

Effects of low-level laser therapy in skin autograft: a systematic review and meta-analysis protocol

Efeitos do uso do laser de baixa potência no autoenxerto de pele: protocolo de revisão sistemática e meta-análise

Efectos de la terapia láser de baja intensidad en el autoinjerto de piel: protocolo de revisión sistemática y metanálisis

Priscilla de Souza Porto¹, Fabiano Calixto Fortes de Arruda², Maria Alves Barbosa³

How to cite: Porto PS, Arruda FCF, Barbosa MA. Effects of low-level laser therapy in skin autograft: a systematic review and meta-analysis protocol. REVISA. 2026; 15(2): 102-107. Doi: <https://doi.org/10.36239/revisa.v15.n2.p102a107>.

REVISA

1.Universidade Federal de Goiás. Faculdade de Medicina. Goiânia, Goiás, Brasil.

<https://orcid.org/0000-0003-2737-4806>

2.Universidade Federal de Goiás. Faculdade de Medicina. Goiânia, Goiás, Brasil.

<https://orcid.org/0000-0002-3035-6994>

3.Universidade Federal de Goiás. Faculdade de Medicina. Goiânia, Goiás, Brasil.

<https://orcid.org/0000-0002-0861-9655>

Received: 17/01/2026
Accepted: 17/03/2026

RESUMO

Objetivo: avaliar os efeitos do laser de baixa potência para a fixação de autoenxerto de pele. **Método:** protocolo de revisão sistemática da literatura e meta-análise. Os estudos serão selecionados conforme a estratégia PICOS (*population, intervention, comparison, outcomes, study design*). Serão incluídas pesquisas sobre os efeitos do uso do laser de baixa potência na fixação de autoenxerto de pele em pessoas ou ratos, sem limite de data. Serão excluídas literatura cinzenta. Será utilizado o software EndNoteWeb para gerenciamento das referências. Para a avaliação do risco de viés serão utilizadas as ferramentas do Instituto Joana Briggs para estudos observacionais. Ao ler o artigo na íntegra, será verificada a heterogeneidade ou homogeneidade dos estudos e a possibilidade ou não de realização de meta-análise.

Descritores: Terapia com luz de baixa intensidade; Transplante de Pele; Revisão sistemática.

ABSTRACT

Objective: To evaluate the effects of low-level laser therapy for the fixation of autologous skin grafts. **Method:** Systematic literature review and meta-analysis protocol. Studies will be selected according to the PICOS strategy (*population, intervention, comparison, outcomes, study design*). Research on the effects of using low-level laser therapy in the fixation of autologous skin grafts in humans or rats will be included, without date limits. Grey literature will be excluded. The EndNoteWeb software will be used for reference management. The tools of the Joana Briggs Institute for observational studies will be used to assess the risk of bias. By reading the article in full, the heterogeneity or homogeneity of the studies and the possibility or not of performing a meta-analysis will be verified.

Descriptors: Low-level Light Therapy; Skin Transplantation; Systematic Review

RESUMEN

Objetivo: Evaluar los efectos de la terapia láser de baja intensidad para la fijación de injertos de piel autólogos. **Método:** Revisión sistemática de la literatura y protocolo de metanálisis. Los estudios se seleccionarán según la estrategia PICOS (*population, intervention, comparison, outcomes, study design*). Se incluirán investigaciones sobre los efectos del uso de la terapia láser de baja intensidad en la fijación de injertos de piel autólogos en humanos o ratas, sin límite de fecha. Se excluirá la literatura gris. Se utilizará el software EndNoteWeb para la gestión de referencias. Se utilizarán las herramientas del Instituto Joana Briggs para estudios observacionales para evaluar el riesgo de sesgo. Mediante la lectura completa del artículo, se verificará la heterogeneidad u homogeneidad de los estudios y la posibilidad de realizar un metanálisis.

Descriptores: Terapia por Luz de Baja Intensidad; Transplante de Piel; Revisión Sistemática.

Introduction

The skin has important roles as physical, chemical, microbiological and immunological barrier between the body and the external environment, in addition to being the largest organ in the human body.¹⁻² Thus, the disruption of the skin barriers can cause harm to wound victims.³

Performing autologous skin grafting is the gold standard in closing wounds, in addition to making the scar look more aesthetic and functional.³⁻⁵ Performing the graft provides a favorable environment for healing and creates a physiological barrier by reducing the loss of water, electrolytes proteins and heat through the injury.⁵

Following graft placement, revascularization occurs as the graft receives nutrients by diffusion from the wound bed. The formation of new blood vessels occurs approximately 48 hours after the surgical procedure, and neovascularization and anastomosis take place. During the vascularization process, the graft integrates with the wound bed.³

Factors associated with graft failure include hematoma formation, seroma, shearing forces, infection, and insufficient vascularization.⁶

Furthermore, low-level laser therapy is a safe and low-risk method that significantly reduces wound size, making it a treatment option for improving skin graft fixation.⁷⁻⁸

The aim of this protocol is to evaluate the effects of low-level laser therapy for skin fixation in adult patients.

Method

This is a systematic review with meta-analysis registered on the PROSPERO website (CRD42024610504).

Search strategy

The studies will be selected according to the PICOS strategy (population, intervention, comparison, outcomes, study design):

- Population: humans and animals of any age, gender, education level and geographic region will be considered. Humans and animals with comorbidities that impair healing will be excluded.
- Intervention: receiving low-light level laser therapy in autologous skin graft.
- Comparison: with or without a comparison group.
- Outcomes:
 - Type and amount of energy used in the laser;
 - Frequency of laser application;
 - Effects of the laser on humans and animals;
 - Graft fixation (amplitude of the skin region, quality of fixation – improvement of skin resistance – fixation time);
- Outcomes:
 - Type and amount of energy used in the laser;
 - Frequency of laser application;
 - Effects of the laser on human and animals;

- Graft fixation (amplitude of the skin region, quality of fixation – improvement of skin resistance – fixation time);

- Study design: any type of quantitative study, without restriction of language and publication date.

The following electronic databases will be systematically searched: PubMed, Embase, Web of Science, Scopus e Cochrane. There will be no restriction on the publication date of the studies. The boolean operators to be used in the search are specified in the Table 1.

Table 1- Boolean operators to be used in the literature searches.

Base de dados ou plataforma	Estratégia de Busca adaptada
Pubmed	("Low-Level Light Therapy"[MeSH Terms] OR "laser therapy low level"[Title/Abstract] OR "laser biostimulation"[Title/Abstract] OR "Photobiomodulation"[Title/Abstract] OR "low level laser irradiation"[Title/Abstract]) AND ("Skin Transplantation"[MeSH Terms] OR "Skin Grafting"[Title/Abstract] OR "Skin Graftings"[Title/Abstract] OR "skin graft"[Title/Abstract] OR "skin grafts"[Title/Abstract])
BVS	(mh:("Terapia com Luz de Baixa Intensidade")) OR ("Terapia com Luz de Baixa Intensidade") AND (mh:("Transplante de Pele")) OR ("Transplante de Pele") AND (mh:(queimaduras)) OR (queimadura*)
Embase	'low-level light therapy'/exp OR 'low-level light therapy' OR ('low level' AND ('light'/exp OR light) AND ('therapy'/exp OR therapy)) OR 'low level laser therapy':ti,ab,kw OR 'laser biostimulation':ti,ab,kw OR 'photobiomodulation':ti,ab,kw OR 'low level laser irradiation':ti,ab,kw AND 'skin transplantation'/exp OR 'skin transplantation' OR 'skin grafting':ti,ab,kw OR 'skin graftings':ti,ab,kw OR 'skin graft':ti,ab,kw OR 'skin grafts':ti,ab,kw
Web of Science	"Low-Level Light Therapy" (Topic) or "laser therapy low level" (Topic) or "laser biostimulation" (Topic) or "Photobiomodulation" (Topic) or "low level laser irradiation" (Topic) AND "Skin Transplantation" (Topic) or "Skin Grafting" (Topic) or "Skin Graftings" (Topic) or "skin graft" (Topic) or "skin grafts" (Topic)
Scopus	((TITLE-ABS-KEY ("Low-Level Light Therapy") OR TITLE-ABS-KEY ("laser therapy low level") OR TITLE-ABS-KEY ("laser biostimulation") OR TITLE-ABS-KEY ("Photobiomodulation") OR TITLE-ABS-KEY ("low level laser irradiation"))) AND ((TITLE-ABS-KEY ("Skin Transplantation") OR TITLE-ABS-KEY ("Skin Grafting") OR TITLE-ABS-KEY ("Skin Graftings") OR TITLE-ABS-KEY ("skin graft") OR TITLE-ABS-KEY ("skin grafts")))

COCHRANE ("Low-Level Light Therapy"):ti,ab,kw OR ("laser therapy low level"):ti,ab,kw OR ("laser biostimulation"):ti,ab,kw OR ("Photobiomodulation"):ti,ab,kw OR ("low level laser irradiation"):ti,ab,kw AND ("Skin Transplantation"):ti,ab,kw OR ("Skin Grafting"):ti,ab,kw OR ("Skin Graftings"):ti,ab,kw OR ("skin graft"):ti,ab,kw OR ("skin grafts"):ti,ab,kw

Biblioteca Digital Brasileira de Teses e Dissertações - BDTD Resultados da busca: (Todos os campos:Low-Level Light Therapy E Todos os campos:Skin Grafting)

Research on the effects of using low-level laser therapy in skin graft fixation in humans or animals will be included, with no date limit. Grey literature will be excluded.

Study selection will be conducted independently by three reviewers. Disagreements will be resolved through discussion until consensus is achieved. The data will be entered into an Excel spreadsheet containing the following data from the articles:

- Authors;
- Article title;
- Level of evidence;
- Strategy used for laser application;
- Effects of laser use.

The review will be reported in accordance with PRISMA guidelines.

Search and selection of the studies

The EndNoteWeb software will be used for reference management.¹²

The review will consist of three phases: searching of articles in databases (identification); identifying duplicate articles, applying inclusion and exclusion criteria, and reading the titles and abstracts of the studies (screening); extracting data from the selected studies (inclusion).

Relevance tests will be applied to guide the exclusion and inclusion of articles in the screening phase:

Title reading phase:

- Is it a study about laser, low-level laser therapy, phototherapy or photobiomodulation?
- Is it a study about autologous skin grafting, full or partial thickness in a recipient area?

- LED laser, carbon dioxide laser and diode laser will be excluded.

Abstract reading phase:

- Is it a study about low-level laser therapy?
- Is it a study about full-thickness or partial-thickness autologous skin grafting in a recipient area?
- Is it a primary study?
- Exclude LED laser, carbon dioxide laser and diode laser
- Exclude studies with combined therapies (laser and others therapies).

Full-text reading phase:

- Is it a study that evaluates the outcomes: type and amount of energy used in the laser; frequency of laser application; effects of the laser on humans and animals; graft fixation (amplitude of the skin region, quality of fixation)?
- Exclude studies in which participants have comorbidities that impair healing.

Risk of bias (quality) assessment

To assess the risk of bias of the selected studies, the Joanna Briggs Institute's tools for observational studies will be used. Thus, studies that meet 80% of the items will be considered to be of "high" quality and low risk of bias. Studies that meet between 60 and 79% of the items will be classified as "medium" quality and moderate risk of bias. Meanwhile, studies that obtain less than 59% of the items will be considered to be of "low" quality and high risk of bias.

For intervention studies, the Cochrane RoB 2.0 tool will be used, which has the following domains:

- Bias due to the randomization process,
- Bias due to deviations from the intended interventions,
- Bias due to lack of outcome data,
- Bias in outcome measurement, and
- Bias in selection of the reported outcome.

The tool includes algorithms that map responses to signaling questions into a proposed risk of bias judgment for each domain. The possible risk of bias judgments are:

- Low risk of bias;
- Some concerns; and
- High risk of bias.

Data synthesis

By reading the article in its entirety, the heterogeneity or homogeneity of the studies and the possibility or not of conducting a meta-analysis will be verified.

A descriptive synthesis will be prepared with the following information: aim, method, results and conclusions of the selected studies, followed by a descriptive analysis of the same subgroups according to the type and amount of energy used in the laser, the frequency of laser application, the effects of the laser on humans and animals, graft fixation, as described in the study results.

The results will be described in the form of mean (M) and standard deviation (SD) of the domains and total score, which are included in the benefit assessment instruments, with significant differences ($p < 0,05$, $**p < 0,01$, $***p < 0,001$).

For meta-analysis, heterogeneity will be assessed using the I^2 based on the Q statistic from the Cochran test. Results will be presented in a forest plot, and the analysis will be conducted using the random-effects method. Publication bias will also be assessed and presented in a funnel plot. The quality of evidence will be analyzed using the GRADE system (The Grading of Recommendations Assessment, Development and Evaluation). The GRADE system assigns levels of evidence and classifies the strength of recommendations for health issues. The level of evidence

represents the confidence in the information used. The evaluation, in the GRADE system, will be performed for each outcome analyzed and classified as high, moderate, low, and/or very low. The following factors will be considered to determine the level of evidence: study design, methodological limitations (risk of bias), inconsistency, indirect evidence, imprecision, publication bias, effect size, dose-response gradient and confounding factors.

A descriptive summary will be prepared with the following information: aim, method, results, conclusions of the selected studies, followed by a descriptive analysis of them by subgroups, according to the type and amount of energy used in the laser, frequency of laser application, effects of the laser in humans and animals and graft fixation.

Acknowledgments

We would like to thank the Fundação de Amparo à Pesquisa do Estado de Goiás (FAPEG) for its financial support. Process number: 202310267000650.

References

1. Rajkumar J, Chandan N, Lio P, Shi V. The skin barrier and moisturization: function, disruption, and mechanisms of repair. *Skin Pharmacol Physiol*. 2023;36:174-85.
2. Rojer M, Fullard N, Costello L, Bradbury S, Markiewicz E, O'Reilly S et al. Bioengineering the microanatomy of human skin. *J Anat*. 2019;234(4): 438-55.
3. Radzikowska-Büchner E, Lopuszynska I, Flieger W, Tobiasz M, Maciejewski R, Flieger J. An overview of recent developments in the management of burn injuries. *Int J Mol Sci*. 2023;24(22):16357.
4. Kandiyali R, Thom H, Young AE, Greenwood R, Welton NJ. Cost-effectiveness and value of information analysis of a low-friction environment following skin graft in patients with burn injury. *Pilot Feasibility Stud*. 2020;31:6:8.
5. Spear M. Skin grafts: indications, applications and current research. IntechOpen; 2011. Available from: <http://dx.doi.org/10.5772/892>
6. Elseth A, Lopez ON. Wound grafts. StatPearls. 2025. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK564382/>
7. Taha N, Daoud H, Malik T, Shettysowkoor J, Rahman S. The effects of low-level laser therapy on wound healing and pain management in skin wounds: a systematic review and meta-analysis. *Cureus*. 2024;16(10):e72542.
8. Castro TNS, Martignago CCS, Assis L, Alexandria FED, Rocha JCT, Parizotto NA, et al. Effects of photobiomodulation therapy in the integration of skin graft in rats. *Lasers Med Sci*. 2020;35(4):939-47.

Correspondent Author

Priscilla de Souza Porto
5ª avenida, S/N. CEP: 74.605-050- Setor Leste
Universitário. Goiânia, Goiás, Brasil
enfermeira.priscilla@outlook.com