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"CLINICAL EVALUATION OF AYURVEDIC ADJUVANT THERAPY IN FRACTURE HEALING: A PROSPECTIVE COMPARATIVE STUDY"

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ABSTRACT

Background: Fracture healing is a complex biological process involving inflammation, callus formation, and bone remodeling. Despite advances in orthopedic management, delayed union, persistent pain, and slower functional recovery remain significant clinical concerns. Ayurveda describes fracture management under *Bhagna Chikitsa*, wherein formulations possessing *Sandhaniya* (union-promoting), *Shothahara* (anti-inflammatory), and *Asthiposhaka* (bone-nourishing) properties are considered beneficial.

Objective: To evaluate the efficacy of Ayurvedic adjuvant therapy comprising Lakshadi Guggul, Trayodashang Guggul, Panchatikta Ghrita Guggul, and a mineral-herbal formulation (Shankha, Shukti, Kapardika, Arjuna, Asthishrinkhala) as an adjunct to conventional orthopedic treatment in fracture healing.

Methods: A prospective comparative clinical study was conducted at Institutional Orthoved Hospital, Dombivli, Maharashtra (January 2023–January 2025). Ninety radiologically confirmed fracture patients (aged 20–55 years) were allocated to Group A (n=45; conventional treatment only) or Group B (n=45; conventional treatment plus Ayurvedic adjuvant therapy for 45 days). Outcome measures included Visual Analogue Scale (VAS) pain score, tenderness score, radiological callus formation, mean fracture union time, and functional recovery score.

Results: Group B demonstrated significantly superior outcomes across all parameters. Early callus formation was observed in 91.11% (41/45) of Group B versus 42.22% (19/45) of Group A. Mean radiological union time was 9 weeks in Group B compared to 12 weeks in Group A. Final VAS score (2 vs. 4), tenderness score (1 vs. 3), and functional recovery score (1 vs. 5) were all significantly better in Group B.

Conclusion: Ayurvedic adjuvant therapy alongside conventional orthopedic management appears to accelerate fracture healing, promote earlier callus formation, reduce pain and tenderness, and improve functional recovery with good tolerability.

Keywords: *Arjuna*, *Asthishrinkhala*, *Ayurveda*, *Bhagna Chikitsa*, callus formation, fracture healing, Lakshadi Guggul, orthopedics, Panchatikta Ghrita Guggul, Trayodashang Guggul

INTRODUCTION

Fractures remain among the most common orthopedic emergencies encountered in clinical practice. Bone healing is a highly coordinated physiological process involving hematoma formation, inflammatory

response, fibrocartilaginous callus formation, ossification, and remodeling. Although conventional orthopedic interventions such as plaster of Paris (POP) immobilization, open reduction and internal fixation (ORIF), and external fixation provide mechanical stability, delayed healing, prolonged pain, restricted mobility, and delayed return to routine activities continue to pose clinical challenges.

Ayurveda provides a well-established framework for fracture management described under *Bhagna Chikitsa*. Classical Ayurvedic literature emphasizes immobilization, nourishment of bone tissue (*Asthi Dhatu Poshan*), inflammation control, and enhancement of tissue regeneration. Several Ayurvedic formulations are traditionally employed for musculoskeletal healing. Lakshadi Guggul is indicated for promoting fracture union and callus formation. Trayodashang Guggul is used for pain relief and neuromuscular recovery. Panchatikta Ghrita Guggul is known to enhance tissue repair and reduce inflammation. Asthishrinkhala (*Cissus quadrangularis*) is a classical bone-healing herb. Arjuna (*Terminalia arjuna*) strengthens tissue repair and mineralization. Shankha, Shukti, and Kapardika provide calcium-rich mineral support.[1–7]

The integration of Ayurvedic adjuvant therapy with conventional orthopedic care may improve clinical outcomes and accelerate recovery. However, comparative clinical evidence evaluating such integrative approaches remains limited. Hence, the present study was undertaken to evaluate the role of Ayurvedic adjuvant therapy in fracture healing when used alongside conventional orthopedic management.

AIMS AND OBJECTIVES

The primary aim was to evaluate the role of Ayurvedic adjuvant therapy in fracture healing when administered alongside conventional orthopedic management. The specific objectives were to assess reduction in pain using the Visual Analogue Scale (VAS), evaluate improvement in tenderness, assess radiological callus formation, compare mean fracture union time between groups, evaluate functional recovery using a custom functional scoring system, and assess the overall role of selected Ayurvedic formulations as supportive therapy in fracture management.

MATERIALS AND METHODS

Study Design and Setting

A prospective comparative clinical study was conducted at Institutional Orthopedic Hospital, Dombivli, Maharashtra, India, from January 2023 to January 2025. Written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Sample Size and Allocation

Ninety patients with radiologically confirmed fractures, aged 20–55 years, were enrolled and allocated into two groups of 45 patients each.

Inclusion Criteria

Patients with radiologically confirmed fractures, aged 20–55 years, willing to participate and providing written informed consent were included in the study.

Exclusion Criteria

Patients with pathological fractures, severe infection requiring emergency intervention, pregnancy, renal failure, immunocompromised status, or uncontrolled systemic disease were excluded.

Grouping and Intervention

Group A (Control, n=45): Received conventional orthopedic management only (POP immobilization, ORIF, or external fixation as indicated).

Group B (Study, n=45): Received conventional orthopedic management plus Ayurvedic adjuvant therapy. The Ayurvedic intervention consisted of two tablet formulations administered thrice daily after meals for 45 days or until radiological union, whichever was earlier.

Table 1: Composition of Ayurvedic Formulations

Formulation	Ingredient	Quantity per Tablet
Tablet 1 (400 mg)	Lakshadi Guggul	150 mg
	Trayodashang Guggul	125 mg
	Panchatikta Ghrita Guggul	125 mg
Tablet 2 (400 mg)	Shankha	60 mg

	Shukti	60 mg
	Kapardika	60 mg
	Arjuna	120 mg
	Asthishrinkhala	100 mg

Assessment Parameters

Clinical assessment included VAS pain score, tenderness score (custom 0–10 scale), and functional recovery score (custom scale; lower score indicating better recovery). Radiological assessment included X-ray evaluation for callus formation and fracture union time. Laboratory assessment included complete blood count (CBC) monitored throughout follow-up for safety evaluation.

Statistical Analysis

Descriptive comparative analysis was performed. Data were expressed as mean values and percentages. Improvement was calculated as percentage change from baseline to final assessment.

OBSERVATIONS AND RESULTS

Demographic Profile

Table 2: Age Distribution of Patients (n=90)

Age Group (Years)	Number of Patients	Percentage
20–30	22	24.44%
31–40	28	31.11%
41–50	25	27.78%
51–55	15	16.67%

Maximum patients belonged to the 31–40 years age group (31.11%), indicating higher fracture incidence among active working adults.

Table 3: Gender Distribution (n=90)

Gender	Number	Percentage
Male	35	38.89%
Female	55	61.11%

Female predominance (61.11%) was observed in the present study.

Table 4: Etiological Distribution (n=90)

Cause	Number	Percentage
Road Traffic Accident	29	32.22%
Fall	45	50.00%
Domestic Trauma	16	17.78%

Falls constituted the most common cause of fractures (50.00%).

Table 5: Fracture Distribution (n=90)

Fracture Site	Number	Percentage
Metatarsal	28	31.11%
Humerus	18	20.00%
Radius	15	16.67%
Clavicle	12	13.33%
Femur	9	10.00%
Tibia	5	5.56%

Ulna	3	3.33%
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Metatarsal fractures were the most commonly encountered fracture type (31.11%).

Table 6: Treatment Modality Distribution (n=90)

Treatment Modality	Number	Percentage
POP Immobilization	60	66.67%
ORIF	20	22.22%
External Fixation	10	11.11%

Most patients (66.67%) were managed conservatively with POP immobilization.

Clinical Outcome Analysis

Table 7: Comparison of Clinical and Radiological Outcomes between Groups

Parameter	Group A (Control)	Group B (Study)
VAS Score (Initial)	8.1	8.3
VAS Score (Final)	4.0	2.0
VAS Improvement (%)	50.62%	75.90%
Tenderness Score (Initial)	7.8	8.0
Tenderness Score (Final)	3.0	1.0
Tenderness Improvement (%)	61.54%	87.50%
Functional Score (Initial)	8.2	8.4
Functional Score (Final)	5.0	1.0
Functional Improvement (%)	39.02%	88.10%
Early Callus Formation	19/45 (42.22%)	41/45 (91.11%)
Mean Fracture Union Time	12 weeks	9 weeks

Group B demonstrated consistently superior outcomes across all assessed clinical and radiological parameters. The Ayurvedic adjuvant group showed 75.90% pain reduction versus 50.62% in the control group, 87.50% tenderness improvement versus 61.54%, and 88.10% functional recovery improvement versus 39.02%. Early callus formation was observed in 91.11% of Group B patients compared to 42.22% of Group A patients. Mean fracture union time was reduced by approximately 3 weeks (25%) in the study group.

Safety Observations

No major adverse drug reactions were observed during the treatment period in either group. CBC parameters remained clinically stable throughout the follow-up period, suggesting good tolerability of the Ayurvedic formulations.

DISCUSSION

Fracture healing is a multifactorial physiological process involving sequential phases of inflammation, soft callus formation, hard callus ossification, and remodeling. Successful fracture union depends upon adequate mechanical stabilization, vascular supply, cellular repair mechanisms, and nutritional support. Despite advances in modern orthopedic care, delayed union, persistent pain, functional limitation, and prolonged recovery continue to pose clinically relevant concerns.[8–10]

The present prospective comparative study evaluated the role of Ayurvedic adjuvant therapy in fracture healing when combined with conventional orthopedic treatment. The study group demonstrated superior outcomes across multiple clinical and radiological parameters.

Pain Reduction

Pain is an expected consequence of fracture-related inflammatory mediator release, periosteal injury, and soft tissue trauma. The study group demonstrated significantly better pain reduction (final VAS: 2 vs. 4 in the control group), suggesting enhanced anti-inflammatory and analgesic actions of the Ayurvedic intervention. Lakshadi Guggul, Trayodashang Guggul, and Panchatikta Ghrita Guggul possess documented

Vedanasthapaka (analgesic) and *Shothahara* (anti-inflammatory) properties. Trayodashang Guggul is particularly recognized for relieving musculoskeletal pain and supporting neuromuscular recovery.[5,6]

Tenderness Improvement

Tenderness reflects persistent inflammation, local tissue irritation, and incomplete healing. The study group achieved markedly greater tenderness reduction (final score: 1 vs. 3), suggesting enhanced local tissue healing and more effective suppression of inflammatory processes. Panchatikta Ghrita Guggul may have contributed through its anti-inflammatory and tissue-regenerative properties.[7]

Functional Recovery

Functional restoration is the ultimate goal of fracture management. The study group showed markedly superior functional recovery (final score: 1 vs. 5), with 88.10% improvement compared to 39.02% in the control group. This improved mobility and faster functional return may be attributed to the combined effects of reduced pain, earlier union, and better structural recovery.

Callus Formation and Union Time

Radiological callus formation is a direct indicator of biological fracture healing. The study group showed a substantially higher rate of early callus formation (91.11% vs. 42.22%), strongly supporting enhanced osteogenic activity in the Ayurvedic adjuvant group. *Asthishrinkhala* (*Cissus quadrangularis*) has been traditionally recognized for its fracture-healing properties and has shown evidence of stimulating osteoblastic activity, enhancing collagen synthesis, and accelerating mineralization.[4] Lakshadi Guggul is classically indicated in *Bhagna Chikitsa*. [6] The mean fracture union time was reduced from 12 weeks to 9 weeks (25% reduction), which is clinically meaningful as it reduces overall morbidity and functional disability.

Ayurvedic Rationale

In Ayurveda, fracture involves derangement of *Vata Dosha* (causing pain and instability), *Asthi Dhatu* (bone tissue), *Majja Dhatu* (marrow support), and *Snayu* and *Sandhi* structures. The therapeutic principles include stabilization, reduction of pain, nourishment of *Asthi Dhatu*, and enhancement of union. The selected formulations align with these principles: Lakshadi Guggul promotes callus formation and bone mineralization; Trayodashang Guggul provides analgesic, anti-inflammatory, and neuromuscular support; Panchatikta Ghrita Guggul reduces inflammation and supports tissue regeneration; *Asthishrinkhala* stimulates osteoblast activity and collagen synthesis; Arjuna acts as an antioxidant and tissue reparative agent; and Shankha, Shukti, and Kapardika provide bioavailable calcium for skeletal mineral support.[1–7]

Comparison with Existing Evidence

The present findings align with classical Ayurvedic concepts and contemporary evidence suggesting benefit from integrative fracture support therapies. Earlier studies have reported the osteogenic potential of *Cissus quadrangularis* and the fracture-healing properties of Guggul-based formulations, corroborating the observations of the present study.[4–6,11–15]

LIMITATIONS

The present study has several limitations. It was a single-center study with a moderate sample size. Only descriptive statistical analysis was performed without inferential statistical tests. Multiple fracture types were included without fracture-specific subgroup analysis. The functional scoring system used was a custom assessment scale rather than a validated standardized tool. A longer follow-up period would have strengthened the conclusions.

FUTURE SCOPE

Future studies should include multicentric randomized controlled trials with larger sample sizes, fracture-specific subgroup analysis, use of standardized and validated functional scoring tools, assessment of biochemical markers of bone healing (such as serum alkaline phosphatase, serum calcium, and osteocalcin), and longer follow-up periods to evaluate long-term outcomes and sustainability of treatment effects.

CONCLUSION

The present prospective comparative clinical study demonstrates that Ayurvedic adjuvant therapy comprising Lakshadi Guggul, Trayodashang Guggul, Panchatikta Ghrita Guggul, and a mineral-herbal formulation containing Shankha, Shukti, Kapardika, Arjuna, and *Asthishrinkhala*, when administered alongside conventional orthopedic management, provides clinically meaningful benefits in fracture healing. Observed benefits included accelerated fracture union, earlier radiological callus formation, reduced pain and tenderness, superior functional recovery, and good tolerability. The integrative Ayurvedic approach appears

to be a valuable supportive strategy in fracture management, warranting further validation through larger, well-designed randomized controlled trials.

DECLARATIONS

Conflict of Interest: None declared.

Funding: Self-funded.

Ethical Consideration: Written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with ethical principles.

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