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Review Article

FROM CLASSICAL WISDOM TO MODERN HEALING: EXPLORING *SUSHRUTOKTA GANAS* IN *SANDHANA KARMA* WITH SPECIAL REFERENCE TO THE MANAGEMENT OF SIMPLE FRACTURE AND SOFT TISSUE INJURY

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ABSTRACT

Bhagna (fractures) and soft tissue injuries are common musculoskeletal conditions requiring effective tissue repair and restoration. Acharya Sushruta described several medicinal groups *(Ganas)* possessing *Sandhanakara* properties that promote tissue healing. Among these, *Priyangvadi Gana, Ambasthadi Gana,* and *Nyagrodhadi Gana* are considered important in *Bhagna Chikitsa* and soft tissue repair. **Materials and Methods:** A comprehensive review of classical Ayurvedic texts, including Sushruta Samhita, Charaka Samhita, Ashtanga Hridaya, Bhavaprakasha Nighantu, and Dalhana commentary, was undertaken. Relevant scientific literature from electronic databases was also reviewed to correlate latest evidence on the pharmacological activities of the constituent drugs with contemporary concepts of fracture healing and tissue regeneration. **Results:** The constituent drugs predominantly exhibit *Kashaya Rasa, Sheeta Virya, Sandhanakara, Stambhana*, and *Dhatu-poshaka* properties. Experimental studies have reported anti-inflammatory, antioxidant, antimicrobial, collagen-promoting, osteogenic, and wound-healing activities, supporting their potential role in enhancing fracture healing and soft tissue regeneration. **Conclusion:** *Priyangvadi Gana, Ambasthadi Gana,* and *Nyagrodhadi Gana* possess promising therapeutic attributes relevant to *Sandhana Karma*. Their classical indications, supported by contemporary evidence, suggest potential utility in managing simple fractures and soft tissue injuries. Further experimental and clinical studies are required to establish their evidence-based applications.

INTRODUCTION

Fractures and soft tissue injuries are among the leading causes of disability worldwide and account for a substantial proportion of trauma-related morbidity. Successful healing requires coordinated repair of both osseous and soft tissues. Despite advances in orthopaedic management, delayed healing, prolonged rehabilitation and residual functional impairment continue to remain important clinical concerns.

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Ayurveda, the ancient science of life, has described various therapeutic principles for the preservation, restoration, and promotion of health. Among the eight major branches of Ayurveda, *Shalya Tantra* occupies a prominent position owing to its comprehensive approach towards the management of traumatic and surgical disorders. Acharya Sushruta, revered as the Father of Surgery, has provided detailed descriptions of trauma care, fracture management, wound healing, reconstructive procedures, and rehabilitation, reflecting the advanced surgical knowledge of ancient India.[1]

Bhagna (fracture) is one of the important traumatic conditions described in *Sushruta Samhita*. *Acharya Sushruta* has devoted separate chapters namely *Bhagna Nidana* and *Bhagna Chikitsa* for understanding the aetiology, classification, clinical

features, prognosis, and management of fractures and dislocations. [2,3] According to Ayurvedic principles, successful management of *Bhagna* involves not only correction of structural deformity but also restoration of tissue integrity and functional recovery. This process is achieved through appropriate reduction, immobilization, dietary regulations, and medicinal interventions that facilitate tissue repair.

One of the fundamental therapeutic concepts governing tissue restoration in Ayurveda is *Sandhana Karma*. The term *Sandhana* literally denotes joining, reunion, restoration, or re-establishment of continuity between separated structures.[4] In the context of *Bhagna Chikitsa*, *Sandhana Karma* refers to the process by which disrupted tissues regain their structural and functional integrity. Although commonly associated with fracture union, the concept encompasses healing of all injured tissues including bone, ligaments, tendons, muscles, and other supporting structures. Thus, *Sandhana Karma* represents a broader principle of tissue regeneration and restoration.

Recognizing the importance of tissue healing, *Acharya Sushruta* described various medicinal groups (*Ganas*) possessing specific therapeutic actions. Among them, *Priyangvadi Gana and Ambasthadi Gana* are described by *Acharya Sushruta* as possessing *Sandhanakara* properties, while *Nyagrodhadi Gana* is specifically indicated in *Bhagna Sandhana* and tissue stabilization.[5] The constituent drugs of these *Ganas* predominantly exhibit *Kashaya Rasa*, *Sheeta Virya*, *Stambhana*, *Vrana-Ropana*, and *Dhatu-poshaka* properties, which are considered essential for facilitating the process of healing and regeneration[6] (Table no.1).

Several medicinal plants included in these *Ganas*, such as *Lajjalu (Mimosa pudica)*, *Arjuna (Terminalia arjuna)*, *Lodhra (Symplocos racemosa)*, *Yashtimadhu (Glycyrrhiza glabra)*, *Madhuka (Madhuca indica)*, and *Nyagrodha (Ficus benghalensis)*, have been traditionally employed for wound healing, tissue repair, and strengthening of body tissues. Contemporary studies have also reported anti-inflammatory, antioxidant, collagen-promoting, osteoprotective, and regenerative activities of these drugs, thereby supporting their classical indications[7-10] (Table 2).

Despite the extensive classical description of these *Ganas* and the increasing scientific evidence regarding their constituent drugs, the collective role of *Priyangvadi Gana, Ambasthadi Gana,* and *Nyagrodhadi Gana* in *Sandhana Karma* has not been comprehensively reviewed. Furthermore, the rationale underlying their classification as *Sandhaniya* and *Bhagna-Sandhanakara* groups remains inadequately explored from both classical and contemporary perspectives.

Therefore, the present literary review has been undertaken to critically analyse the concept of *Sandhana Karma* and to evaluate the therapeutic significance of *Priyangvadi Gana, Ambasthadi Gana,* and *Nyagrodhadi Gana* in the management of simple fractures and soft tissue injuries, with an attempt to correlate classical Ayurvedic principles with contemporary scientific evidence.

AIM AND OBJECTIVES

Aim

To explore the role of *Sushrutokta Ganas* in *Sandhana Karma* with special reference to the management of simple fractures and soft tissue injuries.

Objectives

1. To review the classical references of *Priyangvadi Gana, Ambasthadi Gana* and *Nyagrodhadi Gana* described in *Sushruta Samhita*.
2. To analyse the pharmacodynamic attributes of the constituent drugs relevant to tissue repair and fracture healing.
3. To correlate the classical concepts of *Sandhana Karma* with contemporary scientific evidence related to fracture healing and soft tissue regeneration.

MATERIALS AND METHODS

Literature was collected from classical Ayurvedic texts and electronic databases including PubMed, Google Scholar, Scopus and AYUSH Research Portal. Articles related to fracture healing, wound healing, tissue regeneration and pharmacological activities of the constituent drugs were included. Duplicate reports, non-English articles and studies lacking relevant pharmacological data were excluded.

Classical References of Selected *Ganas* [11]

Priyangvadi Gana

प्रियङ्गुसमङ्गाधातकीपुन्नागनागपुष्पचन्दनकुचन्दनमोचरसरसाञ्जनकुम्भीकस्रोतोज पद्मकेसरयोजनवल्ल्योदीर्घमूलाचति |

Ambasthadi Gana

अम्बष्ठाधातकीकुसुमसमङ्गाकट्वङ्गमधुकबिल्वपेशिकासावररोध्रपलाशनन्दीवृक्षाः पद्मकेशराणि चेति |

Nyagrodhadi Gana

न्यग्रोधोदुम्बराश्वत्थप्लक्षमधुककपीतनककुभाम्रकोशाम्रचोरकपत्रजम्बूद्वयप्रियाल-मधूकरोहिणीवञ्जुलकदम्बबदरीतिन्दुकीसल्लकीरोध्रसाववरोध्रभल्लातकपलाशा न न्दीवृक्षश्चेति ||

The details of above drugs described in three different Ganas are summarized in the following table. (Table no.-1)

Table 1: Identification of Drugs Described in Selected *Ganas* According to Acharya Sushruta and their Botanical Equivalents[12-15]

S.No.	Drug Name	Latin Name	*Rasa*	*Guna*	*Virya*	*Vipaka*	*Dosha karma*
1	Priyangu	Callicarpa macrophylla	Kashay, Tikta, Madhura	Laghu, Ruksha	Sheeta	Katu	Kapha-Pittahara, Sangrahi
2	Samanga (Lajjalu)	Mimosa pudica	Kashay, Tikta	Laghu, Ruksha	Sheeta	Katu	Kapha-Pittahara, Sandhaniya, Sangrahaka
3	Dhataki	Woodfordia fruticosa	Kashaya	Laghu, Ruksha	Sheeta	Katu	Kapha-Pittahara
4	Punnaga (Kampillaka)	Mallotus philippensis	Katu, Tikta, Kashaya	Laghu, Ruksha, Tikshna	Ushna	Katu	Kapha-Vatahara
5	Nagakesara	Mesua ferrea	Kashaya, Tikta	Laghu, Ruksha	Sheeta	Katu	Kapha-Pittahara
6	Rakta Chandana	Pterocarpus santalinus	Tikta, Madhura	Laghu, Ruksha	Sheeta	Katu	Pitta-Kaphahara
7	Kuchandana (Shweta Chandana)	Santalum album	Tikta, Madhura	Laghu, Snigdha	Sheeta	Katu	Pitta-Kaphahara
8	Mocha Rasa	Bombax malbarium	Kashaya	Guru, Ruksha	Sheeta	Katu	Kapha-Pittahara
9	Rasanjana	Berberis aristata	Tikta, Kashaya	Laghu, Ruksha	Ushna	Katu	Kapha-Pittahara
10	Kumbhika	Careya arborea Roxb.	Tikta, Kashaya	Laghu, Ruksha	Ushna	Katu	Kapha-Vatahara
11	Srotanjana / Souviranjana	Sb_2S_3 (Grey/White Antimony)	Katu, Tikta	Laghu, Tikshna	Ushna	Katu	Kapha-Vatahara
12	Padma Keshara	Nelumbo nucifera	Madhura, Kashaya	Laghu, Snigdha	Sheeta	Madhura	Pitta-Kaphahara
13	Yojanavalli (Manjistha)	Rubia cordifolia	Tikta, Kashay, Madhura	Guru, Ruksha	Ushna	Katu	Kapha-Pittahara, Sothahara
14	Dirghamoola (Duralabha)	Fagonia cretica	Tikta, Kashaya	Laghu, Ruksha	Sheeta	Katu	Kapha-Pittahara
15	Ambastha	Cissampelos pareira	Tikta, Kashaya	Laghu, Ruksha	Sheeta	Katu	Vata-Kaphahara, Shoolahara,Sangrahi
16	Katvanga	Oroxylum indicum	Tikta, Kashaya	Laghu, Ruksha	Ushna	Katu	Kapha-Vatahara, Sothahara, Vedanasthapana
17	Madhuka	Glycyrrhiza glabra	Madhura	Guru, Snigdha	Sheeta	Madhura	Vata-Pittahara
18	Bilwa	Aegle marmelos	Kashaya, Tikta	Laghu, Ruksha	Ushna	Katu	Kapha-Vatahara
19	Lodhra	Symplocos racemosa	Kashaya	Laghu, Ruksha	Sheeta	Katu	Kapha-Pittahara
20	Palasa	Butea	Katu, Tikta,	Laghu,	Ushna	Katu	Kapha-Vatahara,

		monosperma	*Kashaya*	*Ruksha*			*Grahi, Raktastambhak*
21	*Nandi Vriksha (Kashmari)*	*Gmelina arborea*	*Madhura, Tikta, Kashaya*	*Guru, Snigdha*	*Sheeta*	*Madhura*	*Vata-Pittahara*
22	*Vata*	*Ficus benghalensis*	*Kashaya*	*Guru, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
23	*Udumbara*	*Ficus racemosa*	*Kashaya*	*Guru, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
24	*Ashwattha*	*Ficus religiosa*	*Kashaya*	*Guru, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
25	*Parisa*	*Thespesia populnea*	*Kashaya, Tikta*	*Laghu, Ruksha*	*Sheeta*	*Katu*	*Pitta-Kaphahara*
26	*Plaksha*	*Ficus lacor*	*Kashaya*	*Guru, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
27	*Arjuna*	*Terminalia arjuna*	*Kashaya*	*Laghu, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
28	*Amra*	*Mangifera indica*	*Kashaya, Madhura*	*Guru, Ruksha*	*Sheeta*	*Madhura*	*Pitta-Kaphahara*
29	*Jambu*	*Syzygium cumini*	*Kashaya, Madhura*	*Laghu, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
30	*Priyala*	*Buchanania latifolia*	*Madhura*	*Guru, Snigdha*	*Sheeta*	*Madhura*	*Vata-Pittahara*
31	*Rohini*	*Myrica nagi*	*Tikta, Kashaya*	*Laghu, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
32	*Madhuka*	*Madhuka indica*	*Madhura*	*Guru, Snigdha*	*Sheeta*	*Madhura*	*Vata-Pittahara*
33	*Vadara*	*Ziziphus mauritiana*	*Madhura, Kashaya*	*Guru, Snigdha*	*Sheeta*	*Madhura*	*Vata-Pittahara*
34	*Tinduka*	*Diospyros peregrina*	*Kashaya, Madhura*	*Guru, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara, Grahi,stambhana*
35	*Shallaki*	*Boswellia serrata*	*Tikta, Kashaya, Madhura*	*Laghu, Ruksha*	*Sheeta*	*Katu*	*Kapha-Pittahara*
36	*Bhallataka*	*Semecarpus anacardium*	*Katu, Tikta, Kashaya*	*Laghu, Snigdha, Tikshna*	*Ushna*	*Madhura*	*Kapha-Vatahara*

N.B- The botanical identities of *Chandana, Srotoja, Yojanavalli***,** and *Dirghamoola* were adopted according to the commentary of Acharya Dalhana on Sushruta Samhita, wherein *Chandana* is interpreted as *Rakta Chandana, Srotanjana* as *Sauviranjana, Yojanavalli* as *Manjistha,* and *Dirghamoola* as *Duralabha*.[12] The identities of certain drugs such as *Kumbhika, Ambastha,* and *Rohini* vary among different *Nighantus* and commentators; therefore, the identities adopted in the present review are based on the most widely accepted interpretations available in classical Ayurvedic literature and standard *Dravyaguna* texts.[12-15]

Table 2: Reported Pharmacological Activity Relevant to Fracture Healing

S.No.	Drug Name	Reported pharmacological activity relevant to fracture healing
1	*Priyangu*	Anti-inflammatory, analgesic, antimicrobial and antioxidant actions; may help reduce local inflammation, pain and infection risk during fracture-associated soft tissue injury.
2	*Samanga/*	Wound-healing, anti-inflammatory, haemostatic and antioxidant actions, supports soft

	Lajjalu	tissue repair and local bleeding control.
3	*Dhataki*	Astringent, wound-healing, antimicrobial and anti-inflammatory actions; supports wound contraction and tissue repair.
4	*Punnaga/ Kampillaka*	Anti-inflammatory, antimicrobial and wound-cleansing actions; useful for reducing inflammation and local microbial load.
5	*Nagakeshara*	Anti-inflammatory, antioxidant, haemostatic and wound-healing actions; may support tissue repair and reduce bleeding/inflammation.
6	*Rakta Chandana*	Anti-inflammatory, antioxidant, cooling and wound-healing actions; may help reduce *Pitta*-dominant inflammation, burning and tissue irritation.
7	*Kuchandana/ Shweta Chandana*	Anti-inflammatory, cooling, antimicrobial and wound-soothing actions; useful in inflammatory soft tissue injury.
8	*Mocha Rasa*	Astringent, haemostatic, wound-healing and tissue-contracting actions; supports wound closure and soft tissue union.
9	*Rasanjana*	Antimicrobial, anti-inflammatory and wound-cleansing actions; supports prevention of infection and tissue repair.
10	*Kumbhika*	Anti-inflammatory, wound-healing and astringent supportive action; may help in reducing swelling and discharge.
11	*Srotanjana/ Souviranjana*	Traditionally used for local inflammation and eye disorders; relevance to fracture healing is indirect through anti-inflammatory and antimicrobial action.
12	*Padma Keshara*	Haemostatic, cooling, antioxidant and wound-healing action; may support bleeding control and tissue repair.
13	*Yojanavalli/ Manjistha*	Anti-inflammatory, antioxidant, wound-healing and osteogenic-supportive activity; may help tissue repair and bone-healing environment.
14	*Dirghamoola/ Duralabha*	Anti-inflammatory, antioxidant and wound-healing supportive action; may help reduce inflammation and support repair.
15	*Ambastha*	Grahi, Sangrahi, anti-inflammatory and wound-healing supportive action; useful in tissue contraction and restoration of continuity.
16	*Katvanga*	Anti-inflammatory, analgesic and wound-healing supportive action; may reduce pain, swelling and support repair.
17	*Madhuka/ Yashtimadhu*	Anti-inflammatory, antioxidant, wound-healing, collagen-supportive and tissue-regenerative activity; supports soft tissue repair.
18	*Bilwa*	Wound-healing, anti-inflammatory and antioxidant activity; experimental studies show wound-healing potential in excision, incision and dead-space wound models.
19	*Lodhra*	Astringent, haemostatic, wound-healing and anti-inflammatory action; supports tissue contraction, bleeding control and repair.
20	*Palasha*	Anti-inflammatory, antimicrobial, astringent and wound-healing action; helps in wound cleansing and tissue repair.
21	*Nandi Vriksha/ Kashmari*	Anti-inflammatory, antioxidant and wound-healing supportive action; may assist soft tissue repair and inflammation control.
22	*Vata*	Astringent, wound-healing, anti-inflammatory and haemostatic action; supports soft tissue contraction and repair around fracture site.
23	*Udumbara*	Astringent, wound-healing, anti-inflammatory and haemostatic action; supports wound closure and tissue healing.
24	*Ashwattha*	Wound-healing, anti-inflammatory, antioxidant and astringent action; supports soft tissue repair and local inflammation reduction.

25	*Parisa*	Anti-inflammatory, antioxidant and wound-healing supportive activity; may help tissue repair.
26	*Plaksha*	Astringent, wound-healing and anti-inflammatory action; supports tissue contraction and healing.
27	*Arjuna*	Wound-healing, antioxidant, anti-inflammatory and collagen-supportive activity; supports tissue regeneration and repair.
28	*Amra*	Antioxidant, anti-inflammatory, astringent and wound-healing supportive activity; helps tissue repair and reduces inflammation.
29	*Jambu*	Astringent, antioxidant, antimicrobial and wound-healing action; supports wound contraction and local tissue repair.
30	*Priyala*	Nutritive, wound-healing supportive and anti-inflammatory action; may support tissue nourishment during healing.
31	*Rohini*	Anti-inflammatory, antimicrobial, astringent and wound-healing supportive action; may help soft tissue repair.
32	*Madhuka/ Mahua*	Anti-inflammatory, antioxidant and wound-healing supportive activity; may support repair and tissue nourishment.
33	*Vadara*	Anti-inflammatory, antioxidant, nutritive and wound-healing supportive action; may assist tissue repair.
34	*Tinduka*	Astringent, Grahi, haemostatic and wound-healing action; supports tissue contraction, bleeding control and repair.
35	*Shallaki*	Strong anti-inflammatory, analgesic, wound-healing and bone-metabolism supportive activity; Boswellia constituents may help reduce pain, swelling and inflammatory bone loss.
36	*Bhallataka*	Anti-inflammatory, immunomodulatory and wound-healing supportive activity; may support repair, but should be used cautiously due to irritant potential.

Source: Compiled from Bhavaprakasha Nighantu, Sushruta Samhita (Dalhana Commentary), Dravyaguna Vigyana and published pharmacological literature on medicinal plants. [16–26]

DISCUSSION

The process of fracture healing is a complex biological phenomenon involving inflammation, cellular proliferation, extracellular matrix formation, callus maturation, and remodelling. In Ayurveda, these sequential events can be understood under the broader concept of *Sandhana Karma*, which denotes restoration of structural continuity and functional integrity of damaged tissues.[27] *Acharya Sushruta* recognized the importance of this process and described specific medicinal groups capable of facilitating tissue repair and regeneration. Among these, *Priyangvadi Gana* and *Ambasthadi Gana* are acknowledged for their *Sandhanakara* properties, whereas *Nyagrodhadi Gana* is specifically indicated in *Bhagna Sandhana*, highlighting its relevance in fracture management.[28]

Analysis of the constituent drugs of these Ganas reveals a predominance of *Kashaya Rasa*, followed by *Tikta Rasa*, along with *Laghu-Ruksha Guna*, *Sheeta Virya*, and *Katu Vipaka*. According to Ayurvedic principles, *Kashaya Rasa* possesses *Stambhana*, *Sangrahana*, and *Sandhana* properties that facilitate tissue approximation, stabilization, and restoration of continuity.[29] These actions are particularly relevant during the early phases of fracture healing, where stabilization of the fracture hematoma and prevention of excessive tissue damage are essential. *Tikta Rasa* contributes to *Shodhana* and *Lekhana* actions, assisting in the removal of damaged tissue elements and creating a favourable environment for regeneration.[30]

The inflammatory phase of fracture healing is characterized by vascular disruption, hematoma formation, pain, swelling, and local inflammatory responses. Several drugs present in these *Ganas* possess *Sothahara, Vedanasthapana, Daha-Shamana,* and *Raktapitta-Shamaka* properties. Experimental studies have demonstrated significant anti-inflammatory and antioxidant activities in drugs such as *Manjistha, Arjuna, Shallaki, Yashtimadhu,* and *Lodhra*, which may help reduce inflammatory tissue damage and oxidative stress at the fracture site. [31–34] This pharmacological profile suggests a potential role in facilitating progression from the inflammatory phase to the reparative phase of healing.

A distinctive feature of *Priyangvadi Gana* and *Ambasthadi Gana* is their association with *Sandhanakara* activity. The predominance of astringent and tissue-stabilizing drugs in these groups indicates their probable role in promoting tissue cohesion and restoration of continuity. Several constituent drugs exhibit *Vrana-Ropana, Stambhana,* and *Sangrahaka* properties that may support fibroblast proliferation, collagen synthesis, extracellular matrix organization, and granulation tissue formation.[35] These actions collectively contribute to soft tissue repair and may create a favourable biological environment for fracture union.

Among the three *Ganas*, *Nyagrodhadi Gana* occupies a unique position because of its specific indication in *Bhagna Sandhana*. The constituent drugs of this *Gana*, particularly *Vata, Udumbara, Ashwattha, Plaksha,* and *Arjuna*, are traditionally recognized for their wound-healing, tissue-binding, and regenerative properties.[28,36] The predominance of *Kashaya Rasa* and *Vranya Karma* within this group may contribute to strengthening of the fracture callus, enhancement of tissue integrity, and promotion of structural restoration. The designation of *Bhagna-Sadhaka* by Acharya Sushruta appears to reflect a therapeutic emphasis on restoration of skeletal continuity and tissue regeneration.

Several drugs belonging to these *Ganas* also possess *Madhura Vipaka*, *Balya*, and *Rasayana* attributes. These properties are traditionally associated with nourishment of tissues (*Dhatu Poshana*) and enhancement of regenerative capacity.[37] From a contemporary perspective, such actions may correlate with improved collagen maturation, matrix deposition, osteoblastic activity, and mineralization during the stages of hard callus formation and remodelling. Furthermore, the haemostatic actions of drugs such as *Nagakeshara, Padma Keshara, Lodhra,* and *Mocharasa* may support stabilization of the fracture hematoma, which serves as a biological scaffold for subsequent repair processes.[38]

In addition, the antimicrobial, antioxidant, and immunomodulatory activities reported in several constituent drugs may help protect the fracture site from infection and oxidative injury, thereby minimizing factors known to delay healing.[39] The combined actions of these Ganas therefore extend beyond symptomatic relief and may influence multiple stages of the healing cascade.

Based on the classical descriptions and available scientific evidence, *Priyangvadi Gana, Ambasthadi Gana,* and *Nyagrodhadi Gana* appear to exert a multidimensional influence on fracture healing through anti-inflammatory, haemostatic, antioxidant, tissue-regenerative, and *Sandhanakara* mechanisms. The collective pharmacodynamic attributes of these *Ganas* provide a scientific rationale for their traditional use in *Bhagna Chikitsa* and support their potential role in promoting fracture union and soft tissue repair.

The findings of the present review suggest that the concept of *Sandhana Karma* extends beyond simple fracture union and encompasses comprehensive tissue regeneration involving bone, ligaments, tendons, fascia, and surrounding soft tissues. This broader understanding highlights the holistic approach of Ayurveda towards musculoskeletal healing and supports the contemporary relevance of *Sushrutokta Ganas* in trauma care and rehabilitation.

RESULTS

A total of thirty-six medicinal substances described under *Priyangvadi Gana*, *Ambasthadi Gana* and *Nyagrodhadi Gana* were reviewed. Analysis of their pharmacodynamic attributes revealed predominance of *Kashaya Rasa, Laghu-Ruksha Guna, Sheeta Virya* and *Katu Vipaka*. Most drugs exhibit *Sandhaniya, Sangrahi, Vranaropana, Stambhana, Sothahara* and *Raktapitta-Shamaka* properties. Review of contemporary literature demonstrated anti-inflammatory, antioxidant, antimicrobial, wound-healing and tissue-regenerative activities among several constituent drugs. These findings indicate their potential role in promoting tissue repair, restoration of structural continuity and fracture healing.

CONCLUSION

The classical descriptions of Acharya Sushruta appear to be supported by contemporary pharmacological evidence, indicating the translational relevance of these *Ganas* in musculoskeletal tissue regeneration and fracture management. The predominance of *Kashaya Rasa, Sandhaniya, Sangrahi and Vranaropana* properties, together with reported anti-inflammatory, antioxidant and tissue-regenerative activities, suggests their potential role in fracture healing and soft tissue repair. These classical drug groups may serve as valuable therapeutic resources in *Bhagna Chikitsa*. Further experimental and clinical studies are required to validate their efficacy and establish evidence-based applications in contemporary fracture management.

Future scope

The classical indications of *Priyangvadi Gana, Ambasthadi Gana,* and *Nyagrodhadi Gana* suggest their potential role in fracture healing and tissue regeneration. Future studies should focus on evaluating their osteogenic, anti-inflammatory, and regenerative properties through experimental and clinical research. Scientific validation of their

Sandhaniya and *Bhagna-Sandhanaka* actions may facilitate the development of evidence-based Ayurvedic interventions and promote their integration into contemporary fracture management. Large sample RCTs may require to prove the efficacy.

Limitations of the study

The present review is primarily based on classical Ayurvedic literature and available published scientific evidence. Variations in the botanical identification of certain drugs among different *Nighantus* and commentaries may influence the interpretation of findings. Furthermore, direct experimental and clinical evidence evaluating the fracture-healing potential of *Priyangvadi Gana, Ambasthadi Gana, and Nyagrodhadi Gana* as complete formulations is limited. Therefore, the conclusions drawn are largely based on classical descriptions and the reported pharmacological activities of their individual constituent drugs.

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