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A DETAILED STUDY OF *SHLESHMADHRA KALA* W.S.R. TO ANATOMICAL CONSIDERATION OF KNEE JOINT

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ABSTRACT

When developing the Anatomical and Physiological Sciences, Ayurvedic Acharyas gave careful consideration to the fundamental components of *Dhatu* and its supporting structure, *Ashaya*. They had also considered the linings that identified the *Ashaya's* interior

walls as *Kala* while thinking about the *Ashaya*. Sushruta and other *Acharyas* describe *Shlesmadhara Kala* as one of the *Sapta Kala*s. It can be found in every *sandhi*. According to Aacharya Sushruta, when counting the Sandhi in our body, only Asthi Sandhi should be taken into account, even if there are many more Sandhi that cannot be tallied. The human body contains two hundred and ten Sandhi in total. Each bone is joined by joints, wrapped in muscles, and supplied with blood by various Sira and Dhamani. Together, these bones make up Asthi Sandhi. All of the body's joints are considered the primary Kapha Dosha Sthana in Ayurveda. The knee, or Janu Sandhi, is the body's largest and most complicated synovial joint. It is crucial for activities like walking and stability, as well as for maintaining an upright posture and evenly distributing body weight.

Determining *ShlesmadharaKala*'s anatomical limitations in these structures is the goal and intent. In order to achieve these goals, we have studied every Ayurvedic classic and relevant work that discusses the construction and functioning of the *janu sandhi* (knee joint) and *Shlesmadhara kala*.

KEYWORDS: Kala, Shleshmadhara Kala, Janu Sandhi, Knee Joint, Synovial Membrane

INTRODUCTION

One of the oldest forms of holistic (whole body) medicine in the world is Ayurveda. India is where it was created thousands of years ago.Anatomy is the study of the many different body structures, including Kala, Twacha, joints, bones, and numerous sense organs. An important concept in and of itself is Ayurveda.[1] There is scientific support for many of the timeless concepts that are still applicable today. Acharya Sushruta mentioned Sapta Kalas in his description of the Pratyangas in the body. Ayurvedic Acharyas carefully considered the essential elements of Dhatu and its supporting structure, Ashaya, when establishing the Anatomical and Physiological Sciences. While contemplating the interior walls of the Ashaya, they had also taken into account the linings that designated the membranes as Kala. They made a pretty quiet presentation of it. The anatomy knowledge included in Ayurvedic books is immensely valuable to current science. When read in their entirety, the Samhitas may appear to be a fanciful tale, although they are fully real and scientific. Acharya Sushruta emphasised the need of Shavavichhedana (cadaver dissection) in gaining a comprehensive grasp of human anatomy. Shareera Sthana describes human

anatomy in detail in the Sushruta Samhita.[2] The human body consists of 210 Sandhi, or joints.In Ayurvedic texts, the knee joint is referred to as the *Janu Sandhi* or *Janu.*The knee joint is a hinge type synovial joint, which mainly allows flexion and extension (and a small degree of medial and lateral rotation). It is formed by articulations between the patella, femur and tibia.[3]

Synovial fluid lubricates this synovial membrane. Despite being a thin, soft membrane, the synovial membrane plays a number of important functions that are vital to our ability to move. Much of the cartilage is sufficiently close to the synovium in any given position to receive nutrients straight from it.[4]

AIM AND OBJECTIVES

1. To study appropriate and descriptive literature of *Shleshmadhara Kala*.
2. To study the available literature from Ayurvedic text and modern text on Janu Sandhi
3. To assess the structural anatomy of Janu Sandhi by cadaveric disection.
4. To find out relation between *Shleshmadhara Kala* and synovial membrane of knee joint.

REVIEW OF LITERATURE

1. Ayurvedic literature

Shleshmadhara kala

चतुर्थीश्लेष्मधरा□□सर्वसन्धिषु□□प्राणभृतांभवति। स्नेहअभ्यक्तेयथाहिअक्षेचक्रंसाधिप्रवर्त्तते।

सन्धयःसाधुवर्त्तन्तेसंश्लिष्टाःश्लेष्मणातथा। (सु.शा.४/१४□१५)[5]

The layers or membranes that contain or secrete mucus are referred to as *Shleshmadhara Kala*, which is the fourth kala. It is found in every bone joint.

The Shleshmadhara Kala lubricates and allows for unrestricted movement of the bone joints. It helps the joints recover from the stress and strain of continuous movement.This kala works similarly to the synovial membranes that line the inside surfaces of joints. This membrane secretes synovial fluid. The Sleshma that resides in Sandhi is known as Sleshaka Kapha. It promotes free mobility of the Sandhi while also lubricating it. The structures indicated above play a direct role in the creation of Sandhi. The structures that aid in mobility, support, and nourish the knee joint. Kapha is responsible for the unification

of joints, function, healing, saturation, and supporting these functions, as well as maintaining the body's water function.[6]

Janu Sandhi

Janu sandhi refers to the union of Jangha and Uru,along with Vaikalyakar and Sandhi Marma, is an important Sandhi.When the Janu Marma is harmed, it causes Khanjata. Ayurveda describes the various structures of Janu Sandhi, including Peshi, Kala, Snayu, and Ashthi, and their roles. Acharya Susruta mentioned 5 Peshi existing in Janu Sandhi.[7]

MODERN LITERATURE

KNEE JOINT

The knee joint is a hinge type synovial joint, which mainly allows flexion and extension (and a small degree of medial and lateral rotation). It is formed by articulations between the patella, femur and tibia.

Articulating Surfaces

The knee joint consists of two articulations – tibiofemoral and patellofemoral. The joint surfaces are lined with hyaline cartilage, and are enclosed within a single joint cavity.

- Tibiofemoral – medial and lateral condyles of the femur articulate with the tibial condyles. It is the weight-bearing component of the knee joint.
- Patellofemoral – anterior aspect of the distal femur articulates with the patella. It allows the tendon of the quadriceps femoris (knee extensor) to be inserted directly over the knee – increasing the efficiency of the muscle

Neurovasculature

The blood supply to the knee joint is through the genicular anastomoses around the knee, which are supplied by the genicular branches of the femoral and popliteal arteries.

The nerve supply, according to Hilton's law, is by the nerves which supply the muscles which cross the joint. These are the femoral, tibial and common fibular nerves.

Movements

There are four main movements that the knee joint permit:

- Extension: Produced by the quadriceps femoris, which inserts into the tibial tuberosity.

- Flexion: Produced by the hamstrings, gracilis, sartorius and popliteus.
- Lateral rotation: Produced by the biceps femoris.
- Medial rotation: Produced by five muscles; semimembranosus, semitendinosus, gracilis, sartorius and poplietus.

SYNOVIAL MEMBRANE

Synovial fluid lubricates the synovial membrane. Despite being a thin, soft membrane, the synovial membrane plays a number of important functions that are vital to our ability to move. Much of the cartilage is sufficiently close to the synovium in any given position to receive nutrients straight from it.Certain parts of cartilage must receive nutrients indirectly, which they may do by "stirring" the synovial fluid or by diffusion through the cartilage.[8]

The synovium's surface can be smooth or covered in projections that resemble fingers, called villi. It is assumed that these projections help the soft tissue adapt to the movement of the joint surfaces against one another.

In addition to lubricating the joints and supplying them with nutrients, the synovial membrane and fluid also have the role of clearing waste from the joints.The ability of the synovium to surround joints prevents injury or irritation to the tendons and bones that move within them. The joint structures can move against a surface made possible by the thick synovial fluid and the soft cushion of the synovial membrane.

Glucose, salt, potassium, oxygen, and other tiny molecules are found in synovial fluid and are essential to the life and well-being of all body cells. These little molecules have the ability to move between the joint's components and the synovial membrane.

MATERIAL AND METHOD

1. Bruhattrayee (Charak Samhita, Sushrutsamhita, Astanghrudya, Ashtang Sangraha) along with their commentaries by different Authors were referred to study knee joint and synovial membrane.
2. Modern Textbook of Anatomy eg. Anatomy Book of BD Chaorasia, A Concise Textbook of Surgery by Dr.K.Das, Grant’s Atlas of Anatomy, Dr.Williams, Dr.Warwick Churchill, Cunningham’s Manual of Practical Anatomy & Dissection.

3. Published article in international or national journals, Internet, PubMed etc.
4. Cadaveric dissection of knee joint was carried out in the department of Rachana Sharira to study the structure of Shleashmadhara Kala with respect to synovial membrane.[9]

DISCUSSION

There are certain structures in our body that are likely to be injured due to external or internal influences. During movements of joints the synovial membrane of knee joint is likely to undergo friction with the overlying structures. These joints are covered and protected by synovial membrane and fibrous capsule and to certain extent they also act as shock absorbers.

The synovial membrane covers bursae, tendon sheaths, exposed osseous surfaces, and intracapsular ligaments. It also lines fibrous capsules. The fluid that lubricates the movement between the articulating surfaces is secreted by and absorbed by the synovial membrane. It is made up of pleomorphic synovial cells embedded in a granular, amorphous, fiber-free extracellular matrix, which is called the cellular intima. Tendon sheaths, bursae, and synovial joints are all filled with synovial fluid. Synovial fluid's composition is consistent with it being primarily a dialysate of blood plasma. Hyaluronan, which is present in it, is assumed to have a major role in determining the viscoelastic and thixotropic (flow rate dependant) characteristics of synovial fluid. In addition to lubricating joints, this hyaluronan gives them nutrition.[10]

CONCLUSION

The detailed study of Janu Sandhi and shleshmadhara kala , as well as its correlation with modern clinical anatomy of the knee joint and synovial membrane aids in the diagnosis of various knee joint disorder, old age problems, life style disorders and chronic damages to knee joint. *Shleshmadhara kala* which secrete *shleshaka kapha* can be considered as *synovial membrane* which secretes synovial fluid in modern science. They both act as lubricant and make movement smoother. Synovial membrane forms fibrous capsule filled with synovial membrane in knee joint. If these conditions are diagnosed clinically by knowing applied anatomy we can avoid further upcoming complications like osteoarthritis, rheumatoid arthritis.

CONFLICT OF INTEREST –NIL

SOURCE OF SUPPORT –NONE

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