

UNDERSTANDING SWEDANA PRINCIPLES WITH MODERN THERMODYNAMICS
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ABSTRACT

Swedana Karma is one among the main Panchakarma procedure in Ayurveda that induces the production of sweat, reduces stiffness (*Stamba*), heaviness (*Gaurava*), and controls the coldness of the body.^[1] *Swedana karma* is widely used as *Purvakarma* for most of the Panchakarma procedures. It also possesses independent therapeutic potential, hence making it a part of *Purvakarma*, *Pradhanakarma* as well as *Paschatkarma*. According to the Ayurvedic *Samhitas*, *Swedana* helps liquefy vitiated *Doshas* and facilitates their movement towards the *Koshta* for elimination.^[2] Modern scientific understanding on different principles of thermodynamics, Laws of thermodynamics and heat transfer mechanisms help us to select the various modes of *Swedana Karma* to be adapted in treating different disease conditions. The thermal energy used during *Swedana* leads to vasodilation, enhanced metabolism, stimulation of sweat glands in the production of sweat and finally improves circulation. These physiological effects can be correlated with *Srotoshodhana*, *Dravikarana* and *Dosha* mobilization mentioned in the Ayurvedic concepts from various *Samhitas*. Further, integrating thermodynamic principles such as conduction, convection, radiation and evaporation with *Swedana Karma* provides a scientific explanation for the therapeutic benefits of *Swedana Karma*.

KEYWORDS: *Swedana Karma*, Thermodynamics, Thermal Energy, *Srotoshodhana*, *Dravikarana*, *Purvakarma*, *Pradhanakarma*, *Paschatkarma*.**INTRODUCTION**

Swedana Karma is a therapeutic procedure in Ayurveda that which promotes the production of sweat, relieves stiffness and heaviness, and controls coldness of the body. According to Charaka *Samhita* *Swedana* is described as: “*Stambha Gaurava Sheethagna Swedanam Swedakaram*”^[1].

Swedana Karma plays a major role in almost all the Panchakarma treatment protocols and is widely used in both *Shamana* and *Shodhana Chikitsa*. In *Shamana Chikitsa*, *Swedana Karma* is adopted based on clinical condition of the patient, involvement and predominance of *dosha* and patient specific factors such as *rogi bala*, *roga bala* etc need to be observed in detail. Acharya Charaka classified *Swedana* under *Apatarpana chikitsa* in *Shadupakrama*.^[3] In *Shodhana Chikitsa*, after the administration of *snehapana*, *Swedana* is applied to

liquefy the vitiated *dosha* spread throughout the body making it easier for expelling out the vitiated *dosha* through *pradhana Karma* such as *Vamana* and *Virechana Karma*. Hence even though *swedana* does not expel vitiated *doshas* like *Vamana Karma* and *Virechana Karma*, instead it pacifies *Vata* and *Kapha dosha*.

RATIONALE BEHIND SELECTING DIFFERENT MODES OF SWEDANA

Patient assessment should be done accurately before administering *Swedana Karma* as to determine the predominant *Dosha* present which in turn guides in the selection of accurate method of *Swedana Karma* to be applied. For example, if *Vata dosha* is predominantly present *Snigdha Swedana* (unctuous or oleation-based fomentation) is advised as it counteracts the roughness and dryness produced from vitiated *Vata dosha*. In conditions where *Kapha dosha* is predominantly present,

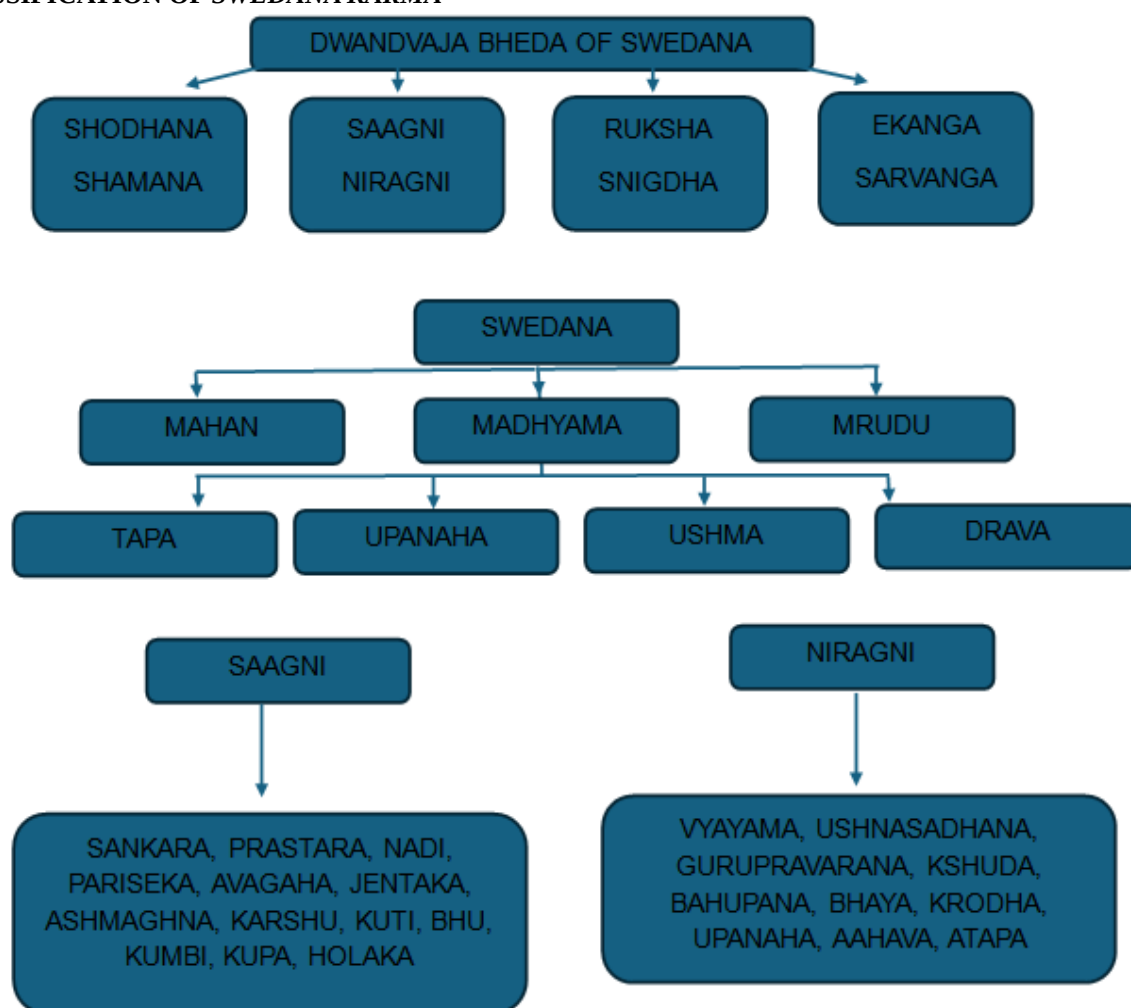
Ruksha Swedana (dry fomentation) is recommended as it relieves the heaviness and unctuous characteristics of *Kapha dosha*. Whereas in cases of predominance of *Pitta dosha*, *Mrudu Swedana* (mild fomentation) is indicated as the patient inherently possess hot nature of *Pitta dosha* hence *Swedana* is least recommended as to prevent further increase of heat within the body.

Rogavastha of patient also plays a crucial role in the selection of *Swedana Karma* to be administered. In *Sama Avastha* the involvement of *Ama dosha* is identified, hence *Ruksha Swedana* is preferred as it helps in *Ama pachana*. Whereas in *Nirama Avastha* where *Ama dosha* is totally absent *Snigdha Swedana* is more appropriate as to promote *Dosha* mobilization.

Other factors such as *Rogi Bala* (strength of the patient), *Sthana* (site of the disease), and *Kala* (season or climatic conditions) should be also considered in selecting the appropriate *Swedana Karma*. The perspiration rate varies from person to person depending on their environmental factors and physiological condition. For example, in the summer season sweat is produced within short duration compared to other seasons. Hence these factors also have a major role in selecting different *Swedana* techniques.

It is also important that *Swedana* is to be avoided in sensitive areas of the body such as eyes, chest region and genital region due to their higher sensitivity towards heat. Considering all these factors final mode of *Swedana Karma* is to be selected.

CLASSIFICATION OF SWEDANA KARMA^[4,5,6]



MODE OF ACTION

According to Charaka Acharya mode of action of *swedana karma* is explained as, “स्तम्भ गौरव शीतघ्नम स्वेदनं स्वेदकारकम्”^[1] that is *swedana* reduces stiffness, heaviness, controls the coldness of the body and produces sweat. *Swedana Karma* acts by inducing perspiration (*Sweda Utpatti*). *Sweda* is one among the

Malas of the body^[7] hence its elimination plays major role in maintaining physiological balance of the body. *Swedana dravyas* predominantly possess *Ushna* and *Tikshna* properties.^[8] These Gunas helps to penetrate the microcirculatory channels (*Srotas*) and stimulates the sweat glands. The production of sweating facilitates *Srotoshodhana* and helps in mobilization and liquefaction of vitiated *Doshas* in the body further

directing them towards the *Koshta* which can be expelled out through proper Shodhana therapies such as Vamana and Virechana procedures.^[9]

Stambhaghna is a significant effect exerted by application of *Swedana Karma* by the correction of deranged functions of *Vata* and *Kapha doshas* which are mainly responsible for maintaining joint mobility and lubrication.^[10] Vitiating of *Vata* and *Kapha dosha* thus leads to stiffness and restriction of movements in the joints. The *Ushna guna* of *Swedana* drugs plays a vital role alleviating this condition by promoting both *Srotoshodhana* and *Ama Pachana*. Thus, *Swedana Karma* helps in restoring normal functions of *Vata* and *Kapha dosha* by maintaining joint lubrication and improving blood circulation and metabolic activities. Hence, *Swedana Karma* effectively reduces stiffness by maintaining physiological balance and the functional integrity of musculoskeletal structures.

Gauravaghna achieved by application of *Swedana Karma* can be explained by understanding the pathophysiological condition. The excessive *Dravatva* and *Guru guna* accumulated in the body leads to the feeling of *Gaurava*. During *Swedana* therapy perspiration occurs helping in the elimination of these excess fluids from the body, hence reducing the stiffness experienced by the patient and improving the mobility. Thus, *Swedana Karma* overall enhances the neuromuscular activities.

Sheetaghna (alleviating coldness) is another important mode of action of *Swedana Karma*. In many disease conditions, the predominance of *Sheeta Guna* leads to symptoms like stiffness, restricted movements and excruciating pain. *Swedana Karma* possesses *Ushna Guna* which counteracts the *Sheeta Guna*. This process can be elaborated with the help of the principle of *Samanya-Vishesha Siddhanta*^[11], where opposite qualities act antagonistically to restore balance. Heat applied during *Swedana Karma* helps in neutralizing the excess *Sheeta Guna* in the body. Thus, by antagonizing the cold quality and promoting warmth, *Swedana* effectively restores the functional activity and gives relief from symptoms associated with cold predominance. To understand *Swedana Karma* in the purview of thermodynamics it is important to understand how *Sweda* is produced. During *Swedana Karma* the heat applied causes vasodilation in the applied region which stimulates the thermoreceptors and muscarinic receptors present in the sweat gland. These receptors bind with the neurotransmitter acetylcholine to mediate parasympathetic responses including smooth muscle contraction, heart rate modulations, glandular secretions and increases the body temperature. These receptors then sent the impulses to hypothalamus causing adrenalin secretion and adipose lipolysis. This in turn produces sweat as by product. Sweat contains NaCl, H₂O, Urea and trace amounts of K⁺, Ca⁺, Lactic acid, Amino acid and Phosphorus.^[12]

EFFECT OF SWEDANA KARMA IN RELIEVING PAIN

The physiological effect of heat on neural, vascular, and metabolic mechanisms explains how *Swedana Karma* relieves pain. Application of heat causes nerve stimulation at the level of skin which stimulates the thermoreceptors present there. These receptors sent impulses to the hypothalamus regarding awareness of heat and reflex inhibition of pain pathways. Due to the analgesic property of Adrenalin muscle spasm reduces causing pain relief. This explains the neural mechanism. Vascular mechanism explains application of heat during *Swedana Karma* causes dilation of blood vessels which in turn increases flow of blood to the applied area. The increased circulation improves oxygen and nutrient delivery to tissues while facilitating removal of metabolic wastes causing pain relief.^[13] Metabolic cellular mechanism explains application of heat enhances adipose lipolysis producing by products which include sweat which helps in healing and causes pain relief. Collectively, the neural, vascular and metabolic responses induced by *Swedana* therapy ultimately led to significant pain relief and functional improvement.^[14]

SWEDANA KARMA IN THE PURVIEW OF THERMODYNAMICS

To understand the thermodynamics of *Swedana Karma*, it is important to firstly understand modes of heat transfer- conduction, convection, radiation and evaporation. The rise in thermal energy during the application of *Swedana Karma* increases molecular motion leading to reduction in tissue viscosity.^[14] These can be correlated with *dravakarana* and *vishyandana*. Also, this thermal energy increases peripheral vasodilation resulting in 50-60% increase in blood circulation explaining *srotasa suddhi* and facilitating efficient elimination of metabolic waste products. Conduction is the heat exchange that occurs between molecules of two materials that are in direct contact with each other, these processes can be observed in *Pinda Sweda Karmas*. Whereas in *Avagaha Sweda* the mode of heat transfer is convection, transfer of heat occurs by the movement of a fluid/gas/liquid between areas of different temperature. Radiation is the transfer of heat in the form of infrared rays between a warmer object which explains *Atapa sweda*. Further procedures like *nadi sweda* can be explained by the process of evaporation.

LAWS OF THERMODYNAMICS AND SWEDANA KARMA

The Zeroth Law of Thermodynamics describes that if two systems are each in thermal equilibrium with a third system, they are in equilibrium with each other, this explains the fundamental concept of temperature. In *Swedana Karma*, external heat sources are at a higher temperature, and patient's body is at a lower temperature. Hence heat flows from higher temperature to lower temperature through a medium to attain equal equilibrium. This explains how *Ushna guna* of *Swedana*

gravya's contracts with *Sheeta guna* of aggravated *Vata* and *Kapha dosha*.

The First Law of Thermodynamics states that energy can neither be created nor be destroyed but can only be transformed from one form to another form. The external thermal energy given during *Swedana Karma* is converted into increased kinetic energy of molecules causing vasodilation, increased blood circulation and muscle relaxation. This can be correlated with *Srotoshadhana* as well as *Vilayana* of morbid *doshas* where transformation from one form to another can be observed.

The Second Law of Thermodynamics states that heat always flows from a higher temperature to a lower temperature, and entropy of an isolated system always increases. While performing *Swedana Karma* heat flows from hot *Swedana* medium to cooler body tissues increasing the entropy of the tissues. This causes loosening of muscle fibers, connective tissues and joint adhesions, thereby reducing stiffness and improving flexibility. From Ayurvedic perspective this can be correlated with the breakdown of *Sanga* in *Srotas* and facilitates *Dosha*

Utkleshana, which is the mobilization of vitiated *Doshas* prior to *Shodhana* therapy.

The Third Law of Thermodynamics states that as temperature approaches absolute zero, entropy approaches minimum. Cold tissues show reduced circulation causing increased rigidity in the body. *Swedana Karma* reverses this by increasing the tissue temperature by the application of heat. This directly correlates the antagonistic properties of *Ushna* and *Sheeta guna*.

DISCUSSION

In the context of Understanding *Swedana* Principles with Modern Thermodynamics Mechanism can be interpreted through the fundamental modes of heat transfer mechanism- conduction, convection, radiation and evaporation.

At the time of *Snehana* and *Swedana* as cell expands peripherally the blebbing of cell membrane is restricted tangentially. The only possibility that remains is blebbing inside the cell membrane. When it attains certain point of temperature gradient and pressure gradient by help of *Swedana* then the blebs detach from the cell membrane and spreads out.^[15] This explains the liquification of morbid *doshas* with help of *Swedana Karma* and the physiology and role of *Swedana Karma* prior to *Shodhana* procedures.

Swedana therapy represents a unique intersection between traditional Ayurvedic wisdom and modern scientific principles. While Ayurveda explains its action through *Dosha* theory, *Srotoshodhana*, and *Dravikarana*,

modern science interprets the same effects through thermodynamics, vascular responses, and metabolic changes. Heat application increases tissue temperature, leading to vasodilation and improved blood circulation. This enhances oxygen and nutrient delivery to tissues and accelerates the removal of metabolic waste products. The sweating process also contributes to detoxification and thermoregulation.

Understanding *Swedana* through thermodynamic principles provides a scientific basis for its therapeutic effectiveness and supports its integration into modern integrative medicine.

CONCLUSION

Swedana Karma is a major therapeutic procedure practiced in Panchakarma treatments possessing both preparatory and independent therapeutic applications. It has major role in relieving stiffness, heaviness and coldness through the process of perspiration and mobilization of *Doshas*.

Modern thermodynamic principles including Laws of Thermodynamics and different modes of heat transfer helps in integrating Ayurvedic concepts with modern scientific understanding which also helps in enhancing the applicability of *Swedana* in contemporary healthcare systems. Hence *Swedana Karma* can be depicted as a controlled therapeutic application of heat, operating on the same fundamental principles as thermodynamic energy transfer, where heat is used as a tool to restore physiological equilibrium.

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