E-ISSN:2456-3110

Review Article

Leech therapy

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Journal of Ayurveda and Integrated Medical Sciences

2025 Volume 10 Number 3 MARCH

Publisher

Maharshi Charaka Ayurveda

www.maharshicharaka.in

Effect of Jaloukavacharana (Leech therapy) on Reconstructive Flaps - A Review

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DOI:10.21760/jaims.10.3.25

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Jaloukas have been used medically for thousands of years dating back to ancient time. Today medicinal leeches are mostly used after Sandhana Karma i.e., in plastic and Reconstructive surgeries for the salvage of free, pedicled and even microvascular anastomosed flaps having venous congestion. The aim of this study is to spotlight on the role of leech therapy after Sandhanakarma. The systemic review of literature was conducted from the online databases and the results obtained in the patients after leech therapy were observed. This study has confirmed the excellent and predictable healing after Jaloukavacharana over the congested flaps. The benefits depend on these main properties of the medicinal leech like bloodletting action during active suction of blood, passive oozing of the wound for 1-2 days and injection of biologically active substances with the saliva into the host. Hence leech therapy is safe, easy to use, beneficial and cost-effective treatment modality to save flaps and reattached body parts in plastic and reconstructive surgery.

Keywords: Jaloukavacharana, medicinal leech, Sandhanakarma, flaps

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How to Cite this Article

Manjukumari, Ashok N, Biradar V, Effect of Jaloukavacharana (Leech therapy) on Reconstructive Flaps - A Review. J Ayu Int Med Sci. 2025;10(3):164-168.

Available From

https://jaims.in/jaims/article/view/4435/

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Conflict of Interest	Funding	Ethical Approval	Plagiarism X-checker	Note
None	Nil	Not required	10.63	

Introduction

Jaloukas have been part of the therapeutic arsenal since ancient times. The first written records of leech therapy in Egypt date back over 3500 years, while evidence of its therapeutic use by Greek, Roman, and Indian civilizations dates back approximately 2000 years. *Jaloukavacharana*, a method of *Raktamokshana*, is described in the *Sushruta Samhita* and *Astanga Hridaya*. Leeches are indicated for conditions such as *Twakroga, Raktajaroga, Dustavrana, Arsha, Vidradhi, Mukhadushika, Indralupta*, and others.**[1,2]** *Jalouka* is considered an *Anushastra* and has been used in parasurgical procedures.**[3,4]** *Sushruta,* the first surgeon, provided a detailed explanation of *Sandhanakarma*, a term referring to joining, union, restoration, and repair.**[5]**

Sandhanakarma is mentioned in various contexts by *Acharya Sushruta*, such as in wound healing, fractures, *Arsha*, intestinal anastomosis, and reconstructive procedures for the ear, lip, and nose. The reconstruction of the ear and nose was extensively described by *Sushruta***[6]**, and his procedure for *Nasasandhana* remains in practice today, forming the foundation for the Indian approach to rhinoplasty*. Sandhanakarma* can be compared to modern plastic and reconstructive surgery. Today, medicinal leeches (Hirudo medicinalis) are used in a practice known as Hirudotherapy. They are widely applied in plastic and reconstructive surgery. Despite significant advancements in reconstructive surgery, especially microsurgery, venous congestion in transplanted or reimplanted tissues remains a common and challenging complication. Medicinal leeches have been used to salvage free flaps, pedicled flaps, nippleareolar complexes, and in the replantation of fingers, ears, lips, noses, penises, and other organs affected by venous congestion**[7]**, a condition that occurs when venous outflow cannot keep up with arterial inflow**[8]**, leading to cell death, tissue necrosis, and flap loss. In 1960, Deganc and Zdravic performed the first leech treatment for a congested flap.**[9]**

In July 2004, the FDA approved leeches as a medicinal device for use in plastic and reconstructive surgery.**[10]** This review aims to explore the role of *Jaloukavacharana* in *Sandhanakarma*.

Materials and Methods

A systematic review of the literature was performed using the PubMed, EmBASE, and ResearchGate platforms. The following keywords were used in the search: "leeches" or "*Jaloukavacharana*" or "leech therapy" and "flap" or "plastic surgery" or "*Sandhanakarma*." *Ayurvedic* classics and relevant books are also referred. This approach allowed me to preselect relevant articles. The data collected focused on the role of leech therapy in plastic surgery.

Results

In plastic and reconstructive surgery, leeches primarily help alleviate venous congestion in compromised flaps. Postoperatively, the success of the flap depends on careful monitoring for vascular issues, with venous thrombosis being both the most common and rapidly damaging complication. This study confirms that *Jaloukavacharana* provides excellent and predictable healing for compromised flaps, leading to successful graft acceptance in plastic and reconstructive surgeries. Medicinal leeches offer a non-surgical solution for plastic surgery patients experiencing venous congestion. This is primarily due to the key properties of medicinal leeches, such as their blood-letting action during active blood suction, the passive oozing of the wound for 1-2 days, and the injection of biologically active substances that promote healing.

Discussion

After reconstructive surgery, flaps or reimplanted tissues may experience venous congestion. This occurs when the small, thin-walled veins involved in microsurgical procedures are unable to effectively carry blood away from the surgical site. As a result, blood pools in the veins and cannot return to the heart and lungs for re-oxygenation. Clinical signs of venous congestion include cyanosis or a dusky coloration, increased turgor, a cool touch, brisk capillary refill, and rapid dermal bleeding**[11]**(Fig. 1). If left untreated, stagnant blood leads to the accumulation of carbon dioxide, which can ultimately result in tissue death. In such cases, *Jaloukavacharana* may be recommended for optimal recovery. Therefore, preventing flap necrosis, the most common complication of venous congestion, becomes a key indication for leech therapy.

Venous congestion-related flap necrosis can develop within a mere 3 hours.[12] To address this complication, all plastic surgeons are familiar with the use of medicinal leeches.

Figure 1: Local flap indicating signs of venous congestion

Application

Leeches should be applied to areas with clinically significant venous congestion. They attach to the skin using a large caudal sucker and create a Y-shaped bite with a smaller cephalic sucker, during which an anesthetic compound is released, often making the procedure painless.[13] Several techniques for leech application have been described. Traditionally, leeches are placed using a 3 ml syringe with the plunger removed, positioning the open end over the affected tissue and waiting for the leech to securely attach to the skin in the targeted treatment area.[14] Published studies show significant variation in the number of leeches used, ranging from 1 to 5 per treatment (Fig. 2), or based on the area, 1 leech per 3 cm^2. Leech therapy is typically maintained until flap neovascularization occurs, requiring an average of 6-10 days.[15]

Figure 2: Leech applied to the buccal flap

Mechanism of action

Leech therapy functions by reducing tissue capillary pressure and promoting local anticoagulation through three main mechanisms: active blood suction, the injection of biologically active substances via saliva into the host, and passive blood oozing from the bite wounds after leech removal.[16] (Fig. 3) The saliva of the medicinal leech contains a variety of bioactive substances, such as anticoagulants, platelet aggregation inhibitors, vasodilators, anesthetics, anti-inflammatory agents, and antimicrobial compounds.[17] Hirudin is the important and principal anticoagulant responsible for enhanced bleeding and prevention of coagulation.[18]

Calin, apyrase, decorsin, saratin, collagenase are platelet function inhibitors accounting for the persistence of bleeding subsequent to biting last for several hours after removal of leech. Hyaluronidase and pyrase are Extracellular matrix degradation, these decreases the viscosity of interstitial fluid and improve the depth wise penetration of nutrients and other substances. Histamine like vasodilators, dilate the vessels. Antistasis, hirustasin, eglin C, carboxypeptidase inhibitor, bdellins, piguamerin, guamerin are anti-inflammatory and analgesic, reduces inflammation and rendering the bite painless.[19]

Thus, leeches aid in the salvage of compromised tissue by promoting sustained bleeding, which significantly reduces tissue congestion. This process helps lower blood volume, alleviate capillary pressure, decrease venous congestion, and relieve compression on nerve trunks and endings. Additionally, it enhances lymphatic flow, improves local hemodynamics, increases oxygen supply, boosts tissue metabolism, and helps resolve tissue ischemia.[20]

Figure 3: Passive oozing from the leech bite

Conclusion

Medicinal leech therapy *(Jaloukavacharana)* has proven to be an invaluable tool in plastic and reconstructive surgery, especially for managing venous congestion in compromised flaps. The historical use of leeches, as documented in ancient civilizations, provides a strong foundation for their continued application in modern surgical practices. By reducing venous congestion and promoting effective venous drainage, leeches facilitate the survival of flaps and reattached tissues, making them an essential nonsurgical option for tissue salvage. This study highlights the predictable and effective healing outcomes achieved through leech therapy, demonstrating its significant role in improving flap viability and graft acceptance. The biological properties of the medicinal leech, such as blood-letting action, passive oozing, and the release of biologically active substances, contribute to these therapeutic effects, including reduced inflammation, improved circulation, and enhanced tissue metabolism.

Given the benefits, ease of use, and cost-effectiveness of this treatment modality, medicinal leeches represent a valuable addition to the armamentarium of plastic and reconstructive surgeons. As the practice of microsurgery continues to advance, the importance of addressing venous congestion remains critical, and leech therapy provides a reliable and safe solution in the management of this complication. Further research and clinical experience will continue to refine the application and optimal use of leeches in surgical practice, ensuring better outcomes for patients undergoing complex reconstructive procedures.

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