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A CRITICAL REVIEW OF SANDHI SHARIRA WITH SPECIALREFERANCE TO CHALA SANDHI

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ABSTRACT

The meaning of word *Sandhi* is "the meeting point of two or more structures." Incontext sandhi means *asthi samyoga sthaana* or the place where bones meet. Thus *sandhi* or joint is formed when two or more bony ends meet at a place. There are two hundred and ten *Sandhi* in the human body. *Sushruta* has classified *Sandhi* on the following basis: (a) On the basis of function(movements) are classified into *Cheshtavanta* and *Sthira Sandhi* while *Aacharya Gananatha Sen* has classified *Sandhis* on the basis of movements as *Bahucheshta*, *Alpacheshta*, *Acheshta*. (b) On the basis of structure are classified into 8 types i.e. *Kora*, *Ulukhala*, *Samudga*, *Pratara*, *Tunnasevani*, *Vayasatunda*, *Mandala* and *Shankhavarta*. Details Knowledge of *sandhi* is specially its structure & movement for better diagnosis & management of disease.

KEYWORD: Sandhi, chala sandhi, biomechanics, synovial joints.

INTRODUCTION

In *ayurvedic* classics the structural entity of *sandhi* is not described properly. But now a days due to life style disorder after joint the incidence of joint are increasing in population.

The definition of *sandh*i in various classics are given as *sandhi* is *samyoga* (union or junction). It is defined as the meeting point of different bones. But in general joint is

considered as the junction between bones, not the junction between *peshi, sira, snayu.*[1] *Sandhi* is the site for *kapha*.[2]

DISCUSSION

Ayurvedic review

According to *Aacharya Charaka*. - 290 *Sandhi* in body.[3] According to *Aacharya Sushruta* body comprises 210 *Sandhi.*[4] Out Of these sixty-eight are in the four extremities; fifty-nine in the trunk (*Koshtha*); and eighty-three in the neck and the region above it.

Acharaya *sushruta* classified *sandhi* by two categories as 1. According to movement 2. According to structure

1. According to movement: it is two types as i. *Chala*(movable) *Sandhi* ii. *Sthira*(fixed) *Sandhi*. The *Sandhi* which is situated in the *Shakhas, Hanu* and *Kati* are *Chala Sandhi* while all the remaining *Sandhi* comes under the *Sthira* in nature.

The *Chala Sandhi* is further classified into two types based on their extent of movement1. They are-1. *Bahu chala* (freely movable) 2. *Alpachala* (slightly movable) The *Sandhi* of *Shakhas, Hanu* and Kati are of *Bahuchala* variety and the *Sandhi* of *Prushtha* etc. are *Alpachala* variety.

2. According to structure it is classified following types as

Table 1: Structural classification of Sandhi.

SANDHI	LOCATION
Kora	*Anguli, Manibandha, Gulpha, Janu & Kurpara.*
Udukhala	*Kaksha, Vankshana* and *Dashana.*
Samudga	*Ansapeeth, Guda, Bhaga & Nitamba.*
Pratara	*Greeva & Prushthavansha.*
Tunnasevani	*Sirakapala & Katikapala.*
Vayastunda	*Hanu.*
Mandala	Kantha, Hrudaya & Netra.
Shankhavarta	*Shrotra & Shringataka.*

Modern review

In modern view diarthrosis form synovial joint which permit free movement, where most of the joint of the body are synovial. Synovial joints are formed by several structures like articular cartilage, synovial fluid, articular capsule, synovial membrane & articular discs.

Articular cartilage

It is mainly hyaline articular cartilage, which is avascular in nature, non-nervous & elastic. It bears tremendous amount of intensive & repetitive physical of stress. The cartilage is important for the lubrication of joint.[5] If it is once damage it cannot be replace by hyaline tissue. In advance age degenerative change occurs in central part of articular cartilage.[6]

Synovial fluid

Synovial fluid has thixotropic and elastic (instantaneous dilatants) properties. Its viscosity decreases with an increase in the rate of movement, but it is pressure-resistant under sudded impact. Owing to its viscoelastic properties (that is, normal stress effect) and to its affinity to the cartilage surfaces, it cannot be squeezed out from between the opposing surfaces. If, however, synovial fluid undergoes any change and acquires Newtonian characteristics, it may be squeezed out and it is no longer capable of carrying a constant load at all rates of movement. Such changes in the synovial fluid result in damage to the articular surfaces since the elasticity of the cartilage and the slippery characteristics of the cartilage would not be sufficient to prevent increased friction.[7]

Viscosities of the fluid maintain lubrication .In cold temperature viscosity increase which leads stiffness of it.[8]

Articular capsule

It consists of outer fibrous capsule & inner synovial membrane. Numerous nerve ending ramify on the capsule which helps in contraction of muscles by stimulation.

Synovial membrane

It is highly vascular connective tissue lubricates the hyaluronic acid & secrete synovial fluid which helps in phagocytic activity.[8]

Articular discs

It helps in complete /partial divide the joint into two compartments. It present in knee & acromio-clavicular joint.

Lubrication & Biomechanics of synovial joint

In ayurveda classics it is mention that *Shleshmadhara Kala* presents in all type of joints. The *Shleshma* which is secreted from *Shlehmadhara kala* helps in lubrication of joints& prevent from friction.[9]

The behaviour of a synovial joint is mainly governed by the characteristics of the articular cartilage and synovial fluid. The articular cartilage is a soft glistening tissue with thickness varying between 1 to 7 cm; its surface is rough and varies with a regular periodicity of 20-50micro metre and amplitude of 2 to 5 micro metre. The synovial fluid is a clear yellowish dialysate of blood plasma with a concentration of hyaluronic acid molecules of about 3.5mg/gm. The hyaluronic acid is a straight, long chain polymer compound with molecular weight 500000 and molecular length of the order of $5x10^{-3}$-10^{-4}cm. Acid molecules do not normally pass through cartilage pores because of the smaller size of these pores.

Normally synovial fluid shows a non Newtonian pseudo plastic behavior. Its viscosity depends on the concentration of the hyaluronic acid molecules. When bones approach one another, water and other low molecular weight molecules pass through the pores of the cartilage and the hyaluronic acid molecules stay behind, thus increasing the concentration of these molecules in the synovial fluid increasing its viscosity. In a diseased joint, the cartilage surface can become rough and cracked and synovial fluid can lose its non-Newtonian behavior. The pores of a cartilage may increase in size and the hyaluronic acid molecules may be able to pass through them.[10]

Although diarthrodial joints experience an enormous amount of loading and motion, the cartilage surfaces undergo little wear and tear during normal conditions because of the special lubrication qualities of synovial fluid and the biphasic structure of the cartilage. Synovial fluid, which is secreted by the synovium into the joint space, contains mainly hyaluronate. Biomechanically, hyaluronate is a highly viscous liquid, with the shear stress depending on the rate of shear strain applied. As the shear rate increases, the viscosity of synovial fluid decreases. However, in the patient with rheumatoid arthritis, because of enzymatic degradation of the hyaluronate molecules, the viscosity of the rheumatoid synovial fluid does not have a normal shear rate dependency and is believed to be less effective in lubrication.[11]

Two lubrication mechanisms in the synovial joint provide minimal friction and cartilage wear: fluid film lubrication and boundary lubrication. During joint rotation, the sliding speed of the articulating surfaces and the viscosity of the synovial fluid create a thin film that is capable of supporting the load, resulting in fluid film lubrication. When the joint is loaded, the two articulating surfaces approach each other, and a squeeze film is generated to support the load. The pressure developed in the lubricating fluid carries the load applied to the joint. The thin film of lubricant also produces a greater bearing surface. In addition, the cartilage is

a biphasic porous medium. Water is bounded in the intrafibrillar space of the collagen matrix by proteoglycans. Intricate interaction of the mechanical stress, the electric charges, and the hydrodynamics result in a special fluid efflux pattern known as *elastohydrodynamic lubrication*. The fluid exudation ahead of and imbibitions behind the moving contact point of the articulating surface further facilitates the lubricant film.[12]

CONCLUSION

In various ayurvedic classics there is not mention about the exact mechanism of movement of a joint. While in modern science kinesiology (science of movement) are belongs to biomechanics. From above discussion it is clear that the factor which helps in mobility of *Chala Sandhi* is *Shleshma* which secreate from *Shleshmadhara Kala***.** The *Shleshma* can correlate with synovial fluid. While in modern science Lubrication depends on light irregularities in the joint surface that trap hyaluronate, Lubricin molecules to create a fluid film over the cartilage surface, elastic deformation of the cartilage to maintain a layer of fluid between opposing cartilage surfaces, alternate application and removal of compressive forces to create fluid flow and fluid being squeezed out of cartilage into the joint space as loading increases.

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