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AN ANATOMICAL EXPLORATION OF THE PAINPATHWAY W.S.R PAIN MANAGEMENT THROUGH *MARMA CHIKITSA*

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ABSTRACT

Pain is an extra ordinary sensation that could range from slight to intense. Ache includes both physical and emotional components. The physical part of ache effects from nerve stimulation. In *Ayurveda*, pain is correlated with *Vedana / Shula*. The feeling of the pain is maximally expressed by *Vedana* in *Ayurveda* literature.[1] Different texts of *Ayurveda* mentioned 107 *Marma* points based on specific anatomical positions and different structures around them. *Marma*s are those places in the body where *Pranas* exist. They have various effects on individuals in terms of physical, mental and social health concern. *Marma points or Pranas* are in the form of vital physiological and mental energy in the body and if the waft of *Prana* or essential energy gets obstructed or blocked, the body structure gets disturbed and pathology starts growing. These points are stimulated by different techniques or methods. This way *Marmas* may be used to remove blockages and stimulate *Prana* or energy flow resulting in a state of healthy body, mind and spirit. In present scenario *Marma Chikitsa* is very popular in various parts of India for its instant, permanent, natural and non-invasive way of treatment. *Marma Chikitsa* had emerged as a new dimension in non-pharmacological treatment of *Ayurveda*. If properly stimulated, *Marma Chikitsa* helps in maintaining the vitality of the body and treatment of disease/pain through *Prana* or natural healing agents such as prostaglandin.

KEYWORDS: *Marma,* Pain pathway, Pain, *Shula, Vedna, Marma Chikitsa, Ayurveda.*

INTRODUCTION

Marma Science and *Marma Chikitsa* is a less implied chapter of Indian surgery. With the exploration of *Marma* science, the whole scenario of Indian surgery may change in multidimensional approaches.[1] These *Marmas* are mentioned and discussed in *Sushruta Samhita* as an anatomical consideration of different parts of the body.[2] Firm unions of *Mansa* (muscles), *Sira*(veins*), Snayu* (ligaments), *Ashti* (bones) or *Sandhi* (bone-joints) are called *Marmas* (or vital parts of the body) which naturally and specifically form the seats of life (*Prana).* Injury to any one of these *Marmas* invariably produces specific symptoms.[3] There are one hundred and seven (107) *Marmas* (vital spots) in the body.[4] For example heart and brain. Trauma to these parts may lead to loss of vitality there fore these parts are known as vital parts.[5] The word "*Marma"* comes from *Sanskrit* origin "*Mra*" which means place of *Prana* (life). Any direct or indirect trauma to these sites may be fatal or can result in the disability of the person. These *Marma* points harmonize the nervous and endocrine system and normalize different pathological conditions in the body through vital power, with proper stimulations. This technique is known as *Marma Chikitsa.*[6]

Pain is a vital function of the nervous system in providing the body with a warning of actual injury. It is both a sensory and an emotional experience, affected by psychological factors such as past experiences, beliefs about pain, fear or anxiety. This article provides an overview of the physiological mechanisms of pain and the important pain pathways. We will discuss pain receptors, transmission of pain signals to the spinal cord and pain pathways within the spinal cord. We will also look at how pain can be modulated at different levels along the pathway. Finally we will discuss different types of pain including visceral and neuropathic pain.[7]

Varieties of pain

1) Physiological pain-starts from receptor-Allodynia, Nociceptive, hyperalgesia

2) Pathological pain- does not start from receptor (neuropathic pain-nerve injury)

Nociceptors

Nociceptors are the specialised sensory receptors responsible for the detection of noxious (unpleasant) stimuli and transforming the stimuli into electrical signals, which are then sent to the central nervous system. They are the free nerve endings of primary afferent Aδ and C

fibres. Distributed throughout the body (skin, viscera, muscles, joints, meninges), they can be stimulated by mechanical, thermal or chemical stimuli.

Inflammatory mediators (eg bradykinin, serotonin, prostaglandins, cytokines, and H+) are released from damaged tissue and can stimulate nociceptors directly. They can also act to reduce the activation threshold of nociceptors so that the stimulation required to cause activation is less. This process is called primary sensitisation.[3]

Primary afferent fibres

In addition to the Aδ and C fibres that carry noxious sensory information, there are primary afferent Aβ fibres that carry non-noxious stimuli. Each of these fibre types possesses different characteristics that allow the transmission of particular types of sensory information (Table 1).

- Aβ fibres are highly myelinated and of large diameter, therefore allowing rapid signal conduction. They have a low activation threshold and usually respond to light touch and transmit nonnoxious stimuli.
- Aδ fibres are lightly myelinated and of smaller diameter, hence conduct more slowly than Aβ fibres. They respond to the mechanical and thermal stimuli. They carry rapid, sharp pain and are responsible for the initial reflex response to acute pain.
- C fibres are unmyelinated and are also the smallest type of primary afferent fibres. Hence they demonstrate the slowest conduction. C fibres are polymodal, responding to chemical, mechanical and thermal stimuli. C fibre activation leads to slow, burning pain.

Table 1: Characteristics of primary afferent fibres Dorsal.

	Aβ fibres	Aδ fibres	C fibres
Diameter	Large	Small 2-5µm	Smallest < 2µm
Myelination	Highly	Thinly	Unmyelinated
Conduction velocity	>40 ms-1	5-15ms-1	< 2ms-1
Receptor activation Thresholds	Low	High and low	High
Sensation on stimulation	Light touch, non-noxious	Rapid, sharp, localised pain	Slow, diffuse, dull pain

Dorsal horn of the spinal cord

Aδ and C fibres synapse with secondary afferent neurons in the dorsal horn of the spinal cord. The dorsal horn can be divided histologically into ten layers called Rexed laminae. Aδ and C fibres transmit information to nociceptive specific neurons in Rexed lamina I and II, in

addition to projections to other laminae. Primary afferent terminals release a number of excitatory neurotransmitters including glutamate and substance P.

Complex interactions occur in the dorsal horn between afferent neuron, interneurons and descending modulatory pathways (see below). These interactions determine activity of the secondary afferent neuron. Glycine and gamma-aminobutyric acid (GABA) are important neurotransmitters acting at inhibitory interneurons.

Ascending tracts in the spinal cord

There are two main pathways that carry nociceptive signals to higher centres in the brain.

- **The spino-thalamic tract: -** Secondary afferent neurone decussate within a few segments of the level of entry into the spinal cord and ascend in the contra-lateral spinothalamic tract to nuclei within the thalamus. Third order neurone then ascend to terminate in the somato-sensory cortex. There are also projections to the periaqueductal grey matter (PAG). The spino-thalamic tract transmits signals that are important for pain localisation.
- **The spino-reticular tract:** - In this also, fibres decussate and ascend to the contra-lateral cord to reach the brainstem reticular formation, before projecting to the thalamus and hypothalamus. There are many further projections to the cortex. This pathway is involved in the emotional aspects of pain.

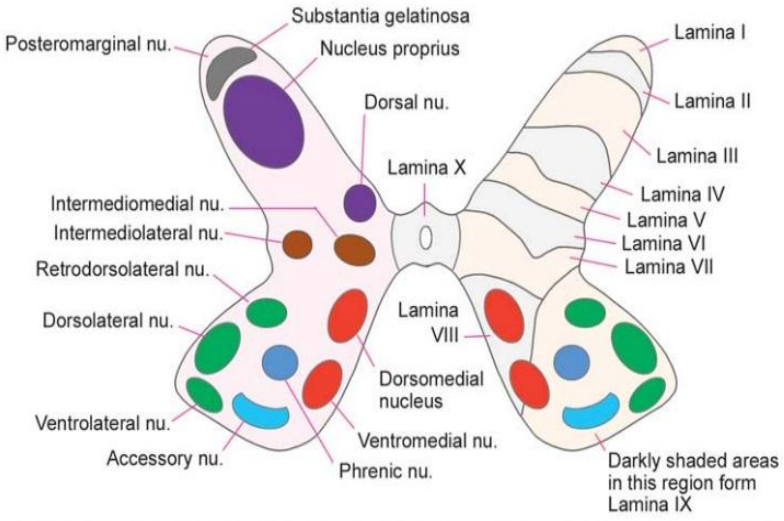

Fig. 1: The laminae of Rexed and related nuclear groups.

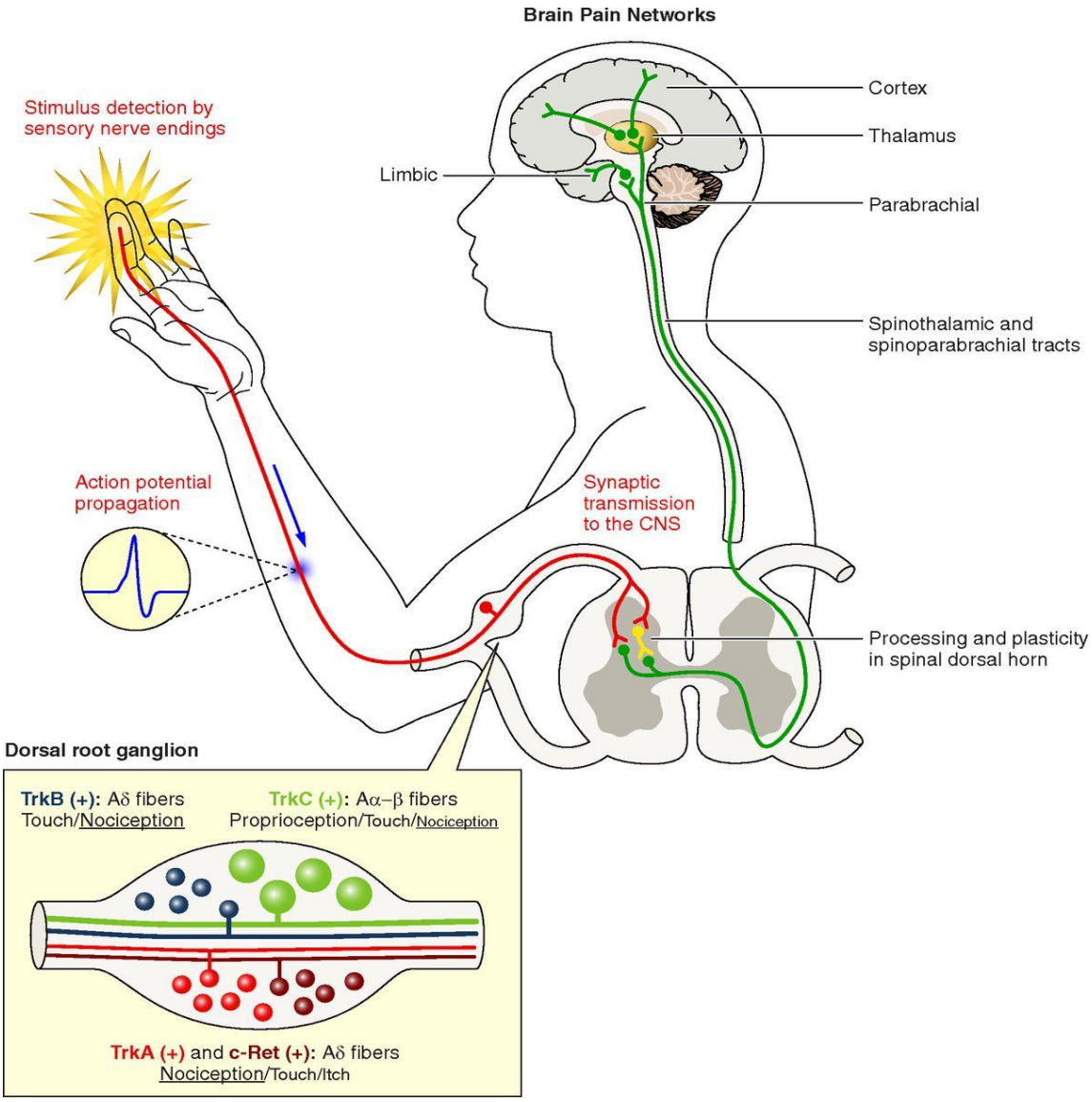

Figure 2: Acute pain pathway.

Visceral pain

Visceral pain is the pain arising from the internal organs. The viscera are largely innervated by C fibres. Visceral pain is typically diffused and poorly localised, often described as deep, dull or dragging type of nature. It can be associated with autonomic changes such as nausea, vomiting and changes in heart rate or blood pressure. It can also evoke strong emotional responses. In contrast to somatic pain, which is felt due to stimuli such as burning or crushing, visceral pain is triggered by smooth muscle distension or contraction, stretching of the capsule surrounding an organ, ischaemia and necrosis or irritation by chemicals produced during inflammatory processes. Referred pain is the pain experienced at a site distant from the source of the pain. It is due to the convergence of different afferents on to the same dorsal horn neurons in the spinal cord. For example, shoulder pain can be felt due to diaphragmatic

irritation following a laparoscopic surgery which is responsible for the stretching the diaphragm.

Neuropathic pain

Neuropathic pain is caused by the damage to the nerves in the central or peripheral nervous system. Damage can be due a number of mechanisms including trauma or surgery, diabetes mellitus, chemotherapy, radiotherapy, ischaemia, infection or malignancy. Neuropathic pain has some different characteristics than the nociceptive pain. This pain is more likely to be spontaneous and is described as burning or 'like an electric shock'. Pain may be experienced in response to a stimulus that does not usually cause pain (allodynia) or there may be a heightened response to a stimulus that is usually painful (hyperalgesia).

Inhibition of pain transmission

There are mechanisms that act to inhibit pain transmission at the spinal cord level and via descending inhibition from higher centres.

A) Gate control theory of pain

The gate control theory of pain was proposed by Melzack and Wall in 1965 to describe a process of inhibitory pain modulation at the spinal cord level. It helps to explain why when we bang our head, it feels better when we rub it. By activating Aβ fibres with tactile, non-noxious stimuli, inhibitory interneurons in the dorsal horn are activated leading to inhibition of pain signals transmitted via C fibres (Figure 3). Accupressure therapy and *Marma* therapy for pain management are based on this. Pressure sensation inhibits pain via collaterals in Substantia Gelatinosa.

B) Descending inhibition

3 Components - periaqueductal grey, nucleus raphae magnus & dorsal pain inhibitory complex

a) Periaqueductal grey (PAG) in the midbrain and the rostral ventro-medial medulla (RVM) are two important areas of the brain involved in descending inhibitory modulation. Both these centres contain high concentrations of opioid receptors and endogenous opioids, which help to explain why opioids are analgesic. Descending pathways project to the dorsal horn and inhibit pain transmission. These pathways are monoaminergic, utilising noradrenaline and serotonin as neurotransmitters.

b) Nucleus raphae magnus

- Projects serotinergic neurons & ends on inter neurons
- NT Serotonin
- Inter neurons dorsal pain inhibitory complex

c) Dorsal pain inhibitory complex

- Inter neurons NT → Enkephalin
- Pre synaptic & post synaptic pain inhibition occurs
- Enkephalin has inhibitory effect on pre & post pain carrying afferents

C) ENDOGENOUS OPIOIDS/ENDOGENOUS CANNABINOIDS

1. Endorphins
2. Enkephalins
3. Dynorphin

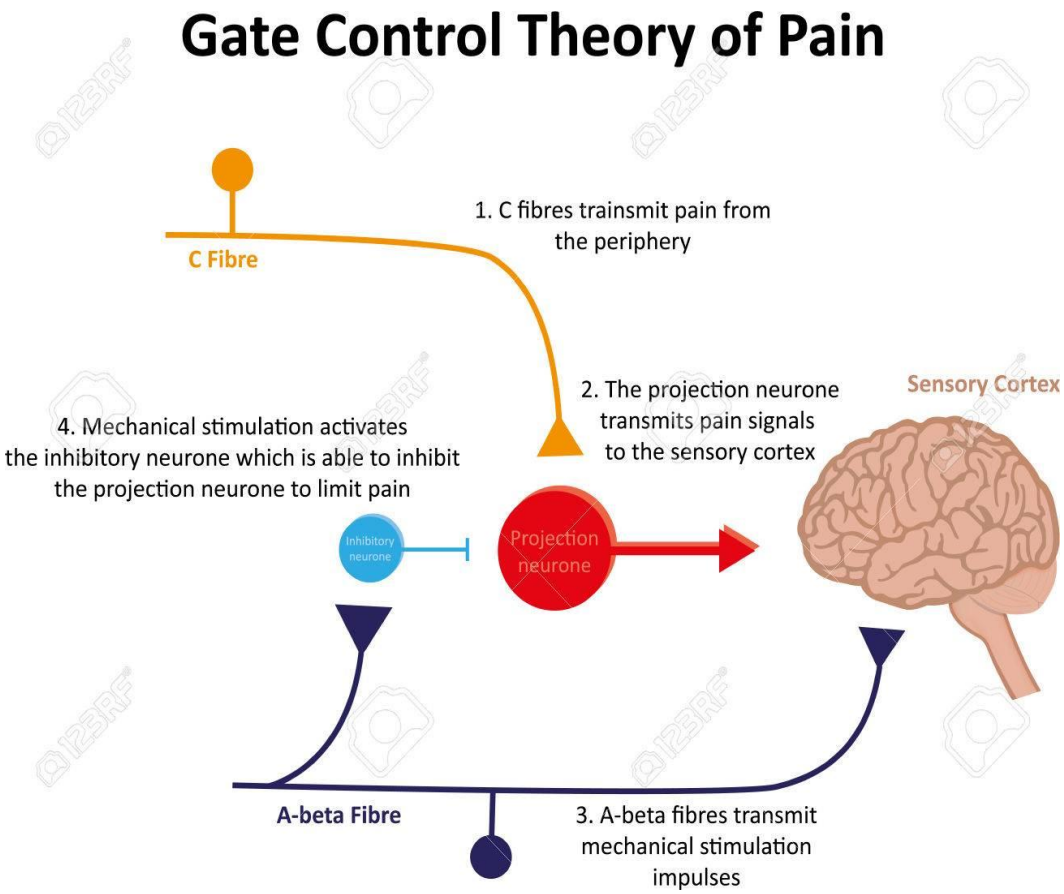

Figure 3: Gate control theory of pain stimulation of Aβ fibres activates inhibitory interneurons in the dorsal horn.

Table 2: Useful definitions (Source: International Association for the Study of Pain).

Term	Definition
Pain	An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage
Nociceptor	A high-threshold sensory receptor of the peripheral somasto-sensory nervous system that is capable of transducing and encoding noxious stimuli
Hyperalgesia	Increased pain from a stimulus that normally provokes pain
Neuropathic pain	Pain caused by a lesion or disease of the somato-sensory nervous system
Allodynia	Pain due to a stimulus that does not normally provoke pain
Sensitization	Increased responsiveness of nociceptive neurons to their normal input, and/or recruitment of a response to normally subthreshold inputs

Marma* and *Shula

Pain is one of the most common feature of traumatic lesions and understanding its nature and properties is important for the successful management of pain. In *Ayurvedic* medicinal therapy, the only lacuna is the immediate management of pain. *Marma* Science and *Chikitsa* have an answer to this and hence, if we incorporate *Marma* science in the broad field of *Ayurvedic* therapy, we can overcome this lacuna. *Marma* science also draws its basic premises from the same body of texts as the other disciplines of *Ayurvedic* practice.[8] *Marmas* are considered as half of the surgery subject as any injury to *Marmas* can prove to be fatal. So if the patient is promptly treated by a skilled doctor, the patient may be relieved from excessive pain.[9] In *Sushruta Samhita*, it is mentioned that the commonest cause of pain is *Vata.*[10] Wound and pain are both co-existing features of trauma. Pain is a feeling of uneasiness. In *Ayurveda*, *Vedana* (pain), *Dukha* (unhappy), *Pida* (ache), *Shula* (pain),*Ruk* (pain), *Ruja* (mental pain), *Bheda* (cutting pain), *Sadana* (unhappiness), *Avasada* (depression)), are words used for pain. The seat of pain is *Mana* (psyche) and *Sharira* (body).In all cases of *Vatika* predominance, the chances of pain are quite common along with other clinical presentations of *Vatika* anomalies. In a normal state, *Vata* is responsible for the activation of several functions of different systems.[11]

According to *Ashtanga Hridaya*, *Sutrasthana* 12/49-50, derangement, displacement, dilatation, piercing pain, anaesthesia, lethargy, pricking and incising pain, constricting pain, breaking pain, twisting pain, excitation of the hair follicle and thirst due to severe pain, tremor, hardening, porosity, dryness, stimulation, spasm, distaste of mouth, black and reddish black discolouration are due to the *Vata.*

Types of pain in wound[9-10]

1*) Vatika Vedana*

2) Paittika Vedana

3) Kaphaja Vedana

4) Tridoshaja / Sannipataja Vedana

Management of Pain

The management of pain comprises a multifold approach. It can be categorized into local management and systemic management. The pain caused by traumatic lesions can be managed by local fomentation, irrigation, application of local medicament and bandaging. In *Ayurveda,* the term *Vedana* is more or less used for the feeling. It may be the feeling of well-being or the feeling of illness (*Sukhatamaka* and *Dukhatmaka).* In *Ayurveda,* there is no particular uniform medicine for any kind of pain. Management of pain depends upon the causative factor or *Doshika* predominance responsible for the pain. In conventional (allopathic) pain treatment, several analgesics, anti-inflammatory, antipyretic drugs, chemotrypsin and serratiopeptidase like chemicals and opioids are used. But there is no universal drug for all kinds of pain till date. Every individual responds to pain in a different way. In the same way, every analgesic chemical acts pharmacologically in a different way. Only one analgesic preparation cannot solve the problem of pain. So, the management of pain is not so simple and satisfactory with the aforesaid drugs. Instant pain relief is the motive *of Marma* therapy. Stimulation of *Marmas* can produce analgesia by secreting several prostaglandin inhibitors, endorphins, interferon and other opioid like substances which are a hundred times more potent than opium. Instant pain relief by *Marma* therapy is possible within no time.

Following *Marma* points are responsible for the relief of pain in different organs.

1. Shoulder pain -*Kshipra Marma* and *Kurpara Marma.*
2. Pain in abdomen –*Kurpara* and *Urvi Marma.*
3. Chest Pain -*Kurpara, Urvi* and *Ani.*
4. Cervical (neck) pain -*Kshipra, Kurpara, Ani Marma*
5. Leg and knee pain -*Kshipra, Gulpha*
6. Sciatic pain -*Kshipra, Gulpha*

Pain management aims at minimizing distress, feeling of unrest, and improving the quality of life. A cardinal point in the management of pain is that it should be holistic and patient centered in its application. This can be fulfilled through *Ayurvedic* approach only in terms of *Marma Chikitsa*

Technique of *Marma* Therapy

Marma therapy is an uncomplicated and easy-to-learn technique of regaining the vital energy.

Posture

For successful practice of self-*Marma* therapy, posture is important. The practitioner must remain steady, quiet and mentally alert during this practice. A sitting posture is most convenient for the practitioners. Usually one should assume a posture of cross-legged position, keeping the spine erect. Keep the hands on the knees in upward position or one can adopt the *DhyanaMudra.*

The most common postures for the practice of self-*Marma* therapy are;

1. Simple cross-legged posture (*Sukhasana*)
2. Lotus posture (*Padmasana)*
3. Half lotus posture (*ArdhaPadmasana)*
4. Diamond posture (*Vajrasana)*
5. Sitting posture on chair
6. Standing posture

In exceptional circumstances, lying down position (recumbent posture) may also be adopted. The practitioner can adopt any one of these postures during the self-*Marma* therapy practice. If one cannot adopt some specific posture, he can do practice in any posture anytime and anywhere. During the practice, one should try to keep the vertebral column erect and achieve the relaxation of the body musculature. In sitting and standing postures, keep the neck and spine in straight line without stiffness or tilting towards any direction. In standing posture, the feet should be parallel to each other. The arms should hang down loosely from the shoulder joints near to the body with open palms facing inwards with straightened fingers.

Pre therapy exercises

It comprises of the following steps

1. Total relaxation of body.
2. Deep breathing exercise.
3. Perception of body as whole.
4. Perception of psychic centers.
5. Perception of *Marma* points.
6. Gentle massage with thumb and fingers over the *Marma* points.

Then comes the actual therapy consisting of application of pressure with thumb or fingers over the *Marma* points.

Pressure - depends upon the nature of the *Marma* Stimulation time -0.8sec/ stimuli
Time -3 times per day

Repetition -15 to 18 times in single sitting.[11]

DISCUSSION

Marma Chikitsa is an important aspect of *Ayurvedic* treatment where the application of pressure or stimulation on these *Marma* points induces the flow of *Prana* (vital energy) along a complete system of subtle channels called *Nadis.* Massage is widely applied in the treatment *of Marmas. Marma Chikitsa* is used to treat the diseases of nervous system. It is beneficial to treat traumatic neurological or neurosurgical lesions, traumatic paraplegia, hemiplegia and monoplegia etc. In orthopedic lesions especially prolapsed intervertebral disc etc, it is helpful to reduce the pain of nerves, muscles, ligaments, bones and joints. It is also useful to improve the function of body organs for achieving homeostasis. *Marma Chikitsa* works on the neuro-endocrine system. Actually, due to pressure or stimulation over these points, certain chemical substances and neuro-transmitters are released like endorphins and enkephalin which send nerve impulses to brain causing the desired effect. Another theory states that the very small electrical changes that occur at *Marma* points are found to be capable of producing effect and responsible for triggering the desired effect. The Gate control theory of Pain is a mechanism in the spinal cord, in which pain signals can be sent up to the brain to be processed to accentuate the possible perceived pain, or attenuate it at the spinal cord itself. The 'gate' is the mechanism where pain signals can be let through or restricted. In *Ayurveda,* the term *Vedana / Shula* means an unpleasant feeling. Had it may be the feeling of well-being or the feeling of illness, the governance of all kinds of body sensations is the subject of the *Vata.* But during the vitiation of *Vata,* all these functions get disturbed and the excessive activity of vitiated *Vata* may cause pain sensation. From the above concept and according to the literature we can conclude that *Marmas* should be stimulated in every type of pain for its analgesic effect. Every *Marma* point has its measurement, hence this should be stimulated within their limits.

CONCLUSION

Marmas are the vital points that regulate our body functions. *Marmas* are considered as centers for the *Prana*. They can be used specifically for the diagnosis and treatment of disease or generally marma therapy is applicable for simple self- treatments to complex clinical procedures. *Marmas* are considered as main pillars of *Ayurvedic* clinical procedure. *Marma* therapy can be used along with all *Ayurvedic Chikitsa* like *Panchakarma* and *Yoga.* This helps to attain the effects of *Yoga* and *Pranayama.* This is the advance technique of *Ayurveda* related to diagnosis, treatment of particular disease and reduce pain. The present article shows the mode of action of *Marma Chikitsa*, as suggested in the literature. Looking to the special capability of *Marma Chikitsa* in treating all kinds of pain disorder, it can be concluded that *Marma* science, which is an extremely ancient field of practice, holds significant promise and is being used to maintain the vitality of the body and treatment of diseases. Pain is both sensory and an emotional experience, and patient's past experiences, fears and anxieties can play an important role in experiencing pain transmission as a result of complex peripheral and central processes. These processes can be modulated at different levels and pain perception is a result of the balance between facilitatory and inhibitory interactions. Current areas of interest in pain research include investigating the effect of mood on pain processing in the brain and looking for novel drugs to block channels involved in pain transmission.

Key points

1. The pain experienced by patients is a result of the interaction between sensory and emotional experiences.
2. Aδ fibres transmit rapid, sharp, localised pain.
3. C fibres transmit slow, diffuse, dull pain.
4. Pain transmission can be modulated at a number of levels, including the dorsal horn of the spinal cord and via descending inhibitory pathways.
5. The spino-thalamic and spino-reticular tracts are important ascending pain pathways.
6. Neuropathic pain can be spontaneous and is often described as burning, shooting, or stabbing.

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