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## RESEARCH ARTICLE

### PREPARATION OF DIFFERENT TYPES OF KSHARA SUTRAS

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#### ABSTRACT

Kshara Sutra refers to corrosive or caustic thread. Kshara is considered superior to all surgical and Para surgical measures, because they perform the work of incision, puncture, and scarification to relieve derangements of the Tridosha and uniformly affect the diseased part to which they are applied. Kshara possess the following qualities – Tridoshaghna, Saumyata, Dahana, Pachana, Darana, Katuka, Ushna, Tikshna, Vilayana, Shodhana, Ropana, Shoshana, Stambhana, Lekhana, Krimighna. Materials used for preparation of kshara Sutra are Snuhi Ksheer, Apamarga Kshara, Haridra powder, Thread Linen Barbour No.20. Recent advances in kshara sutra; Although the standard Apamarga ksharasutra is used successfully in the management of fistula- in –ano, the problem in its preparation and use are worth noting. These problems have put necessity of further modifications in this thread. One of the essential components of this thread is snuhi latex. This latex creates many problems during preparation of the thread. It coagulates if not used early. Collection becomes more difficult in summer, so preparation is possible only in limited seasons. Another disadvantage is that there is a severe pain felt by the patients during the application of the thread. In few cases, the intensity is so severe that the patients discontinue the therapy. To overcome these problems, several researches have been carried out. The researchers are based on searching for the drugs having better actions and acceptability than that of Snuhi latex and Apamarga kshara. These drugs should be having binding property on thread, easy availability in bulk, less irritant (sheeta veerya), having vranashodhak and vrana ropaka properties, having anti-septic and anti- inflammatory activities, and additional beneficial action.

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#### INTRODUCTION

**Etymological derivation of the word Kshara:** As pershabdakalpadruma, the word Kshara is derived from the root Kshara means to melt away or to perish. **Kshara Sutra** means thread made up of caustic material which destroys or cleans the devitalized tissue and to disintegrate the skin or other tissues<sup>1</sup>.

**Origin of Kshara sutra:** Pioneer of Ayurvedic surgery Acharya Sushruta first mentioned Ksharasutra in the treatment of Nadi Vrana (sinus), Bhagandara (fistula in ano), arbuda<sup>2</sup> (Benign tumor) etc. but does not emphasize upon its preparation. Chakrapani Dutta was the first person to mention the method of preparation with its indication in Bhagandara (fistula in ano) and arsha<sup>3</sup> (hemorrhoid). He described method of preparation as smearing a thread repeatedly in latex of Snuhi (*Euphorbianeriifolia*) and Haridra (turmeric) powder<sup>4</sup>. After Chakrapani Dutta almost all the later author described same method of preparation of kshara sutra.

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But because of complexity of preparation and inadequate method of procedure of application, it lost its popularity among Ayurvedic surgeons. Rasatarangini which was published later to Chakradutta a better kshara sutra preparation was introduced. The credit of standardization and development for practical use mainly goes to Prof. P.J. Deshpande<sup>5</sup>, Dr. S.R. Gupta in the present era.

**Properties of kshara:** Kshara is considered superior to all surgical and Para surgical measures<sup>6</sup>, because they perform the work of incision, puncture, and scarification to relieve derangements of the Tridosha<sup>7</sup> and uniformly affect the diseased part to which they are applied. As per Sushruta, kshara possess the following qualities, Tridoshaghna – because of different types of drugs it can pacify all the humours, Saumyata – owing to their white color, Dahana – owing to its burning nature, Pachana- because of its digestive capability, Darana- since many drugs of agneya nature enters into their composition, Katuka – because of its pungent taste, Ushna – because of its heat producing nature, Tikshna – because of its irritant nature, Vilayana – because of its liquefaction property, Shodhana – because of its cleansing

property, Ropana – improves granulation (healing), Shoshana – absorption, Stambhana – arresting or stopping nature, Lekhana – scraping property, Krimighna – because of its antimicrobial action, Sterility<sup>8</sup> – if used in excess, It normalizes Aama, Kapha, visha, medo dhatu and also cures kushtha when given in proper doses. In addition to that Acharya Charak attributed two more properties – Laghu&Bhedana<sup>9</sup>. Vagbhatta said that kshara acts by extracting all the toxins from the site and cures the disease totally<sup>10</sup>.

**Kshara preparation as per Sushruta Samhita<sup>11</sup>:**In the process of kshara preparation; the following precautions are inevitable-

- Kaala-Sharad kala (in between Oct-Nov)
- Place-nearby hilly area

After performing devotional preparation (mangalacharana ) with healthy mushkaka plant along with its root in made into small parts and subjected for boiling till it is converted into total ash.

tensiometer till a point reached when the thread just broke. It was noted after these experimentations that surgical linen no.20 retains its strength throughout the processing and had maximum tensile strength, i.e.5.0 kg<sup>13</sup>. Therefore, non-absorbable natural linen thread no. 20 is chosen as an ideal thread for kshara sutra preparation.

**Kshara (Alkali or caustic agent):** kshara used for kshara sutra preparation should be fine, dry & white powder, which can't be obtained from the Madhya and Tikshna varieties of kshara. Chemically, maximum hygroscopic & caustic action is seen in Mridu variety of pratisarniya kshara (mentioned by Sushruta in Kshara Paka vidhi). Addition of different substances to increase its potency i.e. shankha nabhi, danti etc. really increases its irritability & reduces its alkalinity (pH >9.0)<sup>14</sup>. So, mridu variety of kshara is considered suitable for making of kshara sutra. Further studies have been carried out using different types of kshara and Apamarga kshara is found to be most effective.

**Ksheera (Latex):** kshara itself does not have a sticking property.

**Table 1. List of source plants for kshara preparation as per Sushruta Samhita<sup>12</sup>**

Name	Botanical Name	Family
Mushkaka	<i>Elaeodendron glaucum</i> Pers.	Celastraceae
Kutaja	<i>Holarrhena antidysenterica</i> Linn.	Apocyanaceae
Palash	<i>Butea monosperma</i> Linn.	Fabaceae
Ashwakarna	<i>Dipterocarpus turbinatus</i> Gaertn F.	Dipterocarpaceae
Paaribhadra	<i>Erythrina variegata</i> Linn.	Fabaceae
Bibhitaka	<i>Terminalia bellerica</i> Roxb.	Combretaceae
Aaragwadha	<i>Cassia fistula</i> Linn.	Caesalpinoidae
Tilwaka	<i>Symplocos racemosa</i> Roxb.	Symplocaceae
Arka	<i>Calotropis procera</i> (Ait) R.Br.	Asclepiadaceae
Snuhi	<i>Euphorbia nerifolia</i> Linn.	Euphorbiaceae
Apamarga	<i>Achyranthes aspera</i> Linn.	Amaranthaceae
Paatla	<i>Stereospermum suaveolens</i> DC.	Bignoniaceae
Naktamaala	<i>Pongamia pinnata</i> Pierre.	Fabaceae
Vrusha	<i>Adhatoda vasica</i> Nees.	Acanthaceae
Kadali	<i>Musa sapientum</i> Linn.	Musaceae
Chitraka	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae
Putika	<i>Holoptelia integrifolia</i> Planch.	Ulmaceae
Asphota	<i>Hemidesmus indicus</i> R.Br.	Asclepiadaceae
Ashwamaraka	<i>Nerium indicum</i> Mill.	Apocyanaceae
Saptachhada	<i>Alstonia scholaris</i> R.Br.	Apocyanaceae
Agnimantha	<i>Premna integrifolia</i> Linn.	Verbenaceae
Gunja	<i>Abrus precatorius</i> Linn.	Fabaceae

**Table 2: Division of Plants on the basis of their Doshaghatna**

1)Vataghna	Kadali
2)Pittaghna	Aragvadha, Krutavedhan, Kutaja
3)Kaphaghna	Palash, Karanja, Tilvak, Vaasa, Agnimantha, Apamarga, Snuhi, Putika, Ashwakarna, Nimba, a
	Bibhitaka, Karavira, Arka, Saptachhada, Chitraka, Krishnamushkaka
4)Tridoshaghna	Patala, Sariva, Gunja

After the separation of burnt lime-stones, the ash is collected in a utensil and care is taken that moisture is not contaminated with the ash. This is the praathamika kshara (basic kshara).

**Kshara sutra preparation:** Present technique of manufacturing of kshara sutra is basically an outcome of repeated experimentations based on clinical experiences.

**Material used:** Thread: Ideal thread for the preparation of kshara sutra should possess a sufficient strength to hold the 21 coatings of all the ingredients throughout the therapy. different studies were carried out in this regard by subjecting the different kinds of threads to gradually increasing tension on a

Ksheera, which is used mainly for adhesive purpose, are acidic in nature (pH=9.7) and produces debridement by proteolytic enzymes. Kshara being alkaline in nature overshadows the debridement action of Ksheera, but its sticking property is sustained. Ksheera also potentiates the debridement action of Kshara due to absorption of high concentration of it. Latex of snuhi, papaya, udumbara, Arka, guggulu etc. can be used as binding material for preparation of different types of kshara sutra. Haridra (Turmeric): kshara has been found to be excessively hygroscopic which catches moisture and becomes useless if left exposed to the atmosphere. Haridra prevent direct contact of Kshara with the atmosphere, so it can be

preserved & used for longer period. It also possesses antiseptic & antihistaminic properties too.

### Collection of Snuhi Ksheera

Botanical Name :	<i>Euphorbia Neriifolia</i>
Family :	Euphorbiaceae
Size of the Plant :	2-3 years. Old
Best time for collection:	October – April.

Linear cuts are made on the stem and latex is collected in clean bowl. After sufficient amount is collected it is transferred to a glass bottle. Care to be taken so that the pieces of bark and dust will come along with latex. The Latex to be used immediately, avoid clotting.

**Preparation of Kshara:** Ash is prepared by burning the whole plant along with tila nala. The ash is mixed with 4 times water or Gomutra and filtered thoroughly. Boil the filtrate, evaporate the water and dry powder is obtained. Powder should be stored in air tight container.

### Equipment Needed

1. Kshara Sutra cabinet with ultraviolet light
2. Autoclaved Petridish (for storage of raw material during application)
3. Glass tubes (for packing of the prepared kshara sutra)

**Kshara Sutra cabinet with ultraviolet light:** This is specially designed for preparation of Kshara Sutra. It is available in two designs; horizontal and vertical. The processor can design his own Kshara Sutra cabinet according to his requirement and resources. It has two chambers; the bigger one for the Kshara sutra hangers and smaller one for the hot air blower, fan etc. A thermometer is also fixed which will indicate the temperature inside the cabinet. Ksharasutra hangers are the rectangular shaped structures, made up of thick Aluminum/wooden strips of about 2 cm width and 3-4 mm in thickness. Each hanger has small cuts (notches) on both sides which are placed at a distance of 2 to 2.5 cm from each other. These notches are meant for hooking the thread throughout the width and length of the hangers. Each hanger has 15 to 20 notches on either side. There may be variation in the size of the hanger depending on the size of the cabinet. The width of the hanger is about 30 cm. In this way one hanger can accommodate as many as 30 to 40 threads at a time and one Kshara Sutra cabinet can accommodate as many as 30 to 50 hangers. Thus the capacity of a cabinet to manufacture kshara sutra in one batch is 900 to 1600 threads. Cabinet is also used for preventing the contamination because of atmospheric dust particles from sticking over the wet threads. It dries the coated thread rapidly and maintains sterilization through ultraviolet light; it acts as a bactericidal through constant temperature at 40°C by providing dryness and constant heat. It also prevents the hydrophilic activity of the coated medicated kshara sutra.

**Quantity required:** For 1000 ksharasutra Surgical linen no. 20 = 300 meter

Snuhi latex (*Euphorbia Neriifolia*, Euphorbiaceae) – 3.5 liter  
 Apamarga Kshara (*Achyranthes Aspera*, Amaranthaceae) – 1 kg  
 Haridra powder (*Curcuma Longa*, Zingiberaceae) – 500 gm  
 For the preparation of kshara sutra, linen thread is tied throughout the length and breadth of the hangers which is then

mounted over hanger stand. Each thread on the hanger is then smeared with latex with the help of the clean gauze piece all the four side of the thread viz. front, back, above and below should be uniformly smeared. The hanger then is replaced into to the cabinet. When all the hangers are processed, the cabinet should be closed properly and the hot air is blown in order to dry the threads. 11 such coatings with Snuhi Ksheera should be done. The twelfth coating is done by first smearing the thread with the latex and then passing the wet thread through a heap of finely powdered kshara. When all the threads are smeared with kshara, the hanger should be gently shaken so that all the excess particles of kshara fall down. In the final phase, 3 coatings of Haridra powder and Ksheera were given. Thus, the twenty-one coatings over the thread are complete. Allow it to dry.

### Sterilization and packing of kshara sutra<sup>15</sup>

Prepared ksharasutra is sterilized by ultraviolet radiation by placing them in ksharasutra cabinet for 20-30 min. at 40°C. Sterilized Ksharasutra measuring approx. 10-12 inches is cut away at two ends and packed in polythene bag or sterilized glass tubes. Care should be taken that only one-fold at the center will be given while putting the sutra in a glass tube otherwise folding at many points will allow the coating to be stripped off. Sealed glass tubes should again be put inside the cabinet and exposed to ultra-violet radiation. Each tube should finally be labeled giving details of date of manufacture, date of sealing, batch number etc.

**Reason behind the definite sequence of 21 coatings:** After 21 coatings, linen no.20 assumes the size of 14-15 gauge which is an appropriate size to be introduced into lumen of an average fistula. It is also an auspicious number according to Hindu mythology. The purpose of definite sequence of 21 coatings is as follows:

**First 11 coatings of latex:** Upper few coatings are likely to be neutralized by the application of Kshara; but innermost coatings will still remain protected and will preserve their proteolytic action which helps in the debridement of the tissues.

**7 coatings of latex & Kshara:** Latex only acts as binding material for tiny Kshara particles which helps in maintaining the adequate concentration of Kshara for an effective caustic action.

**3 coatings of latex & Haridra:** It helps in prevention of direct exposure of Kshara to atmosphere & prolongation of preservation of ksharasutra. The sequence and number of coatings was finalized after sufficient discussion, experimentations & a long experience of trial and error, thus it should be ensured that Ksharasutra to be made in definite sequential manner.

**Mode of action of Ksharasutra:** To establish the probable mode of action of Kshara Sutra, various clinical trials and studies have been carried out in India as well as other countries e.g. Sri Lanka, Japan etc. From the outcome of these various analytical studies, it can be postulated that in kshara sutra, linen thread supports the strength of ligation and weight of 21 coatings, while snuhi latex acts as binding material for preserving all the properties of kshara. Kshara sutra works by pressure effect made by ligation which creates mechanical

strangulation of blood vessels and tissues which causes the pressure necrosis of the body of any swelling. Kshara invades into the cells of lesion till engorged tissue destruction occurs by its Ksharana guna (corrosive properties). Snuhi latex is being proteolytic in nature, dissolves the tissue at its base. The action of turmeric powder provides the effect of bactericidal action with healing properties. All these three drugs do not contradict each other but rather support their actions by equal and desirable effect. Kshara sutra has the ability to perform incision with excision slowly by virtue of its controlled chemical cauterization. During cutting effect, there may be oozing of blood which is ceased by sclerosing effect of kshara by its protein coagulation property. Hence, there was no chance of bleeding during the cutting of the mass. The chances of infection are least due to sustained action of anti-infective virtue of kshara. In case of Bhagandara (fistula in ano), kshara sutra also acts as a Seton to allow the proper drainage of pus and debridement of unhealthy tissue, thus, providing a cleaner base for wound healing with minimal scarring and without complications.

### Standardization of Ksharasutra<sup>16</sup>

Kshara sutra and its raw materials have been standardized on the basis of analysis of various physical as well as chemical parameters to ensure the quality control with cost effectiveness at clinical level. Analysis was done at Chandigarh and Lucknow laboratories. Various characteristics of an ideal ksharasutra based upon these analyses are as follows: PH = 10.1

Length :30 ± 1 cm.

Diameter :1.9 mm.

Min. breaking load :5.83 kg.

Weight of coating: 0.83 gm.

Thickness of thread after coating: 2.10+ 0.11 mm

**Recent advances in kshara sutra:** Although the standard Apamarga<sup>17</sup> ksharasutra is used successfully in the management of various surgical diseases, the difficulties in its preparation and application are worth noting. These problems have put necessity of further modifications in this thread. One of the essential components of this thread is snuhi latex. This latex creates many problems during preparation of the thread. A very little amount is collected after the incision of the stem. It coagulates if not used early. Collection becomes more difficult in summer, so preparation is possible only in limited seasons. Another disadvantage is that there is a severe pain felt by the patients during the application of the thread. In few cases, the intensity is so severe that the patients discontinue the therapy. Allergic reactions are also noted. To overcome these problems, several researches have been carried out searching for the drugs having better actions and acceptability than that of Snuhi latex and Apamarga kshara and different types of kshara sutra were prepared.

### Different types of ksharasutra

**1) Udumbara Ksharasutra:** In this thread, latex of *ficus glomerulata* was used.

It is a sheeta veerya drug and is used in dushta vrana.

**Method:** 11 coatings of this kshara was made on the thread. Every time, fresh latex was used. The pH of the thread is 8.5.

### Advantages

- Preparation is easy and requires less time.
- Less irritant, so does not produce much pain.
- Smooth cutting
- Good wound healing.
- Good tolerance by the patients.

### Disadvantages

- UCT (Unit cutting time) was less in comparison to standard thread.
- Sticking ability of latex on thread was less.
- Knotting after application was difficult.

**2) Papaya Sutra:** Papaya is a good cleansing and healing drug.

**Ingredients** –papaya fruit pulp, papain powder (obtained by drying unripe fruit juice- active principle), Haridra powder.

**Method:** 11 coatings by papaya fruit pulp and papain powder and 2 coatings of papaya fruit pulp and Haridra powder, thus making a total of 13 coatings.

**Advantages:** papain contains strong proteolytic enzymes which lead to debridement of necrosed tissue very early after application. It facilitates early wound healing. It can be easily prepared in short time. Patient tolerance was also very good after application.

**Disadvantages:** UCT time is very less.

**3) Guggulu based kshara sutra:** In this thread, guggulu solution was used in place of snuhi latex. Guggulu has analgesic, debridement and healing properties. It is also having good binding action on thread and its anti-inflammatory activities have been proved by researches. It is easily available and solution is prepared very easily in alcohol or water.

### Advantages

- Easy preparation due to bulk availability of guggulu.
- Threads can be prepared for commercial use in a large quantity.
- Excellent tolerance by the patient.
- Pain and anxiety are very less during and after application due to its non-bleeding nature and analgesic action.
- Pain, discharges, indurations are reduced in early sittings in comparison to other threads.
- Good wound healing and cosmetically acceptable scar.

### Disadvantages

Due to its soapy nature, it loosens after application. Subsequent coatings remove first coating to a lesser extent, if alcoholic solution is used. So water solution may be used. Although it has been noted that in skill hands this problem is rarely noted. Nowadays, guggulu-based kshara sutras have been using successfully at various centres all over the country.

**4) Yavakshara coated sutra:** Yavakshara is well known for its scrapping property. According to researches, it

comprises fibrolytic, hygroscopic, and anti-inflammatory actions.

**Advantages:** Pain and agony were reduced very much during & after application. UCT was less (6.48 days/cm) in comparison to the standard thread (9.01 days/cm). Also the thread was tolerated very well.

**5) Ghritakumari (Aloe Vera) ksharasutra-**In this thread ghritakumari pulp was used in place of snuhi latex. Researchers suggest that it possess local anaesthetic property (used in burns). It is not caustic as snuhi. Its pulp possesses binding action.

#### Advantages

- Easy availability & preservation
- Good wound healing
- Good tolerance and no allergic reactions, etc.

**Disadvantages:** Sticking was not uniform. The thread was beaded so pain was noticed during application.

#### PH values of different ingredients

- Snuhi Ksheera- 5.6
- Haridra -6.2
- Apamarga Kshara- 10.2

**Expiry date of kshara sutra:** 6 months from date of manufacture.

#### Conclusion

Kshara sutra is now a very popular and highly practiced treatment modality for the management of hemorrhoids, fistula in ano, chronic fissure with tags, anal warts, pilonoidal sinus, chronic sinuses, rectal polyps, anal papilloma, neoplastic pedunculated growths etc. Several clinical trials have been carried in different prestigious institutes for evaluation and establishment of its action in India as well as in other countries like Srilanka, Japan etc. As in our ancient texts, various types of Kshara as well as binding material e.g. Kshara, Guggulu etc. are described; it is mandatory to make Kshara Sutra by using different combinations of Kshara and binding material to achieve the most potent combination for the benefit of humanity. Need of hour is to standardize all the Kshara sutra as Apamarga Kshara Sutra and to compare results, advantages and disadvantages of each group of the material used. 'Kshara Sutra' has become a boon to the patients. But still the quest is continuing to improve the efficacy of kshara sutra, to make it more acceptable, by using different materials for its preparation.

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