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"*KSHARA KALPANA* AND *KSHARA SUTRA*: A REVIEW OF PREPARATION, STANDARDISATION AND CLINICAL EVIDENCE"

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ABSTRACT

Background: *Kshara* (caustic alkali prepared from plant ash) is described in the *Sushruta Samhita* as superior to sharp instruments for certain procedures. It is used internally (*paniya kshara*) and externally (*pratisaraniya kshara*), and in the form of *Kshara sutra*, a medicated thread used in the treatment of fistula-in-ano and other anorectal conditions. **Objective:** To review the preparation and physicochemical characteristics of *kshara*, the standardisation of *Kshara sutra*, and the clinical evidence for its use. **Methods:** A critical narrative review of classical descriptions, pharmaceutical and analytical studies and clinical trials. **Results:** Classical methods dissolve plant ash in four to eight volumes of water, settle, filter repeatedly (21 times in the *Sushruta Samhita*) and evaporate, with additives giving mild, moderate and strong grades. *Apamarga pratisaraniya kshara* had pH 13.88, potassium 9.19% and sodium 0.63%, indicating a strongly caustic potassium-rich alkali. *Kshara sutra* is made by applying 21 coatings to surgical linen thread: 11 of *Snuhi* latex, 7 of latex with *Apamarga kshara* and 3 of latex with turmeric. A multicentric randomised trial by the Indian Council of Medical Research, a randomised trial against fistulotomy and later comparative studies support its effectiveness for fistula-in-ano, with fewer complications than fistulotomy in some comparisons, although most studies are small and methods of preparation vary. **Conclusion:** *Kshara sutra* is among the best-evidenced Ayurvedic procedures. Standardisation of *kshara* alkalinity, coating load and thread properties, and larger trials against modern sphincter-sparing techniques, are needed.

KEYWORDS: *Kshara*; *Apamarga*; *Kshara sutra*; Fistula-in-ano; Alkali; Standardisation; Medicated seton

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INTRODUCTION

Among the dosage forms of Ayurveda, *kshara* is unusual: it is a chemical agent used for its caustic action. The *Sushruta Samhita* devotes a chapter to its preparation and describes it as superior to surgical instruments and secondary instruments because it can cut, excise and cauterise, can be used where instruments cannot reach, and acts on all three *doshas*[1]. *Kshara* is classified by mode of use into *paniya* (internal) and *pratisaraniya* (external), and by strength into *mridu* (mild), *madhyama* (moderate) and *tikshna* (strong)[2].

The best-known application of *kshara* today is *Kshara sutra*, a thread coated with *kshara* and plant latex that is tied through a fistulous tract and gradually cuts through it while promoting healing. Revived and standardised in the twentieth century, *Kshara sutra* became one of the first Ayurvedic procedures to be tested in a multicentric randomised trial[3,4]. This review summarises the pharmaceutics and clinical evidence.

METHODS OF THE REVIEW

This is a critical narrative review. Literature was identified through PubMed, PubMed Central, DOAJ, Crossref-indexed records and journal archives using the terms *kshara*, *kshara kalpana*, *Apamarga kshara*, *Kshara sutra*, *Ksharasutra*, medicated seton and fistula-in-ano. Classical descriptions, preparation and analytical studies, and clinical trials were included.

PREPARATION OF KSHARA

Table 1. Classical methods for preparing *kshara* from plant ash

Source	Water added to ash	Settling	Filtration
Sushruta Samhita	6 volumes	One night	21 times
Sharangadhara Samhita	4 volumes	Overnight	Clear supernatant decanted
Rasa Tarangini	4 volumes	3 hours	Through three-fold cloth
Ayurveda Sara Sangraha	8 volumes	2–3 days	Four-fold cloth, then 7 times

The plant material, most commonly *Apamarga* (*Achyranthes aspera*), is dried and burned to ash. The ash is mixed with water, allowed to settle, and the clear alkaline solution is filtered repeatedly and then evaporated. For stronger grades, additives (*prativapa*) such as calcined shell, lime or powders of pungent herbs are added during concentration; the *Sushruta Samhita* describes the strong grade with a series of herbal powders[2]. Classical sources differ in the volume of water, settling time and number of filtrations (Table 1), and in the best season for preparation[2].

From a chemical perspective, plant ash consists largely of potassium and calcium carbonates and oxides with other minerals. Leaching with water extracts the soluble alkali, mainly potassium carbonate and hydroxide, leaving insoluble calcium and silica compounds behind. Repeated filtration removes suspended solids, and evaporation concentrates the alkali. Additives such as lime convert carbonate to hydroxide and increase causticity, which explains classical grading by strength.

PHYSICOCHEMICAL CHARACTERISTICS

Analysis of *Apamarga pratisaraniya kshara* prepared from 12 kg of whole plant according to the *Sushruta Samhita* found pH 13.88, total ash 47.03%, acid-insoluble ash 9.69%, potassium 9.19%, sodium 0.63% and iron 0.043%[5]. A pH close to 14 confirms a strongly caustic product, consistent with its use for cauterisation. The potassium content reflects the plant origin of the alkali.

These data suggest specifications that could be used routinely: pH of a defined solution, total alkalinity by titration, potassium and sodium content, acid-insoluble ash, and moisture. Without such specifications, *kshara* from different batches and manufacturers may differ substantially in strength, which matters both for *pratisaraniya* application and for *Kshara sutra*.

KSHARA SUTRA: PREPARATION AND STANDARDISATION

Table 2. Standard preparation of *Kshara sutra*

Component	Specification
Thread	Surgical linen thread, size 20; tensile strength up to about 5 kg, retained through repeated coatings
Coating 1–11	*Snuhi* (*Euphorbia neriifolia*) latex alone
Coating 12–18	*Snuhi* latex followed by *Apamarga kshara* powder
Coating 19–21	*Snuhi* latex followed by *Haridra* (turmeric) powder

Drying	Cabinet with hot air and controlled temperature
Sterilisation	Ultraviolet exposure
Packaging	Sealed tubes with desiccant; batch records

Kshara sutra is prepared by applying a total of 21 coatings to surgical linen thread: 11 coatings of *Snuhi* latex alone, 7 of latex followed by *Apamarga kshara*, and 3 of latex followed by turmeric powder, each coating being dried before the next. The threads are cut to length, sterilised by ultraviolet light and sealed with desiccant in glass tubes, with batch records maintained[6,7]. The latex acts as an adhesive and has its own proteolytic and irritant properties, the *kshara* provides chemical cutting and debridement, and turmeric contributes antimicrobial and anti-inflammatory activity.

Important variables include the quality and collection time of the latex, the strength of the *kshara*, the amount of material deposited per unit length, the moisture content and the sterility of the finished thread. Different latex and alkali sources have been used to prepare alternative types of *Kshara sutra*[8]. Mechanised coating has been developed to improve consistency, and threads prepared by machine and by hand have been compared clinically.

CLINICAL EVIDENCE

1. Fistula-in-ano

The modern revival of *Kshara sutra* began with clinical series of fistula-in-ano treated by the technique[4]. The Indian Council of Medical Research conducted a multicentric randomised controlled trial comparing *Kshara sutra* with conventional surgery and published it in 1991[3]. A randomised trial from Singapore compared the Ayurvedic cutting seton with fistulotomy for low fistula-in-ano[9], and a prospective study evaluated *Kshara sutra* therapy in *Bhagandara*[10]. More recently, a comparative study of 50 patients found similar healing rates at eight weeks with *Kshara sutra* and open fistulotomy, but significantly more postoperative complications with fistulotomy[11].

Collectively, these studies support *Kshara sutra* as an effective treatment for fistula-in-ano, with the advantages of a minimally invasive outpatient procedure, preservation of sphincter function and low cost. Its disadvantages are the need for weekly thread changes, discomfort during treatment and a relatively long overall treatment time.

2. Limitations of the evidence

Most trials are small and single-centre, blinding is difficult, outcome definitions and follow-up periods vary, and the preparation of the thread is often not described in detail. Comparisons are mainly with fistulotomy rather than with modern sphincter-sparing techniques such as fistula plugs, advancement flaps or ligation of the intersphincteric fistula tract. Variations of the technique, such as the use of different latex or alkali sources and combination with partial fistulotomy, complicate comparisons.

OTHER USES OF KSHARA

Kshara sutra ligation has also been used for haemorrhoids and compared with rubber band ligation and haemorrhoidectomy[12,13]; in a study of three thread types in 33 patients, mean healing times were 6.6–7.3 days without significant differences between threads[14]. *Pratisaraniya kshara* is applied to haemorrhoids, warts and chronic wounds, and *paniya kshara* is given internally for digestive and urinary disorders at small doses[2]. These applications have received far less systematic study than *Kshara sutra*, and the caustic nature of *kshara* makes standardised strength and careful technique essential for safety.

RECOMMENDATIONS

- **Kshara specification:** pH, total alkalinity, potassium content, acid-insoluble ash and moisture, with limits for each grade.
- **Thread specification:** thread type, coating load per unit length, *kshara* content per unit length, pH of an extract, tensile strength, moisture and sterility.
- **Clinical reporting:** detailed description of the thread and technique, standard definitions of healing and recurrence, continence assessment and follow-up of at least one year.
- **Comparative trials:** randomised trials against current sphincter-sparing procedures, with cost-effectiveness analysis.

RESEARCH GAPS

The main gaps are: validated assays of *kshara* strength; studies linking coating load and alkalinity to cutting rate and healing; mechanistic studies of tissue effects; and adequately powered, multicentre trials with long-term continence and recurrence outcomes.

CONCLUSION

Kshara is a strongly alkaline, potassium-rich product of plant ash whose classical preparation is consistent with modern chemistry. *Kshara sutra*, made by coating thread with latex, *kshara* and turmeric, is supported by randomised and comparative trials for fistula-in-ano and is one of the best-evidenced Ayurvedic procedures. Defining specifications for *kshara* and for the thread, and conducting larger trials against modern sphincter-sparing techniques, would consolidate its place in anorectal practice.

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