

PHYTOCHEMICAL PROPERTIES AND MODE OF ACTION OF DIFFERENT TYPES OF *KSHARASUTRA* (MEDICATED THREAD)

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ABSTRACT

Ksharsutra is an ancient technique of para surgical procedure used since *samhita*'s period and its clear detailed studies and description are available in *samhita*. This article is focused mainly on more varieties, standardization, mode of action and advance based study of *ksharasutra*. In modern era standardization of *ksharasutra* has been done by Prof. *Prabhakar Janardhan Deshpande* in management of *bhangandar* (fistulae in ano). *Ksharasutra* is prepared by 21 coatings of *snuhi* latex, *Apamarga kshar*, and *haridra* powder. *Snuhi* latex acts as a proteolytic and dissolves the base of the tissue, in *Samhita*'s it is described as a *shodhan* and *ropana* agent. *Apamarga kshara* helps in cleaning debris from the track and removes fibrosis, helps in formation

of granulation tissue results in better healing of the wound. *Haridra* powder provides an effective bactericidal action and healing properties. The slow cutting and healing process results in minimal sphincter mechanism disturbance and almost nil recurrence. All these drugs support each other's action by equal and desirable effect. The most advanced technique that is being used today is IFTAK (Interception of Fistulous Tract with Application of *Ksharsutra*) which was first introduced by Prof. *Manoranjan Sahu*. Treatment of *bhangandar* (fistula in ano) based on drainage, eradication of fistula track, avoiding recurrency and preserve the function of anal sphincter. *Ksharasutra* have all of these properties.

KEYWORDS: Artificial intelligence, *ksharasutra*, standardization, *bhangandar*, *shodhana*, *ropana*, unit cutting rate etc.

INTRODUCTION

Acharya Sushruta is known as the father of surgery. The *Shusruta samhita* is of great historical importance as it contains historically unique chapters describing ancient surgery and training, equipment and procedures that are still followed by the modern science of surgery. One of the oldest *Sushruta samhita* palm leaf manuscript is preserved at the *kaiser* library, Nepal. *Kshara karma* has been first described in *Sushruta Samhita* as a parasurgical procedure (Su.su.11, Su.chi.17/29). Its description can also be found in *Charak samhita* in the context of *bhagandara chikitsa* (ch.chi.12/97) and *Chakradatta* has described the preparation of *ksharasutra* broadly. It is indicated in *arsha* (haemorrhoids) and *nadi vrana* (sinus). *Kshara* is a caustic and alkaline nature obtained from the ashes of plants. It is a minor procedure compared to surgery and thermal cautery. It is superior among the sharp and subsidiary instruments because of performing excision, incision and scraping. This versatile as alkali treatment can be done even in places that are difficult to reach by ordinary measures. It is useful as a substitute of surgical instruments. It can be further classified into *pratisaaraniya* (external application) and *paneeya kshara* (internal application). On the basis of concentration, it can be divided into *mridu*, *madhyam* and *tikshna*.^[1]

Kshara word meaning: The word *kshara* is derived from the root means to melt away or to perish. *Kshara* (caustic alkali) means destroys the vitiated tissues and make them fall off. *Ksharasutra* means *sutra* with *kshara* on it, which destroy or cleans the devitalized tissue or disintegrate (cutting) the tissue.^[2]

Properties of kshara: *Tridoshaghna* (pacify all the humours), *saumya* (cool due to white colour), *lekhana* (scrapping), *dahana* (burning nature), *pachana* (digestive), *darana* (tearing), *katu* (pungent), *ushna* (heat producing nature), *tikshna* (irritating), *vilayana* (liquifecation), *shodhana* (cleansing), *shoshana* (absorption), *ropana* (healing), *krimighna* (anti-microbial), *stambhana* (stopping).^[3]

According to ICP-AES Analysis of all samples of *kshara* revealed that sodium, potassium, calcium, and magnesium are the main constituents.^[4]

Preparations of kshara & ksharasutra

The process of *kshara* formulation, firstly matured *Apamarga Panchanga* was collected and dried completely in sunlight for 8 days and then removed the physical impurities manually. The dried *panchanga* was kept in a big pan and burnt completely. After the self-cooling, the

white ash was collected into a bowl. One part of ash was collected in a specially designed steel vessel and six times of water was added to it. The ingredients were thoroughly mashed with hands and left undisturbed for 3 hours then clear supernatant liquid layers were collected through the outlet and filtered through three layered cotton cloth. The residual ash was again mashed with 6 times of potable water and kept undisturbed for next 3 hours, followed by a collection of the second filtrate. A similar method was followed up to 21 times to collect the third filtrate then dried on heating then collect it.^[5]

Standardrization of *ksharasutra*^[5]

Standard *ksharasutra* is prepared by 11 coating of *snuhi* latex, 7 coating of *snuhi* latex + *apamarga kshara* and 3 coating of *snuhi* latex + *haridra churna*.

p^H-10.1

Length of the *ksharasutra* - 30 cm

Thread Diameter of the - 1.9 mm

Minimum breaking load - 5.83 kg

Weight of coating - 0.84 gm

Thickness of coated thread - 2.10 mm

p^H of individual ingredient : *Snuhi ksheer* - 5.6, *Haridra* - 6.2, *Apamarga kshara* - 10.2

Unit cutting rate: 1cm in 7 days.^[6]

Reason for 21 Coatings^[5]

The innermost coating remains protected and will preserve the proteolytic action which helps in the unhealthy tissue debridement but some upper layer coatings will be neutralized by the *kshara* application. Latex only works as binding material for *kshara* particles that help in maintaining adequate concentration of *kshara* for effective causative action. The order of coating to preserve the quality of the *ksharasutra*. *Kshara* works as excision, incision, scraping.

Coating of latex and *haridra* helps in prolongation and preservation of *ksharasutra*.

Mode of action of *ksharasutra*^[5]

Ksharasutra works by pressure effect made by ligation which turns into mechanical strangulation of blood vessels and tissues which further cause pressure necrosis of swelling in the management of arsha then slough off the arsha or pile mass. The barbour linen thread 20 no. used to make *ksharasutra* which supports the layer of 21 coatings. *Snuhi* latex acts as the

binding material for preserving properties of *kshara*. It is proteolytic in nature which helps debridement of the fibrotic tissue. *Haridra* acts as bactericidal and has healing properties. *Ksharasutra* causes Incision and excision because of its control chemical cauterization. During cutting effect there may be oozing of blood which is seized by sclerosing effect of *kshara* by its protein coagulation properties. Hence, there was no bleeding during cutting of the track or mass. Chance of infection is very least due to anti-microbial action of *Kshara*.

Why kshar sutra is better technique compare to other technique in fistula in ano management

- ✚ Recurrence rate is very low.
- ✚ Kshar sutra causes less damage the sphincter fibres.
- ✚ Pain, burning sensation and discomfort are low.
- ✚ Cosmetically better due to linear scaring and less tissue damage.
- ✚ Cheap in cost.
- ✚ OPD based procedure.
- ✚ Hospital stay is very less.
- ✚ After primary threading patient can perform his/her daily routine without any interference.

Varieties of *Ksharasutra*

Apamarga (Achyranthus aspera / amaranthaceae) ksharasutra

- **Triterpenoid saponin**^[7] have wound healing activity due to enhancing the healthy granulation tissue, collagen formation and angiogenesis. It is also evaluated that synthetic derivatives of beta hederine showed anti cytotoxic properties against major human cell lines. **Saponin** induced cell cycle arrest of human cell line and apoptosis. **Olenolic acid**^[8] was able to stimulate also the production of cytokine induced neutrophil chemoattractant inflammation, this is pro inflammatory phase may speed up the wound healing. **Ecdysterone**^[9] exhibits more obvious granulation tissue formation and proliferation of the epithelial and endothelial cells and fibroblast.
- It is standard *ksharasutra* which contains *snuhi* latex and *haridra*.
- It has *ruksha* (dry), *laghu* (light) and *tikshna* (penetrating) *guna*, *katu* (pungent) and *tikta* (bitter) *rasha*, *katu* (pungent after digestion) *vipaaka*, *ushna* (hot in potency) *virya* properties and its local action are *shothahar* (anti-inflammatory), *vednasthapana* (pain

palliative), *vranashodhana* (cleanses the wound), *vranropana* (healing), *lekhana* (scrapping the debris) and *vishghna* (remove toxicity).^[10]

- Unit cutting rate is 8.58 days/cm.^[11]



Haridra (Curcuma longa/ zingiberaceae)

- **Curcumin**^[12] reduced wound healing time improved collagen deposition and increased fibroblast and vascular density in wounds there by enhancing both normal and impaired wound healing.
- It has *ruksha* (dry) and *laghu* (light) *guna*, *tikta* (bitter) and *katu* (pungent) *rasha*, *katu* (pungent after digestion) *vipaak*, *ushna* (hot in potency) *virya* properties and its local action are *shothahar* (anti- inflammatory), *vednasthapana* (pain palliative), *vranashodhna* (cleanses the wound), *vranaropana* (wound healing) and *lekhana* (scrapping the debris).^[13]



Guggulu (Commiphora mukul / burseraceae) ksharasutra (21 coating)

- **Quinic acid**^[14] exert anti-inflammatory activity through mechanisms involving inhibition of the pro inflammatory transcription factor nuclear factor kappa B.

- It has *laghu* (light), *ruksha* (dry), *tikshna* (penetrating), *sukshma* (minute) and *snigdha* (moist) *guna*, *tikta* (bitter) and *katu* (pungent) *rasha*, *katu* (pungent after digestion) *vipaak*, *ushna* (hot in potency) *virya* and *tridoshar prabhav* properties and its local action are *shothahar* (anti-inflammatory), *vednasthapana* (pain palliative), *vranshodhana* (wound cleaning), *vransropana* (wound healing) and *jantuaghna* (anti-microbial).^[15]
- It has excellent binding property, less pain and burning sensation and also have anti-inflammatory and antibacterial properties against *E. coli*, *enterococcus faecalis*, *staphylococcus aureus*, *pseudomonas* species but presence of resin difficulty face during knotting (1999).^[16]
- Unit cutting rate is 8.85days/cm.^[17]



Udumbur (*Ficus glomerata* / *moraceae*) ksharasutra (11 coating)

- They work as an antioxidant. Antioxidants prevent or slow damage to cells caused by free radical unstable molecules that the body produces as a reaction to the environment and other pressures. Ethanol extracts of stem bark show a potent wound healing in excised and incised wound model in rat.^[18]
- It has *ruksha* (dry) and *guru* (heavy) *katu* (pungent after digestion) *vipaaka*, *sheeta* (cold in potency) *virya* properties and its local action are *shothahar* (anti-inflammatory), *vednasthapana* (pain palliative), *varnya* (bestows good colour) and *vransropana* (wound healing).^[19]
- It is easy to prepare, minimum scarring, low recurrence rate, significantly less pain and burning sensation but less cutting rate compared to standard *ksharasutra* (1984).^[20]
- Unit cutting rate is 8.97days/cm.^[21]



Yava (Hordeum vulgare / poaceae) ksharasutra (21 coating)

- It has **Tannins**^[22] contains anti-inflammatory properties that can help minimize redness and inflammation. For those who wish to reduce cell damage. Tannins acts as an antioxidant against free radicals as a natural astringent. It also leads to improved wound healing and reduced scar tissue formed by inhibition of the formation and removal of reactive oxygen substances. **Flavonoids**^[23] nowadays are being used in different formulations and wound healing dressings. Inflammation, proliferation and reepithelization are involved in wound healing. Flavonoids act as synergistic effects. The inhibition of fibroblast growth by flavonoids is beneficial for the treatment of skin injuries.
- Less pain and burning sensation but due to non-uniform thread and stiff consistency mechanical trauma during application (1990).^[24]
- Unit cutting rate is 6.48 days/cm.^[25]



Papaya (carica papaya) ksharasutra (13 coating)

- **Papain**^[26-27] is said to consists of strong proteolytic enzyme which lead to debridement of necrosed tissue and facilitates early wound healing.
- It has *laghu* (light), *ruksha* (dry), and *tikshna* (penetrating) *guna*, *katu* (pungent) and *tikta* (bitter) *rasha*, *katu* (pungent after digestion) *vipaak*, *ushna* (hot in potency) *virya* properties and its local action are *lekhna* (wound scrapping), *shothahar* (anti-inflammatory), *vednasthapana* (pain palliative).^[28]
- It is easily available. Less pain and burning sensation during *ksharasutra* therapy. Suitable for recurrent fistula with fibrosis, cutting rate is higher than healing. So, it is not suitable for longer treatment (1984).^[29]
- Faster cutting rate of track due to proteolytic action. Unit cutting rate is 4.07days/cm.^[30]

***Nimba (Azadirachta indica/ meliaceae) ksharasutra***

- **Nimbidine**^[31] contain anti-ulcer activity, anti-inflammatory, anti-viral and anti-bacterial against various gram-positive organism.
- It has *laghu* (light) *guna*, *tikta* (bitter) and *kshaya* (astringent) *rasha*, *katu* (pungent after digestion) *vipaak*, *sheeta* (cold in potency) *virya* properties and its local action are *jantuaghna* (anti- microbial), *vranapachana* (wound ripening), *vranashodhana* (wound cleaning), *putihar* (remove debridement), *dahprashamana* (cure burning sensation), and *kanduaghna* (anti- pruritus).^[32]
- It has better healing property compared to standard *ksharasutra* and specific property of unsealing the concealed track, thus reduces the possibility of recurrence.^[33]



Ghritakumari (Aloe barbadensis/ liliaceae) ksharasutra (7 coating)

- Healing property due to ***glucomannam, a manucose- rich polysaccharide and gibberllin*** a growth hormone interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation which in turn significantly increase collagen synthesis and increase the degree of collagen cross linking, it accelerate wound contraction and increased the breaking strength of resulting scar tissue. It inhibits cyclooxygenase pathway and reduces prostaglandin from arachidonic acid shows anti-inflammatory action. An induction of ***glutathione s- transferase*** that inhibition of tumor promoting effect. aloe vera contains 6 anti septic agents (***lupeol, salicylic acid, urea, nitrogen, cinnamonic acid, phenols and sulfur***), they all have inhibitory action on fungi, bacteria and viruses.^[34]
- It has *guru* (heavy), *snigdha* (moisture) and *pichchhil* (sticky) *guna*, *katu* (pungent) *rasha*, *tikta* (pungent after digestion) *vipaaka*, *sheeta* (cold in potency) *virya* properties and its local action are *shothahara* (anti- inflammatory), *vednasthapana* (pain palliative) and *vranaropana* (wound healing).^[35]
- Easy to prepare and preservation. Low recurrence rate but coating peeled off easily (1993).^[36]
- Unit cutting rate is 16.67 days/cm.^[37]



Snuhi (Euphorbia neriifolia / euphorbiaceae) ksheera extract ksharasutra (21 coating)

- **Triterpenoid** saponins have wound healing activity due to enhancing the collagen formation and angiogenesis. It is also evaluated that synthetic derivatives of beta hederine showed anti cytotoxic properties against major human cell lines. **Saponin** induced cell cycle arrest of human cell line and apoptosis.^[38]
- It has *laghu* (light) and *tikshna* (penetrating), *katu* (pungent) *rasha*, *katu* (pungent after digestion) *vipaak*, *ushna* (hot in potency) *virya* properties and its local action are *vednasthapan* (pain palliative), *lekhna* (scrapping).^[39]
- As effective as standard *ksharasutra* but pain and discomfort similar to standard *ksharasutra*.^[40]
- Unit cutting rate is 4.7days/cm.^[41]



Tankan (Borax) ksharasutra (21 coating)

- **Borax**^[42] had effect on immune cell proliferation (lymphocytes proliferation) and induced sister chromatic exchange in human cell. lymphocytes proliferation is the first step in a proper immune response to create effector lymphocytes, necessary to eliminate the same

antigen the host may encounter in the future; this memory function insures that future responses to an antigen are faster and stronger compare to the first encounter. T-lymphocytes destroys virus infected cells and tumor cells, help orchestrate a proper cell mediated immune response.

- Less pain and irritation during application but due to beaded thread with stiff consistency mechanical trauma done (1995).^[43]
- Faster cutting rate then standard snuhi *ksharasutra*. Unit cutting rate is 0.93 cm/week.^[44]



Aragwadhadi (Cassia fistula / fabaceae) ksharsutra (13 coating)

- It contains *anthraquinones, alkaloid, saponin, terpenoids, flavanoids, glycosides, tannins, reducing sugar and steroids*. It shows various activities like anti- inflammatory, anti-microbial, anti-oxident and it's leaves extract; *methanol* shows anti- fungal activity against *trichiophyton rubrum, microsporum gypseum* and *penicillium marneffe*.^[45]
- It has *guru* (heavy), *mradu* (soft) and *snigdh* (moist) *guna*, *madhur* (sweet) *rasha*, *madhur* (sweet after digestion) *vipaaka*, *sheeta* (cold in potency) *virya* properties and its local action are *shothahar* (anti-inflammatory), *vednasthapana* (pain palliative) and *kustghna* (skin diseases).^[46]
- It could prepare in a humid climate because of non-hygroscopic nature. Less pain and burning sensation but difficulty in knotting due to coating got peeled off easily.^[47]
- Unit cutting rate is 6.32days/cm.^[48]



Difficulties and complications of therapy^[49]

- Delayed healing
- Spread of infections
- Bleeding
- Skin erosion
- Problems of healing: wound infection with delayed healing and false healing
- Sphincter injury and incontinence
- Post therapy scar formation and deformity
- Psychological upset pain

***Ksharasutra* used in modern technique**

Seton and IFTAK technique are the advancement of *ksharasutra* technique. In ***Seton***^[50] technique a silk or linen thread is passed the fistula and left in place with a tie and left in situ to create ischaemic necrosis, dividing the muscle slowly without allowing it to spring apart avoiding gutter deformity. This allows the fistula to granulate and heal from above and close completely. It will well-preserve the sphincter function and pressure. It is done for intermediate and inter sphincteric fistula. Two types of seton are present. First loose seton are used mainly to drain for long period in recurrent or postoperative fistulas like crohn's disease. There is no tension. second cutting seton are used enclosed muscle is needed to cut. It is placed tightly. seton technique is totally based on ancient *ksharasutra* procedure. In ***IFTAK (Interception of Fistulous Tract with Application of Ksharsutra)***^[51] is a novel advanced *ksharasutra* technique.

CONCLUSION

Ksharasutra therapy is a minimal invasive ayurvedic para-surgical procedure in the management of anorectal disorders. It is a safe, cure and cost-effective method of treatment for fistula in ano, haemorrhoids, sinus, pilonidal sinus, warts, papilloma and benign growth. *Kshara* sutra ligation treatment is much more beneficial in comparison with haemorrhoidectomy, fistulectomy and fistulotomy at maximum point. *Ksharasutra* ligation is the standard surgical treatment in the management of fistula in ano and haemorrhoid. Affordable treatment for all classes of people in the society. Different types of *ksharasutra* used according to the patient condition.

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