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A REVIEW OF MARMA MANIPULATION AS A THERAPEUTIC MODALITY IN JANU SANDHIGATA VATA (KNEE OSTEOARTHRITIS)

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ABSTRACT

Background: Janu Sandhigatavata Vata, clinically correlated with Knee Osteoarthritis, is a chronic degenerative musculoskeletal disorder characterised by Shoola (pain), Shotha (swelling), Stabdhata (stiffness), Atopa (crepitus), and progressive functional disability of the knee joint. Ayurveda describes Janu Sandhigata Vata as a Vatavyadhi predominantly involving the degeneration of Sandhi (joints) due to aggravated Vata Dosha and leading to deterioration of knee joint function. The increasing prevalence of Janu Sandhigata Vata among the ageing population has created a growing demand for safe, cost-effective, and non-invasive therapeutic interventions. Among various Ayurvedic therapeutic modalities, Marma Chikitsa has gained attention for its holistic approach to musculoskeletal disorders.

Objective: To review the therapeutic role of Marma Manipulation in the management of Janu Sandhigata Vata (Knee Osteoarthritis) by critically evaluating classical Ayurvedic concepts, contemporary scientific evidence, and the proposed mechanisms underlying its clinical effects.

Methods: A review was conducted using classical Ayurvedic texts, including the Sushruta Samhita, Charaka Samhita, and Ashtanga Hridaya, as well as peer-reviewed scientific literature retrieved from databases such as PubMed, Google Scholar, and the AYUSH Research Portal. Relevant evidence on Marma therapy, knee osteoarthritis, manual therapy, and pain modulation was critically reviewed and synthesised.

Results: Classical Ayurvedic literature describes Marma as vital anatomical and physiological sites where muscles, vessels, ligaments, bones, and joints converge and where Prana and Tridosha are predominantly established. Therapeutic stimulation of these points is believed to regulate Vata Dosha, improve tissue nourishment, and restore joint function. Contemporary evidence suggests that Marma Manipulation may exert its therapeutic effects through multiple mechanisms, including modulation of pain via the Gate Control Theory, activation of endogenous analgesic pathways, enhancement of local circulation, reduction of inflammatory mediators, relaxation of muscles, and enhancement of functional mobility and improvement in quality of life (QOL). Clinical studies reviewed consistently demonstrate improvements in pain, stiffness, range of motion, WOMAC scores, and overall functional outcomes in patients with Janu Sandhigata Vata.

Conclusion: Marma Manipulation represents a promising integrative therapeutic approach whose proposed mechanisms are supported by both classical Ayurvedic concepts and contemporary biomedical evidence. Further large-sample-size randomised controlled trials are required to strengthen the current evidence and facilitate the incorporation of Marma Manipulation into evidence-based management of Janu Sandhigata Vata (Knee Osteoarthritis). Overall, Marma Manipulation appears to be a safe, promising, non- invasive, cost–effective and clinically relevant therapeutic approach for the management of Janu Sandhigata Vata (Knee Osteoarthritis).

KEYWORDS: Janu Sandhigata Vata, Knee Osteoarthritis, Marma Chikitsa, Marma Manipulation

INTRODUCTION

Osteoarthritis (OA) is one of the most prevalent chronic musculoskeletal disorders and a major contributor to pain, functional limitation, and disability worldwide. The Global Burden of Disease (GBD) 2021 study estimated that approximately 607 million people were living with osteoarthritis globally in 2021, with around 46.6 million incident cases and 21.3 million years lived with disability (YLDs)i. Knee osteoarthritis represents the largest proportion of the global osteoarthritis burden and is particularly important because impairment of the knee directly affects mobility, physical function, and independenceii.

Osteoarthritis is no longer considered merely a disease of progressive articular cartilage “wear and tear”. Contemporary understanding recognizes it as a whole joint disorder involving interactions among articular, subchondral bone, synovium, ligaments, periarticular muscles, and other connective tissues. These structural and biological alterations interact with mechanical loading and nociceptive mechanisms to produce pain, stiffness, swelling, restricted range of

motion, and functional impairementiii. Current evidence based management of knee osteoarthritis emphasizes exercise, weight management where appropriate, patient education, self-management, and other non-pharmacological interventions, with pharmacological and surgical approaches used according to disease severity and individual clinical requirements. Although pharmacological[1] treatment may provide symptomatic relief, long-term management may be complicated by contraindications, adverse effects, treatment adherence, and incomplete restoration of physical function. Consequently, there is increasing clinical and research interest in complementary therapeutic approaches that may be integrated with established conservative management strategies. Manual therapeutic approaches are recognized within contemporary osteoarthritis care, although current guidelines emphasise that manual therapy should be used as an adjunct to therapeutic exercise rather than as a stand-alone treatment.
Within the Ayurvedic framework, the clinical manifestation of knee osteothritis maybe correlated with Janu Sandhigata Vata , a condition described within the spectrum of vata vyadhi. Classical Ayurvedic descriptions emphasise the involvement of vata in the Sandhi (joint), producing characteristic manifestations including pain, swelling, crepitus, and painful or restricted joint movements. The classical description of Sandhigata vata therefore provides a conceptual basis for understanding a clinical condition characterised predominantly by pain and impairment of joint function.

BACKGROUND

Marma

The concept of Marma occupies an important position in the ayurvedic understanding of human anatomy and vital physiology. The term Marma is traditionally derived from the Sanskrit root "Mr (मृ)," associated with death, injury, or a vulnerable vital siteiv. Acharya Sushruta describes Marma as sites formed by the convergence of mamsa (muscle), sira (vascular channels), snayu (ligamentous/tendinous structures), asthi (bone) and Sandhi (joint), in which prana is particularly establishedv

मम्माण न्म म्सासर्स्नाबसाससथिस्◌्◌, ◌्◌ेषु स्◌भ् एभ थभशेषेण प्णाणसात; ◌्स्मममस-थ्ह्◌ण्ण्न् ◌्◌भ्न्सदते ।। (Su.Sh.6/16)

Thus, the classical description of Marma emphasize that these sites are not merely isolated anatomical points but represent anatomically and functionally significant regions in which multiple tissue structures converge. Acharya vagbhata similarly describes, Marmas are the sites where muscles, bones, ligaments, arteries, veins, and joints meet, and Prana is located there. Those sites which are painful on application of pressure and which show abnormal pulsation are known as Marmasvi.According to Acharya Dhalhan explains the importance of Marmas is explained as "म्र◌े अनेन इथ् मम्म", that means any trauma to these points may lead to disability or even deathvii.

Sandhigata Vata

Sandhigata Vata is a type of Vata vyadhi which commonly occurs in old age due to Vata vitiation
and depletion of body tissues (Dhatus). The disease was described by Acharya Charaka by the name of 'Sandhigata Anila' in Vata Vyadhi,

भ्◌ूणमणथ्तशम शोथ सासध्◌ेतथनने । पस्रण्णुकनरो पभृथृत सभेदन् ॥ (Ch.Chi.28/37)

Vata purana driti sparsha (sounds resembling those made when we rub against a balloon), Shotha (Swelling) in joints, Vedana during prasarana and akunchana (pain during flexion and extension) viii
According to Acharya Sushruta

भ्◌◌े सासथा शून शोफ सासपस्रण्णुकनरो पभृथृ।भ्◌ूणमणथ्तशद हात सासध् सद्॥(Su.Ni.1/29)

When Vata enters and resides in a joint (Sandhi), it produces Shoola (pain), Shotha (Swelling), and difficulty during Prasarana (extension) and Akunchana (flexion) of the affected joint. The joint also exhibits a characteristic sensation known as Vatapurna Driti Sparsha, meaning that on palpation it feels like a leather bag filled with air, which clinically corresponds to crepitus or a rough, crackling sensation produced due to degeneration of the articular surfaces. As the disease progresses, these symptoms lead to marked restriction of joint mobility and impairment of normal function.

Marma Manipulation Technique

The identified Marma sites are systematically stimulated under standardized conditions to ensure consistency of the therapeutic procedure. Marma manipulation is performed preferably on an empty stomach or at least three hours after food intake, thereby avoiding discomfort associated with manipulation soon after a meal. The individual is positioned comfortably, with adequate exposure and support of the area to be treated. Each selected Marma site is accurately identified according to its anatomical landmarks before stimulation. The manipulation is performed using the thumb, with the other hand providing appropriate support to maintain stability and controlled application of pressure is applied directly over the identified Marma site and repeated 18 to 20 times at each site. The pressure duration is comparable to the normal cardiac cycle, which is euivalent to 0.8 sec. The frequency of stimulation is synchronised with the individual's breathing pattern, allowing the stimulation to be performed in a slow and rhythmic mannerix. The intensity of pressure is maintained within the patient's comfort level, avoiding excessive force or discomfort. Pressure is

appreciable but tolerable.

Parameters	SK Joshi -derived methodology
Pressure duration	0.8 sec (similar to 1 cardiac cycle time)
Frequency/Repetition rate	16-18 times/min. (similar to respiratory rate)
Each Marma site	18- 20 times each site
Session/day	3 session/day
Session duration	5 min./session

LITERATURE SEARCH METHODOLOGY

A comprehensive narrative literature search was conducted to identify and synthesise evidence related to the therapeutic role of Marma Manipulation in Janu Sandhigata Vata (Knee osteoarthritis). Classical Ayurvedic literature was reviewed using authoritative texts, including Sushruta Samhita, Charaka Samhita, and Ashtang Hridya, to understand the concepts of Marma, Sandhigata Vata, and their therapeutic significance. Contemporary scientific literature was retrieved from electronic databases, including PubMed, Google Scholar, Scopus, and the AYUSH Research Portal. Additional relevant references were identified through the reference lists of selected articles and standard textbooks on Marma, pain modulation, manual therapy, and musculoskeletal rehabilitation.The literature search included combinations of the following keywords and Medical Subject Headings MeSH), where applicable; “Marma Therapy,” “Marma Manipulation,” “Sandhigata vata,” “Janu Sandhigata Vata” “Knee osteoarthritis,” “Manual Therapy,” “Pain modulation,” “Gate control Theory,” “Endogenous Analgesia,” “Mechanotransduction”, “Activation of descending inhibitory pathways”, “Massage therapy”. Boolean operators (AND and OR) were used to refine the search strategy. Peer-reviewed original research articles, review articles, clinical trials, observational studies, and relevant classical and contemporary textbooks were considered. Studies unrelated to the review objectives, without sufficient data, duplicate publications, and lacking scientific relevance were excluded.

DISCUSSION

Janu Sandhigata Vata is a degenerative musculoskeletal condition which can be clinically correlated with knee osteoarthritis, characterized by pain, stiffness, swelling, crepitus, restricted joint movement, and functional impairment of the knee joint. Although several pharmacological, physical, and surgical treatment modalities are available for the management of knee osteoarthritis, Marma Chikitsa represents a safe, promising, non- invasive, cost–effective and clinically relevant therapeutic approach. The present review attempts to explain the therapeutic effects of Marma Manipulation in Sandhigata Vata (Knee Osteoarthritis) by integrating classical Ayurvedic concepts with contemporary scientific evidence. Although the exact mechanisms underlying Marma Chikitsa remain incompletely understood, both Ayurvedic literature and modern theories suggest several plausible pathways through which Marma stimulation may reduce pain and improve joint function.The available clinical evidence also supports the beneficial role of Marma Chikitsa in the management of knee osteoarthritis. A Case study by Mane et al. (2023) provides preliminary clinical observations regarding the use of Marma Chikitsa in Janu Sandhigata Vata. The intervention involved stimulation of seven Marma points of the lower limb, namely Kshipra, Kurcha, Gulpha, Indrabasti, Janu , Aani, and Lohitaksha Marma. Pressure was applied using the fingertips and thumb with approximately ¼ Matra pressure, exerted from the physician's wrist. Each compression lasted 0.8 seconds, corresponding to the normal heart rhythm, and was repeated 16–18 times at each Marma point, matching the patient's respiratory rate. Each treatment session lasted approximately 15 minutes, with two sessions administered daily for one month. A progressive improvement was observed in both subjective and objective clinical paramaeters during the treatment and followlw up period. The subjective parameters showed a reduction in Sandhi Shoola (pain) from grade 3 on the 7th day to grade 1 on the 28th day and grade 0 by the 35th day, with the improvement maintained at the 42nd day. Similarly, Sandhi Shotha(Swelling) decreased from grade 3 to grade 1 and subsequently to grade 0. Sandhi Stabdhata(stiffness) decreased from grade 1 to grade 0 by the 28th day, while no crepitus was reported during the observation. The WOMAC pain score decreased from 10 to 1 , the WOMAC stiffness score from 3 to 0, and the WOMAC physical function score from 40 to 5 by the 42nd day. The ROM and Walking time parameters also improved to grade 0 during follow-up. The authors additionally reported an improvement in the radiographic appearance of the medial joint space gap on the post treatment X-ray compared with the pre-treatment reportx.Similarly, a single case study by Asthana et al. (2024) evaluated the effectiveness of Marma Chikitsa in the management of Sandhivata (knee osteoarthritis) in a 52-year-old female with a one-year history of knee pain, stiffness, swelling, crepitus, and restricted movements. The intervention consisted of stimulation of Janu Marma, Indrabasti Marma, and Gulfa Marma, with each Marma stimulated for approximately 0.8 seconds, 15–18 times per sitting, three times daily for 21 days, using steady and moderate pressure. Clinical assessment included pain, swelling, stiffness, crepitus, and restricted joint movements. Following 21 days of Marma therapy, the patient demonstrated marked clinical improvement, with pain decreasing from grade 4 to 0, swelling from grade 4 to 2, stiffness from grade 4 to 1, crepitus from grade 3 to 0, and restricted movements from grade 4 to 1xi.Likewise, a single case study by Yogi et al. (2025) evaluated the effectiveness of Marma Chikitsa in the management of knee osteoarthritis in a 51-year-old male presenting with unilateral knee pain, swelling, tenderness, crepitus, stiffness, restricted movements, and a history of persistent symptoms for seven months despite analgesic therapy. The intervention consisted of stimulation of four Marma points—Indrabasti, Gulpha, Janu , and Talahridaya Marma—using steady and moderate manual pressure. Each Marma point was stimulated for 0.8 seconds, repeated 15–18 times, once daily for 21 days, with pressure gradually increased according to the patient's tolerance. After completion of the 21-day treatment, all assessed parameters

demonstrated marked clinical improvement. Pain, swelling, stiffness, crepitus, and restricted movement decreased from Grade 3 to Grade 1, while the VAS score improved from 4–6 to 2–4, indicating substantial reduction in pain intensity and improvement in joint functionxii.Similarly, Bhadage et al. (2017) conducted an observational clinical study to evaluate the effectiveness of Marma Therapy (Suchi Vedhana Karma) in the management of osteoarthritis. The study included 37 patients (9 males and 28 females) with osteoarthritis associated pain who received treatment over six months. The intervention involved identifying the maximum tender point nearest to the affected Marma and performing Suchi Vedhana Karma using a 26-gauge disposable needle. The number of treatment sessions varied according to the patient's clinical condition and localization of pain. The primary outcome measure was pain intensity, assessed using a categorical numerical rating scale (1–10), where 1 represented no pain and 10 represented severe pain. Before treatment, the majority of patients experienced severe pain, with 9 patients scoring grade 10 on the pain scale. Following Marma therapy, 10 patients reported pain grade 2, while 9 patients became pain-free (grade 1). Overall, 15 patients achieved complete resolution of pain and associated symptoms, 20 patients experienced partial improvement, and 2 patients showed no clinical improvement. Furthermore, the authors reported complete improvement in overall health status in 22 patients, partial improvement in 13 patients, and no improvement in 2 patientsxiii. Mishra and Shrivastava (2020) conducted a single-group pre–post experimental study involving 20 patients to evaluate the efficacy of Marma Therapy combined with Janu Basti (Ksheerbala Taila) in the management of Janu Sandhigata Vata (knee osteoarthritis). The intervention consisted of stimulation of Kshipra, Gulpha, Indravasti, and Janu Marma, along with Janu Basti using warm Ksheerbala Taila retained over the affected knee for 35–40 minutes, followed by Nadi Sweda. Marma therapy was administered by applying tolerable pressure with the fingertips and thumb for 0.8 seconds per compression, repeated 18–20 times at each Marma point, three sessions daily for 9 days, followed by a one-month follow-up during which patients continued self-administered Marma therapy and massage. The intervention produced highly significant improvements ($p < 0.001$) in all clinical outcome measures. The mean WOMAC score decreased from 54.93 ± 1.85 to 16.63 ± 1.97, representing a 69.73% improvement ($p < 0.001$). Joint pain (Sandhi Shoola) decreased from 3.10 ± 0.09 to 1.03 ± 0.13 (66.77% improvement; , $p < 0.001$), joint swelling (Sandhi Shotha) from 2.13 ± 0.13 to 0.40 ± 0.10 (81.22% improvement; $p < 0.001$), joint stiffness (Sandhi Stabdhata) from 2.40 ± 0.19 to 0.47 ± 0.10 (80.42% improvement; $p < 0.001$), and crepitus (Sandhi Atopa) from 1.83 ± 0.13 to 1.23 ± 0.13 (32.79% improvement; $p < 0.001$). Objective assessment also demonstrated significant improvement in range of motion (44.43% improvement; $p < 0.001$) and walking time (95.24% improvement; $p < 0.001$). The WOMAC subscales further showed significant reductions in pain (74.35%; $p < 0.001$), stiffness (80.79%; $p < 0.001$), and physical function (67.44%; $p < 0.001$). However, no appreciable radiographic changes were observed after completion of therapyxiv.A Randomized open-label comparative study by Shanmugaloga and Shilpa (2026) compared the efficacy of Marma Chikitsa and Agnikarma in the management of Janu Sandhigata Vata (knee osteoarthritis), involving 40 patients randomly allocated into Marma Chikitsa ($n = 20$) and Agnikarma ($n = 20$) groups. Marma Chikitsa was administered on alternate days for 14 days, whereas Agnikarma was performed in three sittings at 7-day intervals over 17 days, followed by a one-month follow-up. The Marma intervention involved rhythmic stimulation of Ani, Janu , and Indrabasti Marmas using standardised pressure techniques synchronised with the patient's physiological rhythm. Treatment efficacy was assessed using subjective parameters including pain (VAS), stiffness, and WOMAC score, together with objective measures of tenderness and knee range of motion. Both treatment groups demonstrated significant within-group improvement across all clinical parameters. Between-group analysis revealed comparable outcomes for pain, WOMAC score, tenderness, and range of motion ($p > 0.05$), while Marma Chikitsa produced significantly greater improvement in stiffness at the end of treatment (AT2; $p = 0.041$). These findings suggest that Marma Chikitsa is an effective, non-invasive intervention for knee osteoarthritis and may offer additional benefit in reducing joint stiffness while providing clinical outcomes comparable to Agnikarma in other functional parametersxv.

An important observation across all published studies is the remarkable uniformity of the Marma stimulation protocol. Most of the investigators applied steady, moderate manual pressure for approximately 0.8 seconds, repeated 15–20 times at each Marma point in synchronization with the patient's physiological rhythm. Such similarity in the method of stimulation is noteworthy because it suggests that the therapeutic effect may depend not merely on the anatomical location of the Marma, but also on the manner, intensity, duration, and repetition of mechanical stimulation.

Author/yea r	**Marma**	**Stimulatio n time**	**Frequency**	**Sessio n/day**	**Duration**	**Follow up**
Mane et al., 2023	7 -Kshipra, Kurcha, Gulpha, Indrabasti, Janu , Aani, and Lohitaksha	0.8 sec	16-18 times	2 times/ day	28 days	Day 42 and Day 56 from start 2 weeks and 4 weeks after treatment
Asthana et al.,2024	3-Gulpha, Indrabasti, Janu	0.8 sec	15-18 times	3 times/ day	21 days	Not reported
Yogi et al., 2025	4-Gulpha, Indrabasti, Janu, Talahri	0.8 sec	15-18 times	Once in a day	21 days	Not specified

Bhadage et al.,2017	Tender point nearest to Marma	No manual pressure, suchi vedhana (26 no. needle)	Not specified	Not specifi ed	Variable; to >30 treatments reported	Not specified
Mishra et al.,2020	4-Gulpha, Indrabasti, Janu ,kshipra	0.8 sec	18-20 times	3 times/ day	9 days	Day 24 and 39; 6month verbal feedback also reported.
Shanmugalo ga et al.,2026	3- Aani,Indraba sti, Janu	0.8 sec	Not specified	Altern ate days	14 days	Follow-up reported after treatment; exact follow-up schedule should be Kept as Reported in the article

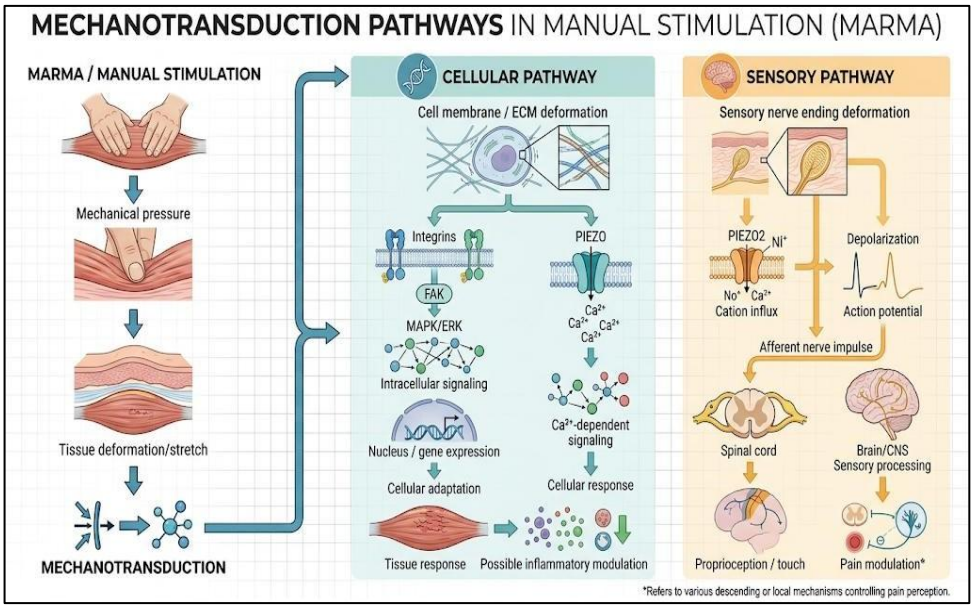
The repeated and rhythmically controlled application of pressure during Marma manipulation may provide a consistent mechanical and sensory stimulus to the underlying cutaneous, neuromuscular structures. Repeated pressure-release cycles may activate mechanosensitive and nociceptive afferents and thereby modify peripheral and central sensory processing. The use of tolerable pressure and brief, repeated application may further permit mechanical stimulation without prolonged tissue compression. In addition, the anatomically targeted nature of Marma stimulation provides a plausible basis for localised neurosensory and vascular responses. Although synchronisation of stimulation with cardiac or respiratory rhythms has been described in certain Marma protocols, its specific physiological advantage has not yet been established experimentally. Therefore, these mechanisms should currently be considered plausible hypotheses that require confirmation through studies incorporating objective measures such as pressure quantification, heart rate variability, local blood flow, electromyography and quantitative sensory testing. Another important observation from the study by Bhadge et al. (2017) is the use of Suchi Vedhana as an alternative, needle-based method of Marma stimulation in Janu Sandhigata Vata . In this study, the maximally tender point over the affected knee, located nearest to the Marma, was identified and punctured using a disposable No.26 needle.The authors distinguished Suchi Vedhana from Siravedhana, stating that the procedure was intended to stimulate minute capillary structures without intentional bloodletting. The use of needle-based stimulation at Marma points has also been described by Frawley et al. as Suchi karma under the instrumental methods of Marma therapy. They relate it to the Ayurvedic concept of Bhedana Karma (Puncturing)and Suchi veda. They further describe the use of fine needles and state that, for balancing the doshas, the sensitive point nearest the centre of the Marma may be puncturedxvi. Lad and Durve, in Marma points of Ayurveda, similarly, recognise Suchi Bharana(Puncturing with needles) among the methods of Marma stimulationxvii. Further, Frank Ros, in Ayurveda and Acupuncture, developed the concept of Marmapuncture or Ayurvedic acupuncture as a needle-based therapeutic approach. His framework emphasises selection of Marma/Sira points according to the patient's Ayurvedic assessment,including consideration of Vata, Pitta, and Kapha, as well as the five Vayus and Prana.

Therefore,the therapeutic rationale of Marmapuncture extends beyond local mechanical stimulation and is conceptualized with in the broader Ayurvedic framework of regulating functional imbalancexviii.Another observation from the study by Mane et al. (2023), quantified the stimulation intensity descriptively as approximately ¼ Matra pressure, applied through the fingertips and thumb with force generated from the physician's wrist. However, the study did not provide an operational definition or objective measurement method for this pressure value; therefore, the reproducibility and inter-practitioner comparability of the reported ¼ Matra intensity remain uncertain. Furthermore, Janu Marma was included in every clinical study, while Indrabasti and Gulpha Marmas were the next most frequently stimulated points. Additional Marma points, including Ani, Kshipra, Lohitaksha, Kurcha, and Talahridaya, were selected according to the extent of pathology and the functional anatomy of the lower limb. The use of multiple Marmas in treatment of Janu Sandhigata Vata may provide a comprehensive therapeutic effect. This approach may help address the functional involvement of the entire lower limb region rather than focusing only on the painful knee joint. Thus, the multi-Marma approach represents an important therapeutic feature of the intervention.

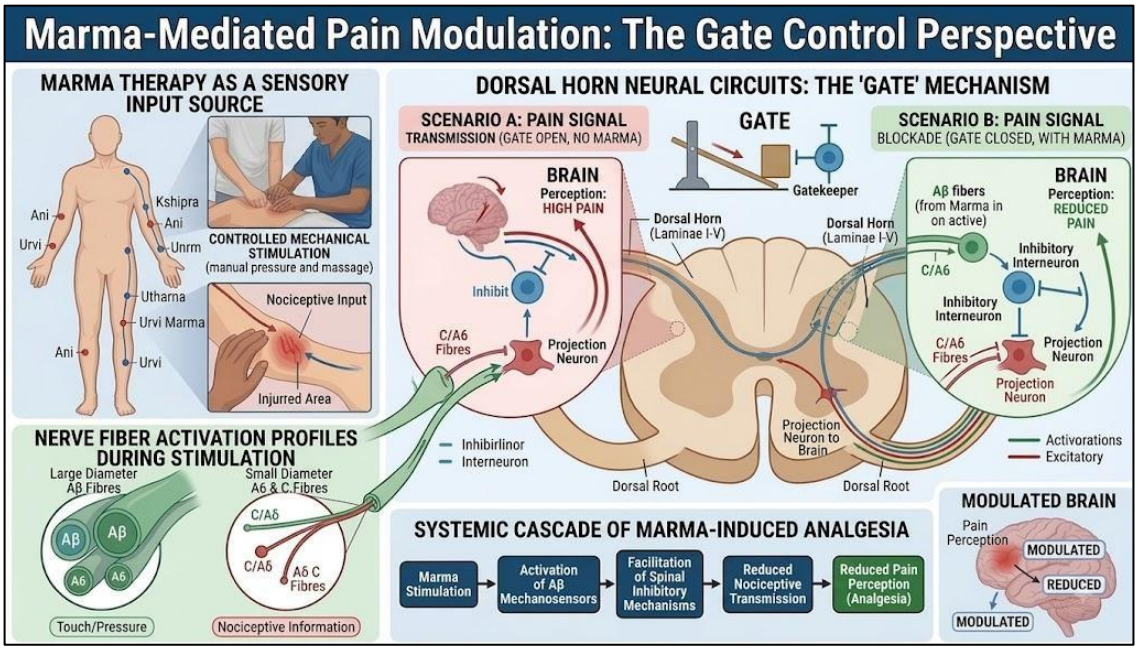
<table>
<tr><th>Study</th><th>Pain assessment</th><th>Before treatment</th><th>After -treatment</th><th>Follow up</th></tr>
<tr><td>Mane et al. (2023)</td><td>Sandhi Shoola grading (0 to 4), WOMAC pain index</td><td>Not mentioned
But at the 7th day
Sandhi Shoola -3
WOMAC-10</td><td>At the 28th day
Sandhi Shoola-1
WOMAC - 4</td><td>At the 35th and 42nd<table><tr><td>Day</td><td>Shoola</td><td>WOMAC</td></tr><tr><td>35th</td><td>0</td><td>0</td></tr><tr><td>42nd</td><td>2</td><td>1</td></tr></table></td></tr>
<tr><td>Asthana et al.,2024</td><td>Sandhi Shool grading (0to 4)</td><td>4</td><td>0 (21st day)</td><td>Not mentioned</td></tr>
<tr><td>Yogi et al., 2025</td><td>Sandhi Shoola grading (0 to 4), VAS Scale</td><td>Sandhi Shoola – 3
VAS Scale range- 4-6</td><td>At the 21st day Sandhi Shoola -1 VAS Scale range- 2 - 4</td><td>Not mentioned</td></tr>
<tr><td>Bhadage et al.,2017</td><td>Sandhi Shoola grading (0 to 10)</td><td><table><tr><td>Grade</td><td>No.of patient</td></tr><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>0</td></tr><tr><td>3</td><td>0</td></tr><tr><td>4</td><td>4</td></tr><tr><td>5</td><td>6</td></tr><tr><td>6</td><td>3</td></tr><tr><td>7</td><td>3</td></tr><tr><td>8</td><td>7</td></tr><tr><td>9</td><td>4</td></tr><tr><td>10</td><td>9</td></tr></table></td><td><table><tr><td>Grade</td><td>No. of patient</td></tr><tr><td>1</td><td>9</td></tr><tr><td>2</td><td>10</td></tr><tr><td>3</td><td>5</td></tr><tr><td>4</td><td>6</td></tr><tr><td>5</td><td>5</td></tr><tr><td>6</td><td>0</td></tr><tr><td>7</td><td>0</td></tr><tr><td>8</td><td>1</td></tr><tr><td>9</td><td>1</td></tr><tr><td>10</td><td>o</td></tr></table></td><td>Not mentioned</td></tr>
<tr><td>Mishra et al.,2020</td><td></td><td>3.10± 0.09</td><td>1.83±0.13 (9th day) (p < 0.001)</td><td>At the 24th and 39th<table><tr><td>Day</td><td>Value</td></tr><tr><td>24th</td><td>1.43</td></tr><tr><td>39th</td><td>1.03</td></tr></table></td></tr>
<tr><td>Shanmugaloga et al.,2026</td><td>VAS Scale</td><td>19.20</td><td>18.25 (at 14th day)</td><td>Not mentioned)</td></tr>
</table>

Across the reviewed Marma studies, pain was repeatedly evaluated as a principal clinical outcome, either through the grading system, WOMAC pain index, or VAS Scale. This consistency suggests that pain relief represents one of the primary therapeutic outcomes investigated in Marma Chikitsa for Janu Sandhigata Vata . The analgesia effect of Marma Chikitsa may be explained through both Ayurvedic and modern neurophysiological mechanisms. From an Ayurvedic perspective, stimulation of Marma is proposed to regulate Vata and Prana Vayu, thereby reducing Shoola and restoring functional balance. From a modern perspective, mechanical stimulation activates cutaneous and deep mechanoreceptors, generating afferent sensory input that may modulate nociceptive transmission through the Gate Control mechanism. It may also facilitate descending inhibitory pain pathways and endogenous analgesic mechanisms, thereby reducing pain perception. Also, an important observation is that the therapeutic effect of Marma stimulation may persist beyond the active treatment period. Mane et al. (2023) reported continued improvement in subjective and objective parameters during follow-up periods after completion of therapy. This suggests that Marma may produce effects that are not limited to immediate analgesia.Another important finding is that the improvements reported across these studies extend beyond pain relief. Most investigators documented simultaneous reductions in stiffness, swelling, crepitus, and movement restriction, together with improvements in walking ability, joint mobility, and functional performance. Such multidimensional improvement suggests that Marma Therapy acts through multiple therapeutic mechanisms rather than a simple analgesic effect. The improvement in walking ability, knee range of motion, and WOMAC scores observed in several studies indicates that Marma Therapy may facilitate restoration of functional independence in patients with knee osteoarthritis. Since impairment in mobility is one of the principal causes of disability in osteoarthritis, improvements in these functional parameters are clinically meaningful and suggest that Marma Therapy may enhance the performance of daily activities and improve overall quality of life.Another observation: in the study by Mishra and Shrivastava, Marma therapy was administered together with Janu Basti, Ksheerbala Taila, Nadi Sweda and subsequent self-administered Marma therapy and massage. Consequently, the observed improvement cannot be independently attributed to Marma stimulation. Such multimodal interventions may demonstrate overall therapeutic effectiveness but do not establish the specific efficacy of Marma therapy. Another finding is that the reported improvement in medial joint space appearance in the case study is noteworthy but should be interpreted cautiously. A change in radiographic joint space width over a short therapeutic interval does not by itself establish structural cartilage regeneration, particularly in the absence of standardized weight- bearing radiography, quantitative joint space measurement and blinded radiographic assessment. Future studies should use standardised imaging protocols and validated structural outcomes before attributing radiographic changes to disease modification.Another noteworthy observation is the favourable safety profile of Marma

Chikitsa. None of the reviewed clinical studies reported serious adverse events or treatment-related complications. Unlike prolonged pharmacological therapy, which is frequently associated with gastrointestinal, renal, and cardiovascular adverse effects, Marma Therapy appears to be a safe, non-invasive, and well-tolerated intervention when performed using standardised techniques. This favourable safety profile makes it particularly suitable for elderly patients requiring long-term conservative management. From an Ayurvedic perspective, Sandhigata Vata is a vyadhi in which Vata accumulates in Sandhi(joint), which develops pain, swelling, stiffness, crepitus and impairment in functional movements. Acharya Sushruta described Marmas as vital anatomical sites where Soma (Kapha), Maruta (Vata), Tejas (Pitta), the three Gunas (Sattva, Rajas, and Tamas), and Bhutatma (vital consciousness) are predominantly establishedxix.The above description highlights that the Marmas are not merely anatomical junctions but rather vital functional centres responsible for maintaining life and physiological homeostasis. The presence of Maruta (Vata), along with Tejas (Pitta) and Soma (Kapha), indicates the intimate association of Marmas with the Tridosha. Since Vata is the principal Dosha governing movement, its disturbance plays a central role in the pathogenesis of Sandhigata Vata. Based on this classical concept, Marma Chikitsa is considered a therapeutic intervention aimed at influencing these vital points through gentle and systematic stimulation. Such stimulation is proposed to restore the normal physiological activity of Vata at the local and systemic levels, thereby helping to reduce pain (Shoola), stiffness (Stabdhata), restricted joint movements, and functional disability. Furthermore, because Marmas are regarded as sites where the Tridosha, Prana, and vital body structures converge, stimulating them is believed to facilitate physiological balance and promote the body's inherent healing mechanisms. Again, Acharya Sushruta, describes that the four types of Sira (vascular channels) are primarily located at the Marmas. From there, they nourish the Mamsa (muscles), Snayu (ligaments/tendons), Asthi (bones), and Sandhi (joints)xx.This description emphasises that Marma points are anatomically and functionally important regions where vital vascular structures are concentrated. The nourishment supplied through these vascular channels sustains the surrounding muscles, ligaments, bones, and joints. Based on this classical concept, therapeutic stimulation of Marma points is proposed to enhance local tissue nourishment, improve circulation, support tissue repair, and maintain joint function. Although these effects are interpreted from Ayurvedic principles highlights the nourishing role of the Sira associated with Marmas.From a contemporary science perspective, the methodology of Marma stimulation can be viewed as a form of localized, controlled mechanical stimulation of tissues containing sensory, muscular, fascial and vascular structures. The repeated pressure-release pattern described in Marma therapy has relevance to modern manual therapy. There are several modern theories that state a plausible neurophysiological explanation for the therapeutic effects of Marma Manipulation. From a modern neurophysiological perspective, pain perception is a dynamic and multilevel process extending from peripheral nociceptive detection to spinal transmission, ascending pathways, brainstem modulation, cortical processing, descending pathways then pain perception. At each level, nociceptive information is subject to excitatory and inhibitory influences. Different proposed mechanisms such as mechanotransduction, Spinal gating through non -nociceptive sensory input, activation of descending inhibitory pathways, and engagement of endogenous analgesic systems may influence nociceptive processing at different levels of the nervous system. Thus, Marma stimulation may potentially reduce pain by modulating nociceptive transmission and central pain processing at peripheral, spinal and Supraspinal levels. Firstly, Mechanotransduction represents a potential cellular and neurophysiological mechanism through which mechanical force, such as stretch, compression, stimulation, or deformation, is converted into an electrical or biochemical signal within cells or sensory neurons. The application of mechanical force produces deformation or changes in tension within the cell membrane, extracellular matrix(ECM) and cytoskeleton. This mechanical deformation is detected by mechanosensitive structures, particularly mechanosensitive ion channels such as PIEZO1 and PIEZO2xxi, as well as mechanically sensitive cell matrix involving integrins. PIEZO channels can respond to mechanical deformation by opening and allowing cations to enter the cell, thereby generating changes in membrane potential and intracellular signalingxxii. PIEZO2 is particularly important in sensory mechanotransduction and has been demonstrated to play a major role in touch and proprioception, including the detection of stretch in muscle spindles and Golgi tendon organs.In parallel, mechanical forces can be transmitted from the extracellular matrix to the intracellular cytoskeleton through integrins and focal adhesions, resulting in activation of signaling molecules such as focal adhesion kinase(FAK) and downstream MAPK/ERK pathways.Mechanical stimulation can therefore be converted into intracellular biochemical signals that influence cellular activity, gene expression, metabolism, tissue adaptation and inflammatory responsesxxiii.Mechanical stimulation may activate Aβ low-threshold mechanoreceptors through mechanotransduction mechanisms involving mechanosensitive ion channels such as PIEZO2xxiv. Experimental evidence in human muscle has demonstrated that massage can increase phosphorylation of FAK and ERK1/2, supporting the ability of mechanical manipulation to activate mechanotransduction-related intracellular signaling. In the same study, massage was associated with the attenuation of NF-kB signaling and reduced inflammatory cytokine responses, suggesting that mechanical stimulation can influence downstream cellular inflammatory processesxxv. In the context of Marma manipulation in Janu Sandhigata Vata, mechanotransduction may activate cellular and sensory pathways that reduce pain and inflammation in the knee joint and promote overall improvement in joint function.

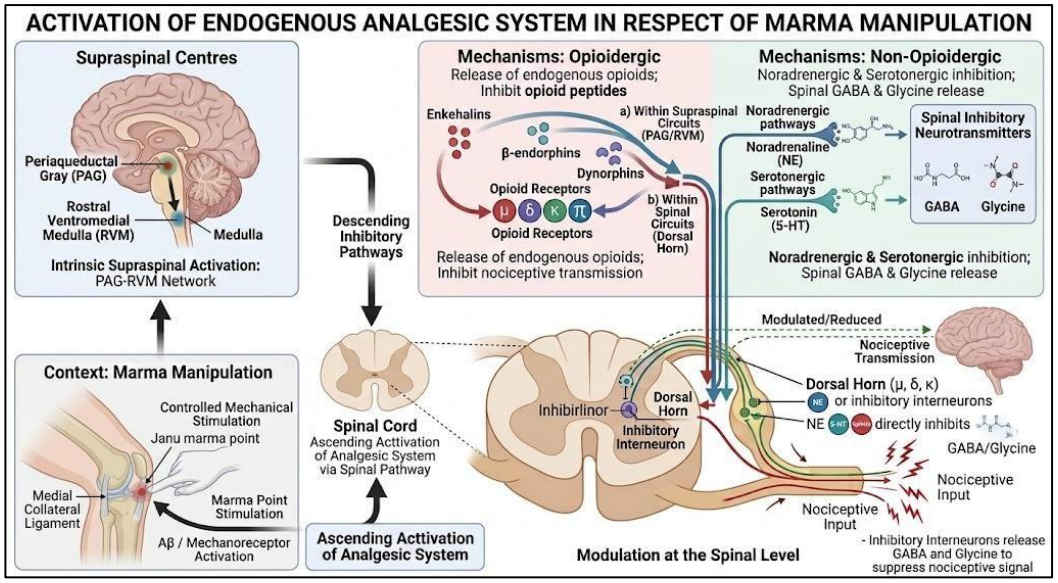


Another theory is “Gate Control Theory of pain” proposed by Melzack and Patrick Wall in 1965, provides a neurophysiological framework for understanding how nociceptive transmission can be modulated at the level of the spinal cord. According to the theory, sensory information from peripheral tissues is transmitted to the dorsal horn of the spinal cord through different classes of afferent nerve fibres. Aδ and C fibres primarily convey nociceptive information, whereas large diameter Aβ fibres predominantly transmit non-nociceptive mechanical sensations such as touch and pressure. Increased activity of large-diameter Aβ facilitate inhibitory mechanisms within the dorsal horn, thereby reducing the transmission of nociceptive information carried by A δ and C fibres. Thus, mechanical stimulation such as touch, pressure, or massage may produce analgesic effects through modulation of spinal nociceptive processing. In the context of Marma Manipulation, controlled mechanical stimulation of specific Marma points may activate mechanosensory afferents and, consequently, influence spinal inhibitory mechanisms, reducing nociceptive transmission and thereby decreasing the perception of pain. Thus, the Gate Control Theory provides a plausible neurophysiological explanation for the analgesic effect observed following manual Marma stimulation.



Similarly, there is another theory: “Activation of the endogenous analgesic system or Activation of descending inhibitory pathways" is an intrinsic neurophysiological network that regulates nociceptive transmission through descending pathways from supraspinal centres to the spinal cord. A major component of this system involves the periaqueductal gray (PAG) in the midbrain and the rostral ventromedial medulla RVM). Activation of the PAG-RVM network produce analgesia by modulating nociceptive processing at the spinal levelxxvi. PAG and RVM activate or recruit descending pain inhibitory circuits. This descending modulation involves both opioidergic and non- opioidergic mecahnisms, in opioids mechanisms , release of Enkehalins , β- endorphins, dynorphins, act through opoid receptors within supraspinal and spinal circuits and inhibit nociceptive transmissionxxvii.In parallel, non-opoidergic mechanisms involving noradrenergic and serotonergic pathways, as well as spinal inhibitory neurotransmitters such as GABA and

glycine, also contributer to the suppression or modulation of nociceptive transmission. In the context of Marma manipulation, controlled mechanical stimulation may activate endogenous analgesic systems that inhibit nociceptive transmission of painxxviii



These mechanisms should not necessarily be considered as independent explanations. Mechanical stimulation of Marma sites may simultaneously generate peripheral mechanosensory input, influence spinal nociceptive processing, and engage supraspinal pain-modulatory networks. At the tissue level, mechanical loading may activate mechanosensitive cellular pathways, whereas at the neural level, non-nociceptive afferent input may modulate nociceptive transmission and potentially influence descending inhibitory control. Thus, the therapeutic response to Marma manipulation may present a multilevel interaction between peripheral tissue mechanotransduction, spinal sensory gating, supraspinal pain modulation, and behavioural restoration of movement, rather than a single isolated mechanism. These observations provide a plausible neurophysiological explanation for the pain-relieving effects of Marma Manipulation, which also involves sustained rhythmic pressure over specific anatomical sites. According to NICE (National Institute for Health and Care Excellence) guidelines, "Manipulation and stretching should be considered as an adjunct to core treatments, particularly for osteoarthritis of the hip". Although these recommendations specifically address hip osteoarthritis, they support the broader role of manual therapeutic interventions in osteoarthritis managementxxix.Overall, the available evidence indicates that Marma therapy consistently demonstrates beneficial effects in reducing pain intensity, stiffness, tenderness, swelling, crepitus, WOMAC Index, and improving range of motion and functional mobility in patients with Janu Sandhigata Vata (Knee Osteoarthritis). The observed clinical outcomes are supported by contemporary concepts of pain modulation by Mechanotransduction, gate control theory of pain, Activation of Endogenous Analgesic system, which supports the possibility that controlled mechanical stimulation may alleviate symptoms of Knee Osteoarthritis. However, despite these encouraging findings, most published studies on Marma Therapy consist of case reports or small clinical trials with limited sample sizes. Therefore, well-designed randomised controlled trials with standardised treatment protocols, larger sample sizes, and longer follow- up periods are warranted to establish the long- term efficacy and underlying mechanisms of Marma Manipulation in the management of Knee Osteoarthritis (Janu Sandhigata Vata).

CONCLUSION

The present review suggests that Marma Manipulation has considerable therapeutic potential in the management of Janu Sandhigata Vata (Knee Osteoarthritis) with evidence from a clinical study. Further large-sample-size randomised controlled trials are required to strengthen the current evidence and facilitate the incorporation of Marma Manipulation into evidence-based management of Janu Sandhigata Vata (Knee Osteoarthritis). Overall, Marma Manipulation appears to be a safe, promising, non- invasive, cost–effective and clinically relevant therapeutic approach for the management of Janu Sandhigata Vata (Knee Osteoarthritis).

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