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THE ROLE OF *MARMA* POINTS IN MUSCULOSKELETAL HEALTH: AN ANATOMICAL PERSPECTIVE

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ABSTRACT

Marma points are vital energy centers in the body that are important in the musculoskeletal system because they connect muscles, ligaments, bones, veins, and joints. There are 107 Marma points in the body. They are also associated with different organs and nerves, and are related to Nadis and Chakras. Marma therapy is a self-care and self-healing practice that involves massaging Marma points to relieve stiff muscles and boost circulation.

A musculoskeletal disorder is an injury that affects the human body's movement or musculoskeletal system, including muscles, tendons, ligaments, nerves etc. Ayurveda understands the ailment in detail like etiological factors, Marma-chikitsa, a traditional therapy for managing vital points and specific Panchakarma to manage ailments effectively. Marma is a special concept described by Sushruta. Mamsa Marma's are 11, they are Talahridaya- 4, Indrabasti- 4, Guda- 1, Stanarohita- 2. Asthi Marma's- are 8, they are Kateekataruni- 2, Nitamba- 2, Amsaphalaka- 2, Shankha- 2. Snayu is a vital structure that helps maintain joints stability during movement, and all joints are bind together by snayu. There is 27 Snayu Marma. The musculoskeletal system is a system that provides our body with movement, stability, shape, and support. Besides its main function to provide the body with stability and mobility, the musculoskeletal system has many functions; the skeletal part plays an important role in other homeostatic functions such as storage of minerals and hematopoiesis, while the muscular system stores the majority of the body's carbohydrates in the form of glycogen. Hence playing important perspective in present study to know detail about the importance of Marma points in musculoskeletal health.

KEY WORDS: Marma, Mamsa Marma, Musculoskeletal system.

INTRODUCTION

As we all know the marma points are the important and vital structures of the body. Classification of marma is done based on its structure, composition, location, etc. here an attempt is made to see the importance of marma points in Musculo-skeletal health.
Marma is explained as the anatomical area were the five– principle anatomical structures Mamsa, Sira, Snayu, Asthi, and Sandhi are collectively present. It is the intense point of Prana, which gives its vitality. It is a site where pulsation is felt and generates pain when pressure exists.[1]

Marma classification according to their composition:

- Mamsa Marma: These are mainly composed of muscles and related structures like fascia. 11 in number. Talhridya, indrabasti, guda and stanrohita.
- Sira Marma: These are mainly composed of blood vessels. 41 in number. Nila, manya, matrika and shringataka.
- Snayu Marma: Snayu marma are composed of ligaments, tendons, and muscle aponeurosis. 27 in number. Ani, vitapa, kakshadhar, vasti etc.
- Asthi Marma: Asthi marmas are composed of bones and bony structures. 08 in number. Krikatika, nitamba, amsaphalak, and shankhaka.
- Sandhi Marma: Sandhi marma are made up of joints. 20 in number. Janu, kurpara, simant, gulpha etc.

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MAMSA MARMAS

There are 4 Mamsa Marmas (by names) and 11 Mamsa Marmas (by number). They are-

Sl. No.	Name	Type/Number	Location	Anatomical correlation
1.	Talahridaya	Kaalaantara Praanahara/4	Located at the middle of palm, Middle of sole/palm	In adhah shakhagat- Medial plantar artery, Lateral plantar artery, plantar nerve, plantar aponeurosis, Abductor hallucis muscles.[2] In Urdhwa Shakhagata-talhridaya marma- Flexor retinaculum, Palmar aponeurosis, Palmaris brevis muscle, interossei palmar muscle.[3]
2.	Indravasti	Kaalaantara Praanahara/4	Located at the middle of forearm on front side, Middle of leg in line with medial	pronator teres, Flexor carpi radialis, Palmaris longus, Flexor carpi ulnaris, Flexor digitorum superficialis, Radial artery and ulnar artery, Median nerve and ulnar nerve.[4]
3.	Guda marma	Sadhyo Praanahara/1	Located in the region of anus, attached with colon	rectum / anus, Bulks of levator ani muscle, Transverse peronei muscle, the sphincter ani muscle.
4.	Stanarohita	Kaalantara Praanahara/2	Located above the nipples on both sides of the chest	The areolar space is referred for the stanrohit marma, pectoralis minor muscle, Intercostal muscle, intercostal nerves, Internal thoracic artery.[5]

SNAYU MARMAS

There are 27 Snayu Marmas covered under 10 names and scattered all over the body. They are -

Sl. No.	Name	Type/Number	Location[8]	Anatomical correlation
1.	Aani	Vaikalyakara/4	Three angula (6cm) above the kurpar (elbow joint) and janu (knee)	Upper extremities- The brachial artery, median nerve, radial nerve, and ulnar nerve. Musculocutaneous nerve, coracobrachialis muscle, biceps brachii and triceps brachii muscles.[6] Lower extremities- Five relative structures are seen a. mamsa- the lower end of rectus femoris, vastus intermedius, vastus medialis, b. sira- femoral vessels, c. snayu- tendon of quadriceps femoris, d. asthi- the lower end of the femur and patella, e. sandhi- the joint between patella and femur.[7]
2.	Vitap	Vaikalyakar/2	Between the rushan (testis) and vankshan (inguinal/groin region).	Males- External oblique aponeurosis, Internal spermatic fasciae, Cremasteric fascia, External spermatic fascia, Ilio-inguinal nerve, Spermatic cord, Inguinal ligaments.[9] Fmales- External oblique aponeurosis, Internal oblique muscle of abdomen, ilio-inguinal nerve
3.	Kakshadhar	Vaikalyakar /2	in between the vaksha (thorax) and kaksha (axilla)	the brachial plexus, lateral Cord, median cord, posterior cord, axillary artery, axillary vein, and tendon of pectoralis minor.[10]
4.	Kurcha	Vaikalyakar/4	Upper limb- proximal to the junction b/w thumb & forefinger. Lower limb- proximal to junction b/w big toe & 1st toe	Upper limb- Carpo-metacarpal and intermetacarpal ligaments, Tendons of Extensor pollicis longus, Extensor digitorum, Extensor indicis, Flexor carpi radialis brevis muscles, Radial artery and its Dorsal metacarpal branches, Interosseous muscles, Carpo-metacarpal and inter metacarpal articulations. Lower limb- Tarsometatarsal and inter-tarsal ligaments, Extensor digitorum brevis, Dorsalis pedis and Dorsal intertarsal arteries, Tendons of Extensor digitorum longus, Extensor hallucis longus, Peroneus tertius muscles, Branches of deep Peroneal nerve[11]

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5.	Kurchashira	Rujakar/4	Upper limb – distal to the wrist joint. Lower limb- distal to the ankle joint	Upperlimb- Ulnar Collateral ligaments, Radial collateral ligaments, Inter-carpal ligaments, Transverse carpal ligaments, Ulnar artery, Median nerve, Superficial branches of ulnar nerve, Inter-carpal articulations. Lowerlimb- Deltoid ligaments, Talocalcaneal ligaments, Calcaneofibular ligaments, Annular ligaments, Tendon of Tibialis anterior muscle
6.	Basti	Sadya pranhar/1	Mutrashaya (urinary bladder)	the tissues involved in Basti Marma are the urinary bladder, terminal part of the ureter, prostate & prostatic urethra, puboprostatic/pubo-vesical ligaments and other ligaments, vesical branches of the internal iliac artery, the internal iliac veins and its tributaries from bladder, sympathetic and parasympathetic nerves from inferior hypogastric plexus etc.[12]
7.	Kshipra	Kalantar pranhar/4	In hand- in between the index finger and thumb In foot- in between big and 2nd toe	Upper limb- Dorsal metacarpal Artery, Flexor Pollicis Brevis, Oblique and transverse head of adductor pollics, Branches of the median nerve, Superficial and deep palmar arch supplying blood to the finger. Lower limb- Dorsal Pedis Artery, Branch of deep peroneal nerve going to big toe, Adductor halluces Brevis, Lumbricalis muscles, Plantar arch, Medial plantar artery, Posterior tibial nerve, Meta tarso- phalangeal joint.[13]
8.	Amsa	Vaikalyakar/2	in between the arms, head and neck	Coraco-clavicular ligaments, Conoid ligaments, Trapezoid ligaments, Acromio-clavicular ligaments, Coraco-clavicular ligaments.[14]
9.	Vidhur	Vaikalyakar /2	at the back (or behind) the ear and below it	- Stylomastoid artery, and the facial nerve is especially found at the site of Marma passing through the stylomastoid foramen.[15]
10.	Utkshep	Vishalyaghana/ 2	It is located at the level of the scalp's hairline, above the temple	superficial and deep fascia of the temporal region, i.e. up to the meninges, super facial temporal artery, deep temporal artery and vein zygomatic temporal nerve. The pterion is a small circular area within the temporal fossa which contains the junction of the frontal, sphenoid, parietal and temporal sutures.[16]

ASTHI MARMA:

There are 8 Asthi Marmas covered under 4 names and scattered all over the body. They are -2 in number

Sl. No.	Name	Number	Location	Anatomical Correlation [17]
1.	Kateeka taruna	2	Low back, one on either side of the back bone, on the pelvic bones	Ilium near sacroiliac joint, common iliac vessels
2.	Nitamba	2	Above the pelvic region covering the viscera and between the 2 lateral parts	Iliac crest, lumbar plexus
3.	Amsaphalaka	2	Upper part of the back, on both lateral sides of vertebral column and at the place of union of 3 bones (scapula, humerus and clavicle)	Scapula, supraspinatus, subscapularis, chords of brachial plexus
4.	Shankha	4	Between ear and forehead on either side, in the temples	Squamous part of temporal bone, middle meningeal artery

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SANDHI MARMA

There are 20 Sandhi Marmas covered under 09 names and scattered all over the body.[18] They are -

Sl. No.	Name	Type	Location	Anatomical Correlation [19]
1.	Janu	2	At the region where jhanga and uru unites	knee joint
2.	Koorpara	2	Region where arm and forearm joins	Elbow joint
3.	Seemanta	5	5 sandhi present in shirah	Frontal, sagittal, occipital sutures
4.	Adhipati	1	Within the cranial cavity, in its upper part	confluence of sinuses
5.	Gulpha	2	Region where pada and jhanga unites	ankle joint
6.	Manibandha	2	Region where forearm and arm joins	wrist joint
7.	Kukundara	2	On either side of vertebral column in the jaghana bahirbhaga	Sacro-iliac joint, sciatic nerve
8.	Aavarta	2	Depressed area above bhru	Orbicularis oculi muscle,levator palpebrae superioris.
9.	Krukaatika	2	Joint between shira and greeva	Atlanto-occipital joint

MUSCULOSKELETAL SYSTEM

The musculoskeletal system / locomotor system is a human body system that provides our body with movement, stability, shape, and support. It is subdivided into two broad systems:

1. Muscular system, which includes all types of muscles in the body. Skeletal muscles, in particular, are the ones that act on the body joints to produce movements. Besides muscles, the muscular system contains the tendons which attach the muscles to the bones.
2. Skeletal system, whose main component is the bone. Bones articulate with each other and form the joints, providing our bodies with a hard-core, yet mobile, skeleton. The integrity and function of the bones and joints is supported by the accessory structures of the skeletal system i.e., articular cartilage, ligaments, and bursae.

Besides its main function to provide the body with stability and mobility, the musculoskeletal system has many other functions; the skeletal part plays an important role in other homeostatic functions such as storage of minerals (e.g., calcium) and hematopoiesis, while the muscular system stores the majority of the body's carbohydrates in the form of glycogen.

Parts of the Musculoskeletal System

- Skeleton — this is the framework of the body. The adult human skeleton is made up of 206 bones.
- Joints — an area where 2 bones work together.
- Cartilage — is a cushioning that covers the ends of 2 bones.
- Ligaments — tough bands of tissue that join bones to other bones to strengthen joints.
- Muscles — there are more than 600 skeletal muscles in the human body. They help the body move.
- Tendons — these are made of strong fibrous connective tissue and they attach muscles to bones.

1. **Muscular system -** The muscular system is an organ system composed of specialized contractile tissue called the muscle tissue. There are three types of muscle tissue, based on which all the muscles are classified into three groups:
   - Cardiac muscle- which forms the muscular layer of the heart (myocardium)
   - Smooth muscle- which comprises the walls of blood vessels and hollow organs
   - Skeletal muscle- which attaches to the bones and provides voluntary movement.

Based on their histological appearance, these types are classified into striated and non-striated muscles; with the skeletal and cardiac muscles being grouped as striated, while the smooth muscle is non-striated. The skeletal muscles are the only ones that we can control by the power of our will, as they are innervated by the somatic part of the nervous system. Skeletal muscles- The skeletal muscles are the main functional units of the muscular system. There are more than 600 muscles in the human body. They vary greatly in shape in size, with the smallest one being the stapedius muscle in the inner ear, and the largest one being the quadriceps femoris muscle in the thigh.

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Anatomical Structure

Structurally, the skeletal muscles are composed of the skeletal muscle cells which are called the myocytes (muscle fibres, or myofibrils). Muscle fibers are specialized cells whose main feature is the ability to contract. They are elongated, cylindrical, multinucleated cells bounded by a cell membrane called sarcolemma. The cytoplasm of skeletal muscle fibers, contains contractile proteins called actin and myosin. These proteins are arranged into patterns, forming the units of contractile micro-apparatus called sarcomeres.

Each muscle fiber is enclosed with a loose connective tissue sheath called **endomysium**. Multiple muscle fibers are grouped into muscle fascicles or muscle bundles, which are encompassed by their own connective tissue sheath called the **perimysium**. Ultimately, a group of muscle fascicles comprises a whole muscle belly which is externally enclosed by another connective tissue layer called the **epimysium**. This layer is continuous with yet another layer of connective tissue called the deep fascia of skeletal muscle, that separates the muscles from other tissues and organs.

This structure gives the skeletal muscle tissue four main physiological properties:

- Excitability - the ability to detect the neural stimuli.
- Contractibility - the ability to contract in response to a neural stimulus.
- Extensibility - the ability of a muscle to be stretched without tearing.
- Elasticity - the ability to return to its normal shape after being extended.

Tendons - A tendon is a tough, flexible band of dense connective tissue that serves to attach skeletal muscles to bones. Tendons are found at the distal and proximal ends of muscles, binding them to the periosteum of bones at their proximal (origin) and distal attachment (insertion) on the bone. As muscles contract, the tendons transmit the mechanical force to the bones, pulling them and causing movement.

Being made of dense regular connective tissue, the tendons have an abundance of parallel collagen fibers, which provide them with high tensile strength (resistance to longitudinal force). The collagen fibers within a tendon are organized into fascicles, and individual fascicles are ensheathed by a thin layer of dense connective tissue called endotenon. In turn, groups of fascicles are ensheathed by a layer of dense irregular connective tissue called epitenon. Finally, the epitenon is encircled with a synovial sheath and attached to it by a delicate connective tissue band called mesotenon.

Functions of the muscular system - The main function of the muscular system is to produce movement of the body. Depending on the axis and plane, there are several different types of movements that can be performed by the musculoskeletal system. Some of the most important ones include- Flexion and extension, Adduction and abduction, Rotation, Supination and pronation .

Both during movement and stationary positions, muscles contribute to the overall support and stability of joints. Many muscles and their tendons pass over joints and thereby stabilize the articulating bones and hold them in position. In addition, the muscles also play an important role in maintaining posture. While the movements occur mainly due to muscles intermittently contracting and relaxing, the posture is maintained by a sustained tonic contraction of postural muscles. These muscles act against gravity and stabilize the body during standing or walking. The postural muscles include the muscles of the back and abdominal muscles. Another important function of muscles is heat production. Muscle tissue is one of the most metabolically active tissues in the body, in which approximately 85 percent of the heat produced in the body is the result of muscle contraction. This makes the muscles essential for maintaining normal body temperature.

2. Skeletal system

The adult human skeleton is composed of 206 bones and their associated cartilages. The bones are supported by ligaments, tendons, bursae, and muscles. The bones of the body are grouped within the two distinct divisions:

- Axial skeleton, that includes the bones along the long axis of the body. The axial skeleton consists of the vertebral column, bones of the head and bones of the thoracic cage.
- Appendicular skeleton, that involves the bones of the shoulder and pelvic girdle, as well as the bones of the upper and lower extremities.

Bones- Bones are rigid structures made of calcified dense connective tissue. Bone tissue is composed of a mineralized bone matrix that consists of type 1 collagen fibers dispersed throughout the ground substance. The cellular component of the bones is represented by three types of specialized bone cells called osteocytes, osteoblasts and osteoclasts.[20]

Types of bones- Long bones, Short bones, Flat bones, Sesamoid bones, Irregular bones.

Cartilage - Cartilage is a flexible connective tissue found in multiple organ systems of the body. Cartilage is composed of specialized cells called chondrocytes, collagen fibers and abundant ground substance rich in proteoglycan and elastin fibers.

Cartilage is classified into the following types based on its composition:

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- Hyaline cartilage is composed of type II collagen and an abundance of ground substance, which gives it a glossy appearance. It is the most abundant type of cartilage found in joints (articular cartilage), as well as the nose, larynx, trachea and ribs.
- Elastic cartilage is similar to hyaline cartilage but contains more elastic fibers. It is found in structures such as the pinna of the ear, auditory tube and epiglottis.
- Fibrocartilage is composed of plenty of collagen fibers type I and a smaller amount of ground substance. Examples of fibrocartilage include intervertebral discs, pubic and other symphyses.

The musculoskeletal system specifically contains articular cartilage, a type of cartilage that lines the articulating surfaces of bones. The articular cartilage provides congruence to the articulating bones and allows them to bear weight and glide over each other with very little friction.

Joints - Each bone of the musculoskeletal system is connected to one or more bones via a joint. Joints provide a fulcrum to the bones, on which they pivot and thereby allow movements of body parts. However, movement is not a necessary attribute of a joint as some joints do not move, such as joints between the bones of the skull. The integrity or stability of a joint is provided by several factors including the bony congruence and structures that cross the joint, such as tendons and ligaments. According to the movements they allow and/or the shape of their articulating surface, the synovial joints can be further subdivided into 6 major types- Ball and socket joints, Condyloid joints, Hinge joints, Pivot joints, Saddle joints, Plane joints

Ligaments -Ligaments are fibrous bands made of dense regular connective tissue which are similar in structure to tendons. Unlike the tendons that connect muscles to bone, the ligaments connect bone to bone. Besides the musculoskeletal system, the ligaments are also found in many other parts of the body, where they usually stabilize and hold internal organs in place and transmit neurovascular structures. In the musculoskeletal system, ligaments stabilize the articulating bones and reinforce the joints. Depending on their anatomic position relative to the joint capsule, ligaments are classified into:

- Capsular ligaments are essentially thickenings of the joint capsule that form either elongated bands or triangular structures. These ligaments serve to reinforce the integrity of the joint capsule.
- Intracapsular ligaments are the ligaments that lie internal to the joint capsule. These ligaments reinforce the connection of the articulating surfaces of the joint, but allow a far wider range of motion than other ligaments.
- Extracapsular ligaments are ligaments that lie outside the joint capsule. These ligaments provide the most stability to the articulating bones, and are important for preventing dislocations. [21]

DISSCUSSION

Marma therapy works by restoring balance in prana and doshas. By stimulating specific marma points, practitioners aim to- Rebalance prana flow throughout the body, promoting optimal function and healing, reduce inflammation and promote tissue repair, easing pain and discomfort, improve circulation by stimulating blood flow to affected areas, aiding in healing and reducing pain.

Acharya Susruta has defined Marma as the anatomical site where Mamsa, Sira, Snayu, Asthi and Sandhi meet together. Prana dwells at these sites and so they are important.
Marma is not only anatomical structure but also a part of applied anatomy, it is physio-
anatomical concept described in ayurveda. Marma is the part of surface anatomy where we get knowledge of internal structures and pathological conditions due to trauma. With the help of skin surface of particular marma and region of the marma we understand the area, internal structure and severity of the trauma.

So the detail of marma and importance of mamsa, asthi, sandhi, snayu marma with its anatomical importance is explained which help in forming Musculo-skeletal system. By having the knowledge all the above structures one can maintain the normalcy of functioning of all the systems of our body.

CONCLUSION

All the above descriptions show the importance and vitality of the marma point. Marma is the confluence of muscles, veins, ligaments, bones, and joints. In these places, prana (life) resides specifically by nature; hence when fatal spots are injured, producing their respective effects. Mamsa, Snayu, Asthi, Sandhi plays an important role in the posture of the human body. Snayu marma, better known as the vital point in ayurvedic anatomy, is a specific location in the human body characterized by the predominance of the ligament. The injury to the nerve, muscles or ligaments may lead to a decrease in length, strength movement and emaciation of limb. Therefore, knowledge of marma, especially, mamsa, asthi marma, is essential for physicians and surgeons for preventive and curative aspects. Therefore, we need

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to protect these by knowing its structure. As they play important role in forming muscular and skeletal system. Hence an attempt is made to see the importance of marma in maintaining the Musculo-skeletal health.

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