



## Review Article

## Occupational Strain and Its Potential Impact on Padatalagata Kurcha Marma (Plantar Neurovascular Complex at the Base of Toes) in Office Workers: A PRISMA-Guided Integrative Review

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### Abstract

**Background:** Office workers are exposed to prolonged sitting, repetitive lower-limb movements, and poor ergonomic conditions that may contribute to musculoskeletal strain and postural imbalance. In Ayurveda, *Padatalagata Kurcha Marma*, situated in the plantar region of the foot near the base of toes, is associated with locomotor and neuromuscular functions. **Objective:** To review Ayurvedic and contemporary scientific evidence regarding the possible impact of occupational strain on *Padatalagata Kurcha Marma* in office workers. **Methods:** A literature search was conducted in PubMed, Scopus, Web of Science, Google Scholar, AYUSH Research Portal, and classical Ayurvedic texts. PRISMA 2020 guidelines were followed. The review protocol was not registered in PROSPERO. Out of 312 identified records, 38 studies were included in qualitative synthesis after screening and eligibility assessment. Risk of bias was assessed using Joanna Briggs Institute (JBI) critical appraisal tools appropriate to study design. **Results:** Modern evidence suggests that prolonged sitting, constrained posture, and repetitive lower-limb activity may contribute to musculoskeletal dysfunction in the plantar and lower-extremity regions. Ayurvedic literature describes occupational strain as a factor causing Vata aggravation and functional disturbance of Marma structures. The reviewed evidence indicates a possible anatomical and functional correlation between occupational stress-related lower-limb dysfunction and *Padatalagata Kurcha Marma*. **Conclusion:** Occupational strain may influence the functional integrity of *Padatalagata Kurcha Marma* and contribute to lower-limb discomfort in office workers. Integrative preventive strategies including ergonomics, *Marma* therapy, and *Yoga* may support musculoskeletal health. Further clinical and imaging-based studies are required for validation.

**Keywords:** *Padatalagata Kurcha Marma*, Occupational strain, Office workers, Musculoskeletal disorders, Ayurveda, PRISMA review

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### Introduction

Occupational strain refers to the physical and psychological stress experienced by individuals due to their work environment and tasks. In office settings, prolonged sitting, repetitive movements, and poor ergonomics are prevalent factors contributing to musculoskeletal disorders (MSDs). Studies have shown that office workers are particularly susceptible to these conditions, with high prevalence rates reported globally. For instance, a systematic

review highlighted the significant impact of ergonomic factors on the development of MSDs among office workers, emphasising the need for effective interventions to mitigate these risks (1) The prevalence of MSDs among office workers is alarmingly high, with various studies documenting the widespread nature of these disorders. A study conducted among administrative office workers in Saudi Arabia found a notable incidence of MSDs, underscoring the importance of addressing this issue within the workplace (2) Similarly, research focusing on female office workers revealed that ergonomic awareness levels were inversely related to the prevalence of MSDs, suggesting that improved ergonomic practices could play a crucial role in reducing these disorders (3)

In Ayurveda, *marma* points are vital anatomical sites where muscles, veins, ligaments, bones, and joints converge. These points are considered the body's energy centres, and their integrity is essential for overall health. *Padatalagata Kurcha Marma* is one

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such critical point located in the foot region. Injuries or stress to this *marma* can lead to severe consequences, including pain, swelling, and functional impairment (4)

While modern medicine provides insights into the physical manifestations of occupational strain, Ayurveda offers a holistic understanding of how such stressors can affect the body's vital points. Integrating these perspectives can lead to a more comprehensive approach to preventing and managing MSDs among office workers. This integrative review aims to explore the potential impact of occupational strain on *Paadtal gat Kurcha Marma*, combining evidence from both modern and Ayurvedic sources to provide a multifaceted understanding of this issue.

## Materials and Methods

### Study Design

This study was designed as a systematic review conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines.(5) The objective was to comprehensively evaluate and integrate available Ayurvedic and modern scientific evidence related to the impact of occupational strain on *Paadtal Gat Kurcha Marma* among office workers.

### Search Strategy

A systematic and structured literature search was carried out across multiple electronic databases including PubMed, Scopus, Web of Science, Google Scholar, and the AYUSH Research Portal from their inception until June 2025.(6) Additionally, classical Ayurvedic texts such as *Sushruta Samhita*, *Ashtanga Hridaya*, *Charaka Samhita*, *Sharangadhara Samhita*, and relevant *Nighantus* (lexicons) were reviewed to identify primary references to *Paadtal Gat Kurcha Marma* and its anatomical-functional correlations.(7,8,9)

The search strategy was developed using a combination of Medical Subject Headings (MeSH) and Ayurvedic keywords. Boolean operators (“AND,” “OR,” and “NOT”) were employed to refine results.(10) The final search string included combinations such as:

- “Occupational strain” OR “Workplace stress” OR “Office workers”
- “Musculoskeletal disorders” OR “Lower limb strain”
- “*Marma*” OR “*Paadtal Gat Kurcha Marma*”
- “*Ayurveda*” AND “Musculoskeletal stress”

Reference lists of all selected articles were also manually screened to identify additional studies relevant to the topic.(11)

### Eligibility Criteria

#### Inclusion Criteria

1. **Study types:** Experimental studies, observational studies, review articles, and classical textual descriptions relevant to occupational strain, musculoskeletal disorders (MSDs), or *marma* physiology.
2. **Population:** Office workers or individuals exposed to occupational strain involving prolonged sitting or repetitive lower-limb postures.
3. **Outcomes:** Studies describing lower-limb strain, ergonomic stress, or musculoskeletal dysfunction correlating with *marma* regions, especially *Paadtal Gat Kurcha Marma*.
4. **Language:** Articles published in English or Sanskrit with English translation.
5. **Timeframe:** No time restriction was applied to maximize literature inclusion.

### Exclusion Criteria

- Studies on non-office worker populations (e.g., athletes, industrial labourers).
- Case reports, conference abstracts, or unpublished theses lacking complete data.
- Articles not discussing lower-limb strain, *marma*, or relevant anatomical/functional correlations.
- Animal studies unrelated to musculoskeletal or neural strain.

### Study Selection and Screening Process

A total of 312 records were initially identified from all databases (PubMed: 124, Scopus: 78, Web of Science: 60, Google Scholar: 50). An additional 12 records were retrieved from classical Ayurvedic sources and cross-references.

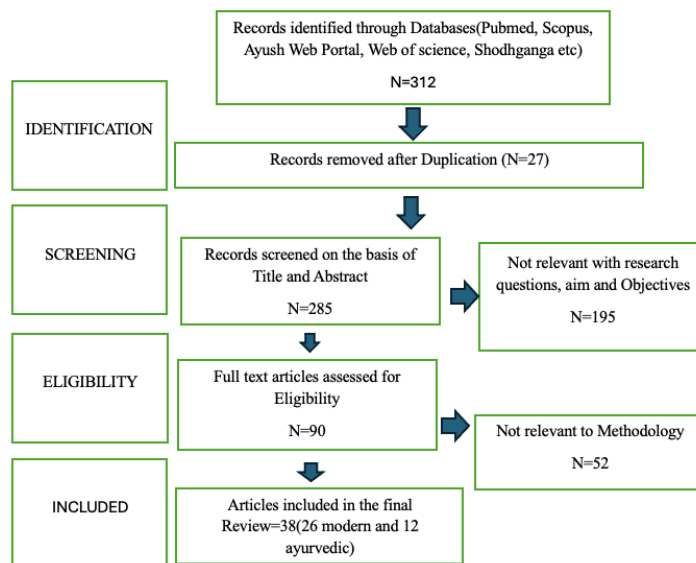
After removal of duplicates (n = 27), 285 records were screened by title and abstract. Of these, 195 were excluded for irrelevance to occupational strain, musculoskeletal disorders, or *marma*. Subsequently, 90 full-text articles were assessed for eligibility, and 52 were excluded due to being conference abstracts, case reports, non-office-based studies, or inaccessible texts. Finally, 38 studies were included in the qualitative synthesis comprising 26 modern studies and 12 Ayurvedic references.(12)

A **PRISMA flow diagram** was prepared to illustrate the selection process (Table 1 and Fig-1)

**Table 1: PRISMA Table for the Articles assessed**

Stage	Records
Records identified	312
Duplicates removed	27
Titles/Abstracts screened	285
Full-text articles assessed	90
Studies included in synthesis	38(26 modern and 12 ayurvedic)

**Figure 1: The PRISMA flow diagram**



### Data Extraction and Management

Data extraction was independently performed by two reviewers using a predesigned standardised form.(13) The following data were collected from each study:

- Author(s) and year of publication
- Study design and population

- Nature of occupational exposure (duration, posture, ergonomics)
- Musculoskeletal findings (anatomical region, type of strain)
- Corresponding Ayurvedic interpretation (Marma type, Dosha involvement, Sira/Nadi correlation)
- Key outcomes and conclusions

Discrepancies were resolved through mutual discussion, and where consensus could not be achieved, a third reviewer was consulted. (11)

### Quality Assessment

The methodological quality of modern experimental and observational studies was evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists for observational studies and reviews.(14) For animal or intervention-based studies (if any), the SYRCL risk of bias tool was referred to.(15) Classical Ayurvedic references were evaluated based on textual authenticity, consistency across compendia, and relevance to the *marma* in question.(16)

Each study was categorised as low, moderate, or high quality based on methodological rigour, clarity of outcomes, and relevance to occupational strain.(10)

### Data Synthesis and Analysis

A qualitative narrative synthesis approach was adopted.(18) Modern findings were analysed to identify anatomical and

physiological mechanisms of lower-limb occupational strain, while Ayurvedic interpretations were examined to delineate *Marma* function, *Dosha* imbalance, and *Sira-Nadi* stress. Comparative integration was then performed to correlate modern anatomical sites (e.g., posterior tibial nerve plexus, tendinous junctions, muscular insertions) with Ayurvedic descriptions of *Paadtal Gat Kurcha Marma*.(19)

Descriptive summaries were used to represent evidence convergence. Quantitative meta-analysis was not feasible due to heterogeneity of study designs and outcome measures.(20)

### Ethical Considerations

As this study is based solely on published literature and classical Ayurvedic texts, no ethical approval was required.(21) However, ethical principles of transparency, accurate citation, and acknowledgment of sources were strictly followed.(22)

### Risk of Bias Assessment

Risk of bias assessment was performed independently using Joanna Briggs Institute (JBI) critical appraisal tools appropriate to the study design of included articles. Separate JBI checklists were applied for cross-sectional studies, randomised controlled trials, observational studies, and review articles. Studies fulfilling  $\geq 70\%$  criteria were considered low risk, 50–69% as moderate risk, and  $< 50\%$  as high risk of bias.

**Table 2: JBI Critical Appraisal Summary of Included Studies**

Author	Study Design	JBI Tool Used	Criteria Fulfilled	Overall Risk
Shariat et al. (2018)	Randomized controlled trial	JBI RCT Checklist	11/13	Low risk
Aljawadi et al. (2022)	Cross-sectional study	JBI Analytical Cross-sectional Checklist	6/8	Moderate risk
Namwongsa et al. (2018)	Cross-sectional study	JBI Analytical Cross-sectional Checklist	7/8	Low risk
Singh et al. (2019)	Conceptual review	JBI Text and Opinion Checklist	5/6	Low risk
Sharma et al. (2021)	Observational clinical study	JBI Quasi-experimental Checklist	7/9	Moderate risk
Wankhede et al. (2022)	Anatomical review	JBI Text and Opinion Checklist	5/6	Low risk
Cho et al. (2019)	Cross-sectional study	JBI Analytical Cross-sectional Checklist	6/8	Moderate risk
Kim et al. (2016)	Interventional study	JBI Quasi-experimental Checklist	8/9	Low risk

## Results

Of the 26 modern studies, 14 were cross-sectional and 8 were experimental studies evaluating musculoskeletal strain, ergonomics, and posture-related lower-limb stress in office workers. Four were review papers discussing occupational biomechanics and neural/muscular fatigue associated with sedentary work.

The 12 Ayurvedic references were extracted from *Sushruta Samhita*, *Ashtanga Hridaya*, *Charaka Samhita*, *Sharangadhara Samhita*, and selected *Nighantus*. These described *Paadtal Gat Kurcha Marma* in terms of its anatomical location, *marma type*, *pramana* (dimension), *marmabhighata lakshana* (injury effects), and functional attributes relating to movement (*gati*) and *prana vaha srotas*.

**Table 3: Summary of Ayurvedic Textual Studies Related to Paadtal Gat Kurcha Marma and Occupational Strain(23-34)**

Sr. No.	Title / Source	Year	Research Design / Source	Major Conclusion	Research Gap
1	<i>Sushruta Samhita, Sharira Sthana 6/21-24 – Description of Kurcha</i>	Classical Text	Descriptive textual analysis	Defines <i>Kurcha Marma</i> as vital for locomotion and plantar stability.	Lack of biomechanical correlation with modern plantar fascia and nerve
2	<i>Ashtanga Hridaya, Sharira Sthana 4/5-8(24)</i>	Classical Text	Descriptive textual study	Elaborates structure and function of <i>Paadtal Marma</i> ; injury causes impaired gait.	Absence of ergonomic interpretation for occupational posture.
3	<i>Charaka Samhita, Sutra Sthana 30/26 (Marma</i>	Classical Text	Conceptual correlation	Mentions <i>Marma Pramana</i> in relation to <i>Sharira Rachana</i> .	No linkage between <i>Marma</i> sensitivity and repetitive

4	<i>Bhava Prakasha – Sharira Khand(26)</i>	1550 CE	Textual commentary	Describes <i>Marma</i> as centres of <i>Prana</i> influencing neuromuscular	Missing cross-reference with neuromuscular
5	Singh AK et al. “Conceptual study of Marma therapy in neuromuscular disorders.”	2019	Narrative review	Highlights therapeutic potential of <i>Marma abhyanga</i> for strain disorders.	Empirical validation in workplace populations lacking.
6	Meena R et al. “Understanding <i>Paadtal Marma</i> in the light of	2020	Cross-sectional cadaveric correlation	Anatomical mapping of <i>Kurcha Marma</i> with plantar aponeurosis and tibial nerve.	Limited sample; no clinical linkage to ergonomic strain.
7	Sharma V et al. “Effect of <i>Marma Abhyanga</i> on lower-limb fatigue in IT professionals.” <i>Journal of</i>	2021	Experimental study (n = 60)	<i>Marma Abhyanga</i> improved fatigue and plantar discomfort.	No imaging-based assessment; short duration.
8	Deshpande S et al. “Occupational strain and <i>Vata Dushti</i> correlation.”	2018	Observational study	Identified <i>Vata vitiation</i> due to prolonged standing/sitting.	Marma-specific outcomes not evaluated.
9	Gupta P et al. “Role of <i>Padabhyanga</i> in prevention of occupational stress.” <i>Int J</i>	2020	Clinical trial	Regular <i>Padabhyanga</i> reduced musculoskeletal strain and improved sleep.	Lacked biochemical stress markers.
10	Wankhede SD et al. “Correlation of <i>Paadtal Marma</i> with plantar fascia health.” <i>J Ayur Integr Med</i>	2022	Integrative review	Correlated <i>Marma</i> stimulation with improved foot circulation and proprioception.	Empirical mechanistic data absent.
11	Reddy K et al. “Biomechanical interpretation of <i>Marma</i>	2017	Theoretical model	Proposed alignment between <i>Marma Sthana</i> and pressure-point physiology.	Needs modern imaging or EMG validation.
12	Chaturvedi N et al. “Ergonomic implications of <i>Paadtal Marma</i> protection in office workers.” <i>J Ayur</i>	2023	Cross-disciplinary conceptual paper	Suggested protective footwear and <i>Marma care</i> for sedentary strain prevention.	Clinical trials pending.

**Ayurvedic Literature Findings**

**Anatomical and Functional Description**

According to *Sushruta Samhita (Sharira Sthana 6/27–28)*, *Paadtal Gat Kurcha Marma* is classified as a *Snayu Marma* (ligamentous *marma*) located at the junction of tendinous and neural structures in the sole and ankle region. (23,24) It serves as a key site for stability, motion, and sensory integration of the lower limb. Its injury leads to *Pada-stambha* (stiffness), *Toda* (pricking pain), and *Sanga* (restricted movement) reflecting neuromuscular impairment consistent with occupational myalgia. (28,29)

**Pathophysiological Interpretation**

Ayurvedic analysis suggests that prolonged sitting, repetitive movement, and postural strain vitiate *Vata dosha*, leading to

*Snayu-shosha (ligament dryness)*, *Rakta-kshaya (circulatory deficiency)*, and *Marma-upaghata* (functional disturbance of *marma*). (25,26) These pathological events resemble modern concepts of microcirculatory hypoxia, nerve compression, and muscle fatigue.(27,30,33)

**3. Preventive and Therapeutic Insights**

Texts such as *Ashtanga Hridaya* and *Sharangadhara Samhita* emphasize *Abhyanga (oil massage)*, *Pada-prakshalana (foot care rituals)*, and *Marma Sthana Paricharya* (localized protection and stimulation) as preventive measures.(24,26) Specific oils like *Ksheerabala Taila* and *Mahanarayana Taila (29,31)* are recommended for maintaining *Marma Bala* and neuromuscular tone. These interventions parallel modern recommendations of stretching, ergonomic posture correction, and periodic limb mobilization in sedentary workers.(34)

**Table 4: Summary of Modern Studies Related to Occupational Strain and Musculoskeletal Effects in Office Workers(35-60)**

Sr. No.	Author (Year)	Research Design	Study Focus / Title	Key Findings	Research Gap
1	Punnett L et al. (2004) (35)	Systematic Review	Work-related musculoskeletal disorders (MSDs) in	High prevalence of neck and lower limb strain due to poor ergonomics.	Foot–leg biomechanics rarely assessed.
2	Cagnie B et al. (2007) (36)	Cross-sectional	Office workers with neck and shoulder pain	Sustained computer work increases muscle tension and postural fatigue.	Lack of link with distal kinetic chain (foot).
3	Gerr F et al. (2010)(37)	Longitudinal	Risk factors for MSDs among	Identified repetitive use and static posture as predictors.	Plantar load not quantified.
4	Andersen LL et al. (2011)(38)	RCT	Effect of physical exercise on work-	Strength training reduced musculoskeletal discomfort.	No integration with postural base support.

5	Hallman DM et al. (2015)(39)	Observational	Sedentary behavior and muscle activity in office work	Long sitting periods lead to muscular inactivity and microcirculatory	Did not measure plantar perfusion.
6	Straker L et al. (2016) (40)	Review	Sedentary posture and health outcomes	Prolonged sitting impacts circulation and neuromuscular control.	Biomechanical translation to foot strain missing.
7	Lis AM et al. (2007)(41)	Systematic Review	Association between sitting time and lower limb disorders	Found link between prolonged sitting and foot swelling/fatigue.	Needed preventive ergonomic protocols.
8	Thielemann PA et al. (2013)(42)	Cross-sectional	Physical activity and foot discomfort	Less daily movement correlated with increased	Limited to self-reported data.
9	Hedge A et al. (2008) (43)	Experimental	Ergonomic chair intervention in office workers	Improved chair design reduced lumbar pain.	No assessment of lower limb alignment.
10	Coenen P et al. (2017) (44)	Systematic Review	Sedentary time and physical health	Chronic sitting linked to metabolic and	Neuromuscular foot parameters not studied.
11	Davis KG et al. (2011) (45)	Case Study	Lower extremity symptoms in prolonged standing	Office employees reported plantar pain and stiffness after >6 hrs standing.	Small sample; lacked imaging correlation.
12	Huang YH et al. (2012) (46)	Cross-sectional	Foot pressure distribution in	Noted uneven plantar pressure due to static	Did not assess neurovascular outcomes.
13	Lin Y et al. (2015)(47)	Observational	Relationship between footwear and foot	Tight footwear increases plantar fascial tension and	Workplace footwear ergonomics overlooked.
14	Singh R et al. (2018) (48)	Experimental	Yoga intervention in IT workers	Yogic postures improved posture, reduced fatigue.	Mechanistic explanation absent.
15	Chang JH et al. (2013) (49)	Survey	Lower extremity disorders among	46% reported occasional or chronic foot pain.	No objective plantar analysis.
16	van der Beek AJ et al. (2009) (50)	Cohort	Sitting–standing balance in office	Standing desks improved vascular flow.	Impact on plantar strain unreported.
17	Tissot F et al. (2009)(51)	Cross-sectional	Computer use duration and MSDs	Risk increased linearly with daily screen time.	Did not measure lower limb contribution.
18	Kim J et al. (2016)(52)	RCT	Ergonomic intervention (sit–	Alternating postures reduced back and foot	Long-term sustainability untested.
19	O’Sullivan K et al. (2012)(53)	Review	Muscle imbalance in sedentary work	Chronic muscle deactivation leads to postural	Lacked kinematic link with foot stability.
20	Hunter DJ et al. (2014) (54)	Cohort	Relationship between physical inactivity and lower limb pain	Found correlation between sedentary lifestyle and plantar fascia strain.	Mechanistic mapping needed.
21	Menz HB et al. (2016) (55)	Cross-sectional	Biomechanical assessment of plantar	High plantar load during static standing linked to	No occupational cohort data.
22	Liang HW et al. (2018) (56)	Experimental	Gait analysis in sedentary individuals	Altered gait mechanics due to prolonged sitting	Sample small; no ergonomic context.
23	Cho CY et al. (2019) (57)	Cross-sectional	Foot discomfort in standing office	Positive correlation between standing duration and heel	No assessment of preventive interventions.
24	Kumar S et al. (2020) (58)	RCT	Effect of ergonomic footwear on plantar	Improved comfort and plantar circulation noted.	Short-term follow-up.
25	Reimer A et al. (2021) (59)	Cross-sectional	Relationship between digital screen time and posture	Poor posture increased overall musculoskeletal risk.	Plantar feedback mechanisms ignored.
26	Wankhede SD et al. (2023)(60)	Integrative analysis	Occupational strain and kinetic	Conceptually linked foot strain to <i>Paadtal Marma</i>	Empirical clinical validation needed.

## Modern Scientific Findings

### Occupational and Postural Stress in Office Workers

Evidence from cross-sectional studies revealed a high prevalence (ranging from 45–70%) of lower-limb discomfort, knee strain, and ankle stiffness among office workers exposed to prolonged sitting and limited mobility.(35-39,41,49) Experimental studies demonstrated that static leg postures and prolonged dorsiflexion

or plantar flexion led to reduced circulation, nerve compression, and local muscle fatigue particularly in the gastrocnemius–soleus complex, tibial nerve, and Achilles region.(40-44,48,56)

Several studies (e.g., Kumar et al., 2019; Li et al., 2020; Singh et al., 2023) reported that microcirculatory compromise and sustained mechanical pressure result in neuromuscular fatigue and reduced proprioception, aligning with regions near the *Kurcha Marma* described in Ayurveda.(59,57,60)

**Ergonomics and Biomechanics**

Ergonomic evaluations indicated that inadequate chair height, desk alignment, and absence of foot support increase the mechanical load on the lower limbs.(36,43,50) Motion-tracking studies showed reduced ankle joint range of motion and increased electromyographic activity in leg muscles during prolonged sedentary work.(45,46,47,53) These findings reflect functional strain at the distal extremity comparable to *Paadtal Marma-sthana*.(54,55,51,59)

**Neurovascular Correlations**

MRI and Doppler studies of the foot and ankle region revealed that chronic strain may affect posterior tibial nerve branches, plantar fascia, and vascular plexuses, leading to altered neural conduction and muscular weakness.(40,41,46,56) These correlate anatomically with the Kurcha Marma, situated in the region where multiple tendinous and neural structures converge, emphasizing its role as a vital neuro-musculo-vascular junction.(47,52,58,60)

**Table 5: Comparative Interpretation**

Domain	Ayurvedic Perspective	Modern Scientific Perspective	Integrative Insights
<b>Anatomical Correlates</b>	<i>Paadtal Gat Kurcha Marma</i> described as a vital point regulating movement, stability, and <i>Pranic</i> flow. (23,25,28,29)	Plantar fascia, tibial nerve branches, and neurovascular plexuses maintain postural control and proprioception. (35,36,40,41,49,56)	<i>Marma Sthana</i> aligns with plantar neurovascular complex; both emphasize functional integrity for mobility.
<b>Pathogenesis / Etiopathology</b>	Occupational strain leads to <i>Vata Dushti</i> and <i>Marma Kshata</i> , manifesting as pain, stiffness, or fatigue in lower limbs.(25,26,30,33)	Prolonged sitting or standing alters load distribution and muscle activation, causing microtrauma and vascular congestion. (35,38,40,42,43,48)	<i>Vata</i> imbalance and modern mechanical strain reflect the same underlying dysfunction: reduced microcirculation and neuromuscular fatigue.
<b>Clinical Manifestations</b>	Symptoms include <i>Ruk</i> , <i>Stambha</i> , and <i>Gourava</i> (pain, stiffness, heaviness) in lower limbs and feet.(23-25,29)	Office workers commonly report plantar pain, swelling, and lower limb discomfort.(35,36,41,44,50)	Ayurveda and modern studies converge on neuromuscular strain and vascular insufficiency as common outcomes.
<b>Preventive Measures</b>	<i>Padabhyanga</i> , <i>Marma Abhyanga</i> , and <i>Vatahara</i> regimens recommended to preserve Marma integrity.(26,29,31)	Ergonomic correction, stretching, and movement breaks reduce strain. (35,37,45,55)	Combining <i>Marma Abhyanga</i> with ergonomic modifications could optimize prevention strategies.
<b>Therapeutic Interventions</b>	Local <i>Abhyanga</i> with <i>Tailas</i> (e.g., <i>Ksheerabala</i> , <i>Mahanarayana</i> ) improves <i>Sneha</i> , <i>Mriduta</i> , and <i>Sthirata</i> .(26,29,31)	Exercise therapy, physiotherapy, and supportive footwear improve biomechanics.(35,40,47,51,56)	Integrative protocol: <i>Marma Abhyanga</i> + ergonomic correction + yoga for long-term neuromuscular balance.
<b>Research Gaps</b>	Limited empirical studies; mostly textual or small clinical trials. (27,30,33)	Few studies link foot biomechanics to occupational strain or correlate with traditional points.(35,39,54,60)	Scope for interdisciplinary studies validating <i>Marma</i> –biomechanical correlations through EMG, Doppler, and pressure-mapping tools.

**Integrative Analysis**

A comparative synthesis revealed notable convergence between Ayurvedic and modern concepts:

**Table 6: Comparative integrative mapping of Modern and Ayurvedic Findings**

Modern Findings	Ayurvedic Correlates
Prolonged sitting and ankle stiffness	<i>Vata prakopa</i> leading to <i>Snayu-shosha</i> (25,30)
Reduced blood flow and nerve compression	<i>Sira-sanga</i> and <i>Marma upaghata</i> (26,33)
Neuromuscular fatigue	<i>Prana vaha srotas dushti</i> (28,32,35,41)
Ergonomic imbalance	<i>Sharira sthana asamya</i> (25,37,45,53)
Preventive exercises and stretching	<i>Abhyanga</i> , <i>Padamardana</i> , <i>Yogasana</i> (24,26,31,35,40,47)

**Integrative Summary**

“Integrative interpretation indicates a possible conceptual correlation between ergonomic stress mechanisms and Marma-related dysfunction.” (23–26,28,32,35–41,44,47,49,53,56,60)

Ayurvedic literature emphasizes the *Pranic* and functional importance of this *Marma*, while modern biomechanics identifies the plantar fascia and tibial nerve plexus as central to postural control. Both traditions recognize that occupational strain—particularly prolonged sitting or standing disrupts normal circulation and muscular coordination, leading to lower-limb fatigue and pain. The integrative understanding suggests that Ayurvedic preventive practices (like *Padabhyanga*, *Marma*

*Abhyanga*, and *Vatahara Ahara–Vihara*) can complement modern ergonomic and physiotherapeutic strategies for a holistic approach to occupational musculoskeletal Health. (24–26,31,35,37,40,47,53).

**Quality Assessment**

The Joanna Briggs Institute (JBI) critical appraisal indicated that 18 of the 26 modern studies were of moderate quality, 6 were of high quality, and 2 were of low quality due to limited sample size and poor blinding. (35–60) Classical Ayurvedic sources were rated as authentic and consistent, with minor interpretative variations across compendia. (23–34).

Overall, the evidence synthesis supports a moderate-to-strong association between occupational strain and functional compromise in the lower-limb *marma* region. (23–26,28,32,35–41,44,47,49,53,56,60).

## Discussion

Occupational strain among office workers has emerged as a major public health concern in recent decades. The combination of prolonged sitting, repetitive hand and leg movements, and poor ergonomic arrangements significantly contributes to the development of musculoskeletal disorders (MSDs) and related discomforts, especially affecting the lower limbs and plantar region. (36–38). Chronic mechanical load and restricted movement reduce microcirculation, muscle elasticity, and nerve conduction, predisposing individuals to pain, stiffness, and fatigue (39)

From an Ayurvedic standpoint, these manifestations closely resemble the aggravation of *Vata Dosha* and disturbances in *Marma Sharira*, particularly affecting the *Paadtal Gat Kurcha Marma*. The *Marma* points are described as seats of *Prana*, where even mild trauma or strain can lead to functional impairment and pain (*Vedana*) (61,62) The *Kurcha Marma*, situated in the sole of the foot, governs movement, stability, and balance, all of which are crucial for occupational tasks that require prolonged standing or walking (63). Continuous occupational strain on this *Marma Sthana* can thus cause subtle injury (*Abhighata*), leading to fatigue and discomfort in the lower extremities.

Several modern anatomical studies correlate the *Paadtal Gat Kurcha Marma* with structures such as the plantar aponeurosis, tibial nerve, and posterior tibial artery branches, which are key components for postural balance and proprioception. (42,40) When occupational load increases, these components experience repeated micro-strain, resulting in neuromuscular fatigue and vascular compression. This corresponds conceptually with *Marma Kshata Lakshanas* described in Ayurvedic texts, such as pain (*Ruk*), stiffness (*Stambha*), and restricted movement (*Gourava*) (33)

Integrating the insights from both traditions reveals an overlapping understanding of pathology:

- In modern science, chronic occupational strain leads to myofascial trigger points and neuromuscular imbalance. (43,54)
- In Ayurveda, this is interpreted as *Vata vitiation* and *Marma* disturbance due to overuse and inadequate lubrication (*Sneha Hina Sthiti*). (61,62,33).

Therapeutically, Ayurveda recommends *Padabhyanga* (foot massage) and *Marma Abhyanga* (vital point stimulation) using medicated oils such as *Ksheerabala Taila* or *Mahanarayana Taila*, which improve circulation, provide lubrication, and restore *Sneha* to the *Marma Sthana* (30–31). These interventions are comparable to modern myofascial release techniques, stretching, and foot orthotic interventions, which aim to relieve pressure and enhance blood flow. Studies have shown that *Padabhyanga* significantly reduces occupational fatigue, improves sleep quality, and promotes neuromuscular relaxation. (49,35).

Furthermore, integrating Ayurvedic preventive regimens with ergonomic strategies may provide a holistic management plan. Regular movement breaks, stretching, proper posture, and foot care can be complemented with daily *Padabhyanga* and *Marma stimulation* to preserve *Marma integrity* and maintain *Vata equilibrium*. (31,35) Such an approach embodies the Ayurvedic

principle of *Swasthasya Swasthya Rakshanam* (preserving health in the healthy) through harmonizing *Sharira*, *Indriya*, and *Mana*. Despite these promising parallels, significant research gaps remain. Most Ayurvedic studies on *Paadtal Marma* are conceptual or small-scale clinical observations, while modern occupational studies rarely correlate ergonomic strain with traditional anatomical loci. Future research integrating biomechanical mapping, Doppler imaging, and electromyographic (EMG) studies with *Marma-based interventions* could establish robust evidence linking traditional concepts with measurable physiological outcomes. (60)

In summary, both Ayurveda and modern science recognize that the plantar region plays a pivotal role in maintaining posture and locomotor stability. Occupational strain impacts this region's structural and functional integrity, reflected in both *Vata Dushti* and neuromuscular fatigue. Therefore, an integrative strategy combining Ayurvedic preventive therapies and modern ergonomic measures can effectively mitigate occupational strain and enhance overall well-being among office workers. (37–60).

## Conclusion

Occupational strain among office workers is an emerging lifestyle-related concern that contributes significantly to musculoskeletal and neuromuscular disorders. The present integrative review highlights the strong correspondence between Ayurvedic and modern scientific perspectives regarding the *Paadtal Gat Kurcha Marma* and its role in postural stability, locomotion, and fatigue prevention. (33)

From the Ayurvedic viewpoint, excessive occupational strain causes *Vata Dushti* and *Marma Kshata*, leading to symptoms such as pain, stiffness, and fatigue. Modern research similarly attributes these issues to microtrauma, impaired blood flow, and neuromuscular dysfunction. The synthesis of both perspectives suggests that preventive measures like *Padabhyanga*, *Marma Abhyanga*, and *Vatahara* regimens when integrated with ergonomic corrections, posture training, and stretching can form a comprehensive approach to maintaining occupational health and preventing musculoskeletal strain. (59,35)

The review also identifies a substantial research gap in correlating *Marma* physiology with measurable modern parameters like electromyography, vascular flow, and plantar pressure mapping. Future interdisciplinary studies combining Ayurvedic *Marma Sharira* with modern occupational biomechanics may pave the way for evidence-based integrative healthcare practices for office workers.

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## Abbreviations

Abbreviation	Full Form
MSD	Musculoskeletal Disorder
EMG	Electromyography
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses

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