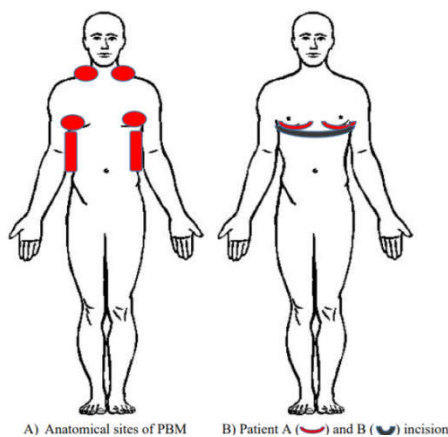


Figure 1. Anatomical sites for PBM application: A) subclavian and axillary lymph node region (right and left, 25 s / each side) and lateral chest region (right and left, 1 m / each side); B) the entire length of the mastectomy region, for 3 m, in a scanning mode, both patients A (red) and B (blue).

At the end of PBM application, the suture area was covered with sterile gauze fixed with micro pore. Everyone in the room where the PBM was applied wore standard protective goggles. Patient A, a 33-year-old transgender man, was submitted to “masculinizing chest surgery”. The patient reported the use of testosterone and the absence of any comorbidity, such as diabetes, high blood pressure, cancer, and/or healing disorders. At the first PBM session, Patient A presented good general condition, limited arm movements, and overflow of reddish-colored exudate at the ends of the suture. There were two surgical sutures, each one measuring 23 cm. This patient related score eight (8) before and six (6) after the first PBM session (Figures 2 and 3).

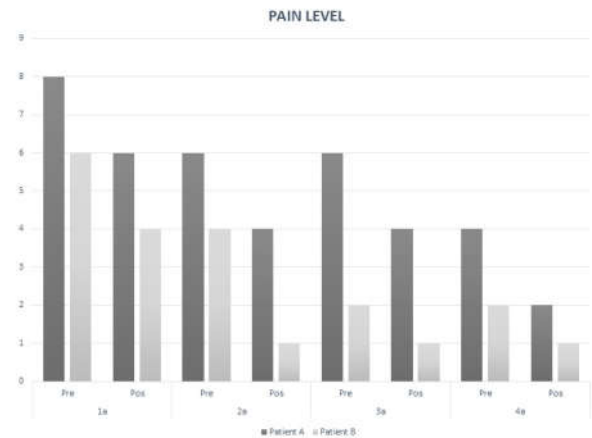


Figure 2. Patient A and B Pain level referred at 5h, 24h, 48h and 72h after a masculinizing chest surgery, pre and post PBM sessions

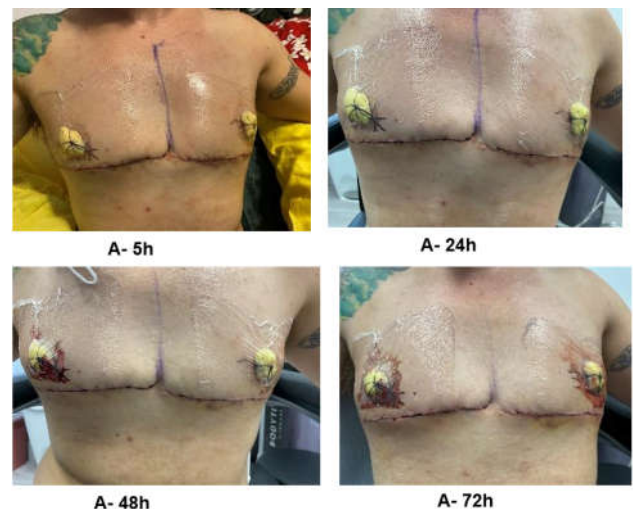


Figure 3. Patient A: PBM in post immediate of a masculinizing chest surgery. Images show the appearance of the chest 5 (a), 24 (b), 48 (c), 72 (d) hours after surgery. Transverse scars represent the double incision used to remove the inframammary fold. Breast tissue might be spared to allow aesthetic contouring and may remain at risk for neoplasia

The second PBM session was applied 24 hours after surgery. The exudation had the same appearance, with reduced flow. The patient previously reported pain level 6, reduced to 4 by the end of the PBM session. In addition, the nipples showed great sensitivity before PBM (VAS level 8) that was no longer noticed at the end of the session. At 48 h (Figure 2c) and 72 h PBM sessions, there was no plasma exudation. Pain levels were 6 to 4 before and after the PBM session (48 h), and 4 to 2 before and after 72 h PBM session (Figures 2 and 3). Nipple sensitivity was also reported, although at a lower level, 6 before and 0 after PBM after 48 h, and 4 before and 0 after 72 h PBM session.

Patient B, a 35-year-old transgender man, submitted to "masculoplasty", reported the use of testosterone and arterial hypertension as comorbidity. The PBM sessions were applied with the same protocol described to Patient A. This patient presented a 56 cm long surgical suture. At the first PBM session (5 h), the patient showed good general conditions, arm movements were limited and a reddish-colored exudate at both extremities of the suture were visible. The pain level was six (6) before and four (4) after the first PBM session (Figures 2 and 4). The second PBM session was applied 24 h after surgery, and the patient's general conditions were still good, with limited movements of both arms and reduced exudation at the suture extremities.

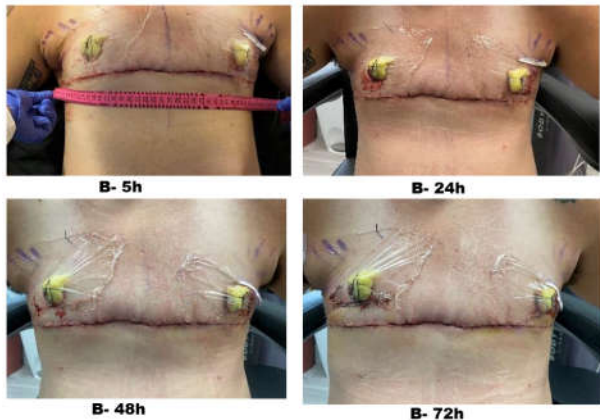


Figure 4- Patient B: PBM in post immediate of a masculinizing chest surgery. Images show the appearance of the chest 5 (a), 24 (b), 48 (c), 72 (d) hours after surgery. Transverse scars represent the single incision used to remove the inframammary fold. Breast tissue might be spared to allow aesthetic contouring and may remain at risk for neoplasia

The patient related pain level 4 (four) before PBM and 1(one) after the end of phototherapy. Nipple sensibility was reported with level 4 pre and 1 post PBM. The patient stated that the nipple tingling ceased after PBM. At 48 h and 72 h, patient B showed good general conditions without plasma exudation. Pain levels were 2 to 1, before and after PBM (48 h), and 2 to 1, before and after 72 h PBM session (Figures 2 and 4). Nipple sensitivity ceased after both PBM sessions (48 h and 72 h).

DISCUSSION

The present study, pioneer in the literature, proposes the use of a clinical protocol with four PBM sessions, starting immediately after a female-to-male aesthetic surgery. Although scientific research in healthcare using the photobiomodulation therapy has spread rapidly, resistance in its adoption in clinical procedures is still detected. Among the reasons for this stance in relation to light therapy, the diversity of similar protocols with conflicting results and gaps in understanding the mechanism of action of light on cells stand out. However, studies carefully planned and executed with adequate protocols, observing both the type of tissue and the treated process, have presented consistent results indicating the benefits of photobiomodulation (Hersant *et al.*, 2015). Published studies have reported changes in the redox state of cells and increased ATP levels arising from the intracellular transformation of light absorbed by viable cells into energy to maintain their biochemical processes (Nestor *et al.*, 2017; Kasuya & Tokura, 2017). PBM reduces or inhibits the production of important inflammatory mediators and significantly reduce leukocyte infiltration or can inhibit neutrophil recruitment in different inflammatory conditions (Lopes-Martins *et al.*, 2020). Surgical managements frequently manipulate and intensely attack the tissues, altering their hemostasis and triggering an inflammatory response. Immediately after the damage, the repair of the lesions begins. Wound healing is a well-orchestrated process, where numerous factors are activated or inhibited in a sequence of

steps, and it is followed by the proliferation phase, including fibroplasia, angiogenesis, and re-epithelialization (das Neves *et al.*, 2020; Zurada *et al.*, 2018). In the female-to-male (FtM) transgender population, "top" surgery is especially important and there is no single best surgical approach due to the significant variance in the preoperative patient's anatomy (Hamblin, 2017). The patients in our study underwent bilateral mastectomy with free nipple grafts, resulting in large chest scars. The classic signs of inflammatory response (erythema, edema, and pain) observed in the postoperative period are due to this surgical procedure. Although Gallagher *et al.*, 2019, reported 4/10 as the mean pain score at patient discharge, the pain index reported by patients on the VAS five hours after surgery was higher (A = 8 and B = 6), even though they were using medication to reduce pain intensity (codeine). These results, associated with the edema and erythema observed at the surgical site, indicate the presence of an intense acute inflammatory process. The protocol used in this study establishes the PBM applied daily in the initial period of 72 hours, considering that the events of the inflammatory response occur in overlapping stages, induced by the production and release of chemical mediators (Kasuya & Tokura, 2014; Hersant *et al.*, 2015; Zurada *et al.*, 2018; Lopes-Martins *et al.*, 2020). A review published by Hamblin, 2017, pointed out that PBM induces a biphasic response, where low levels of light have stimulant effects, while high levels have inhibitory effects. PBM acts on cells with oxidative stress, reducing the levels of ROS and inflammatory markers in activated inflammatory cells.

Consequently, PBM results in a general reduction of the inflammatory process present in the immediate postoperative period, which culminates in the reduction in the level of pain. The PBM equipment used was a class IV diode laser, with four wavelengths (650 nm, 810 nm, 915nm, and 980 nm) that allow acting on the different strata of the skin (epidermis and dermis), inducing the reduction of the inflammatory response, mainly edema and the production of inflammatory mediators associated with pain. These actions favor the formation of granulation tissue, starting the healing process with fewer complications. PBM is a non-invasive, non-drug, painless, quick and easy-to-use therapeutic tool. Its application has safely reduced edema formation in tissues and pain intensity without side effects and relevant efficacy. The results reported in the two clinical cases attest that, regardless of the surgical technique used and the level of pain sensitivity of each patient, the photobiomodulation reduced the inflammatory response, tissue edema, and pain (Albertini *et al.*, 2004). The great sensitivity of the nipples was also intensely reduced after the application of PBM, bringing a great feeling of relief to the patients. Therefore, the final question is: "Why not include PBM application in the immediate postoperative period of cosmetic surgeries, considering its numerous benefits, the absence of contraindications and, above all, patients' well-being?"

CONCLUSION

This case report showed PBM applied in the post-surgical period of transgender non-conforming surgery of female-to-male patients. The results indicate that PBM application reduces pain intensity and nipples hypersensitivity, suggesting reduction of the inflammatory process. PBM is a non-invasive technique with significant improvement in the quality of tissue healing. The benefits reported in this study suggest the indication of this complementary therapy to cosmetic procedures for transgender people.

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