



THERAPEUTIC POTENTIAL OF *AYURVEDA* MANAGEMENT IN OSTEOARTHRITIS: A SYSTEMATIC REVIEW

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Abstract:

Background: Due to the urbanization and sedentary lifestyle, millions of people around the world are suffering from the Musculoskeletal disorders (MSD) and it causes significant pain and physical disability. In Ayurveda MSD described under the headings of *Vatavyadhi* which combines *Sandhivata* (Osteoarthritis), *Vatarakta* (Gout), *Aamvata* (Rheumatoid arthritis), *Gridhrasi* (Sciatica), *Visvachi* (Brachial neuralgia) etc. *Sandhivata*, a degenerative disorder of the joints that affects weight-bearing joints including the knee, elbow, and others, causes painful and limited joint movements. Its manifestation occurs due to ageing, poor diet, obesity, job habits, etc. With aging *Dhatu*s undergo *Kshaya* (degeneration), which results in *Vata Prakopa* and leads to *Sandhivata*. It resembles Osteoarthritis (OA) in respect to aetiology, pathology, and clinical features. **Aims and Objectives:** *Ayurvedic* treatments for *Sandhivata* have been mentioned in details in the form of *Kwatha*, *Guggulu Kalpana*, *Ghrita*, *Taila*, *Rasa Aushadhi*, and *Panchakarma* procedures like *Abhyanaga*, *Swedana*, *Basti*, *Rasayana* therapy and Para Surgical procedure like *Agnikarma*. Thus, a systematic review is carried out to explore the strength of evidence on efficacy and safety of *Ayurvedic* treatments to manage OA. **Material and Methods:** Literature searches were conducted using databases including Medline, Cochrane Database, AYUSH research portal, and many others. All randomized controlled trials on individuals with *Sandhivata* using *Ayurvedic* treatment (alone or in combination) with an exposure period of > 10 days were included, with primary outcomes being improvement in cardinal features of *Sandhivata*. **Discussion:** A systematic review of 13 studies with various *Ayurvedic* modalities including oral medications, cleansing therapies, and Para surgical procedures proven effect in cardinal features of *Sandhivata*. These results and outcome will be depicted in details. There was no untoward effect as observed. **Conclusion:** *Ayurvedic* treatment are proven by the RCT that It has efficiency to enhance the quality of life of individuals and terminate the further progression of disease. It is the topic of research in future prospect on large population and multicentric level.

Key- words: *Ayurveda*, Herbal and Herbo- mineral medicines, Osteoarthritis, *Panchakarma*, *Sandhivata*, Systematic review

Introduction

The most prevalent type of arthritis, known as osteoarthritis (OA), is a degenerative joint disease that is caused by a breakdown of the diarthrodial (movable, synovial-lined) joint. It causes chronic disability at older ages and is characterised by progressive articular cartilage disintegration, as well as the formation of new bone at the joint margins (osteophytes) and in the floor of the cartilage lesions (eburnation).^[1] Mild to severe clinical manifestations of osteoarthritis (OA) can affect the hands as well as weight-bearing joints like the knees, hips, feet, and spine. Osteoarthritis (OA) is a clinical syndrome has been defined by varying degrees of inflammation, joint pain, tenderness, restriction of motion, crepitus, and sporadic effusions without any systemic effects.^[2] Epidemiology estimates that 22–39% of Indians have OA. The majority of adults over 65 have radiographic evidence of OA. Most people (80%) are older than 75. Roughly 11% of people over 65 suffer from knee OA symptoms. In India, the percentage of men and women over 65 is 5.3% and 4.8%, respectively. Women are affected by OA more frequently than men, and after menopause, the condition becomes more common, severe, and recurrent. Multifactorial aetiology is the cause of OA. Articular cartilage becomes softer, more susceptible to ulceration, and becomes malfunctioning due to a variety of morphological and biochemical changes.^[3] Age, gender, body weight, repetitive trauma, and genetic factors have all been proposed as risk factors that are significant in the development of OA. In classical texts *Aacharya* has described the disease in *Vatavyadhi* chapter under the heading of *Sandhigata Vata*. *Sandhigata vata* and OA are quite similar in terms of the disease's nature and symptomatology. The illnesses caused by morbid *Vata Dosha* are more prevalent in the elderly, or *Jaravastha*. In addition to ageing, improper food, injuries, cold exposure, suppression of natural urges, and other factors can aggravate *Vata*, causing it to take up residence in the joints. Because of its *Rooksha* (~dryness), it degenerates the joints, can lead to the early loss of cartilage, and dries up the lubricating synovial fluid inside the joint capsule. One of the outcomes of this procedure is *Sandhivata*. It is characterized by *Shoola* (~pain), *Vatapurnadruti Sparsha* (~sound resembling that made when rub against a balloon or transparent container filled with air), *Shotha* (~swelling), *Vedana* during *Prasaran* and *Akunchan* (~painful movement including extension and flexion, *Atopa* (~abnormal sounds due to damage of joints or crepitus), *Sandhihanti* (restriction of joint movements). There is involvement of *Vata Doasha* (~*Doṣha* responsible for movement and cognition), *Madhyam Roga Marga*, and *Dhatu Kshaya* (~diminution of major structural components of body) in *Sandhivata*. Therefore, it is regarded as *Kashtsadhya Vyadhi* (~disease curable with difficulty).^[4] *Acharya Vagabhata* has described a common treatment for *Vata Vyadhi*, which involves the repeated use of *Basti* (~Enema), *Mridu Virechana* (~Mild Purgative), *Snehana* (~Oleation therapy), and *Swedana* (~Sudation therapy).^[5] *Acharya Sushruta* has explicitly mentioned the therapies for *Sandhigata Vata* like *Snehana* (~Oleation therapy), *Upanaha* (~application of pultice), *Agnikarma* (~thermal cauterization), *Bandhana* (~bandaging), and *Unmardana* (~manual massage in ascending direction).^[6]

Aim and Objectives:

The main object of this study is to propagate safe and effective management of *Sandhivata* by using *Ayurvedic* herbal and Herbo- mineral medicines, *Basti karma*, and other para- surgical methods. For this purpose, current systematic review is trying to attempt various research manuscripts related to treatment of *Sandhivata* with various *Ayurvedic* treatment modalities.

Materials and methods

Search strategy and selection criteria

Medline, Cochrane Database, Google Scholar and AYUSH research portal were searched with keywords “*Sandhivata*”, “*Panchkarma*”, “*Ayurvedic* clinical trials”, “*Osteoarthritis*”, “*Ayurvedic* management”. In addition, manual searches are also done for relevant journals and cross-referenced articles to avoid missing any potentially eligible studies. The search period is from the year 2010 to year 2022. Total 34 articles were screened through PubMed and Google Scholar in which 2 articles were removed due to duplicity^{[7], [8]}, 10 review articles were excluded^{[9], [10], [11], [12], [13], [14], [15], [16], [17], [18]}, 8 articles were removed because they didn't meet with inclusion criteria^{[19], [20], [21], [22], [23], [24], [25], [26]} and 1 article excluded due to non-availability of full text^[27]. [Flow chart- 1]

Selection Criteria

Participants

Human with specified diagnosis criteria of Osteoarthritis (OA).

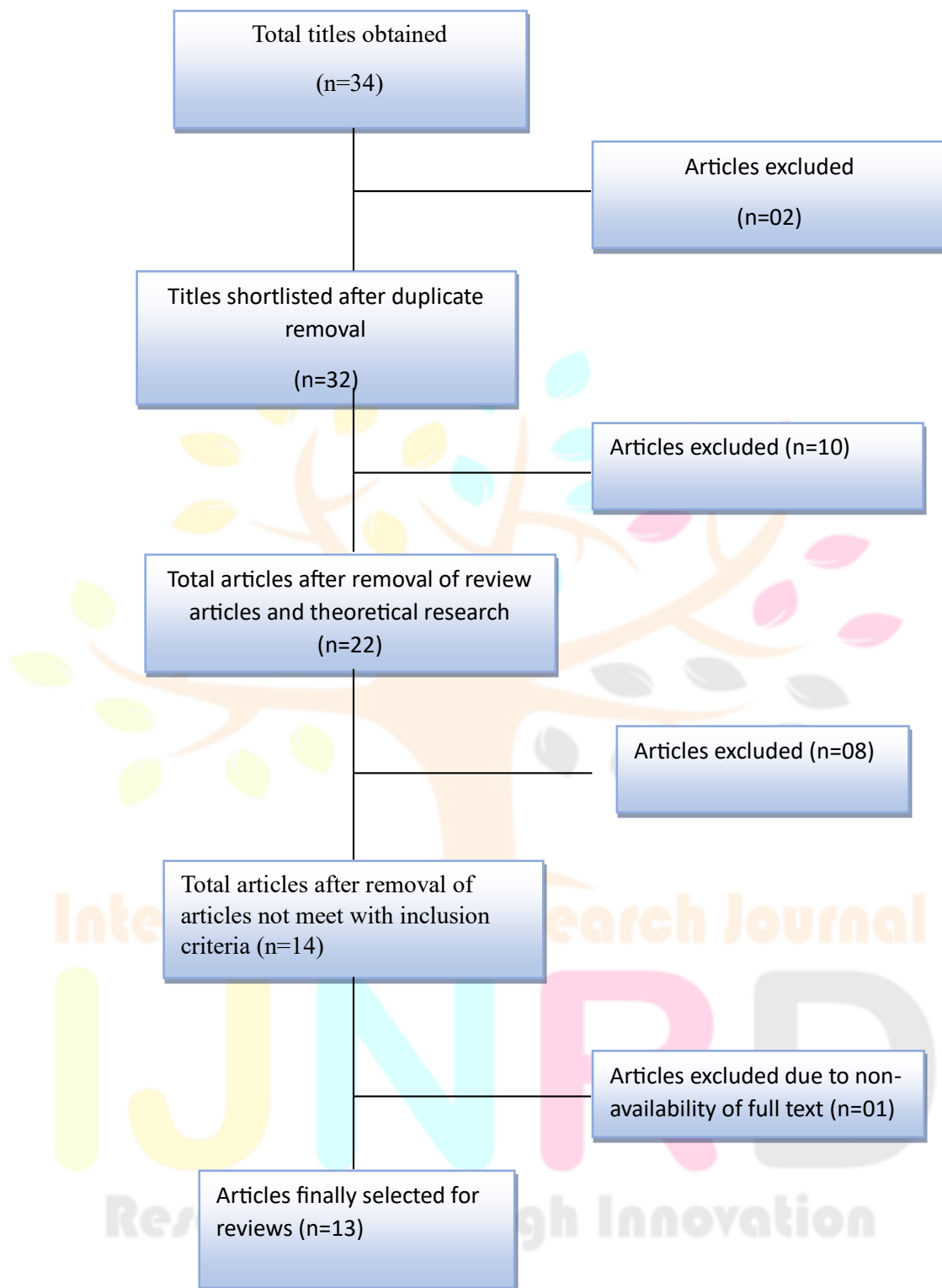
Inclusion Criteria

The references of main clinical studies manuscripts which are in English language were selected. Studies which included patients between the age group of 30-80 years of either sex, have intervention of *Ayurvedic* drugs and procedures for more than 10 days were chosen for systemic review. Patients suffering from classical sign and symptoms of *Sandhivata* such as *Shula* (~Pain), *Shotha* (~Swelling), *Sthambha* (~stiffness), *Sparshasayyata* (~tenderness), *Sphutana* (~crepitus), *Aakunchan Prasaran vedna* (~painful movement including extension and flexion) etc.

Exclusion Criteria

Review studies, case studies, animal studies and studies which were focused on other than Osteoarthritis such as Traumatic arthritis, Psoriatic arthritis, Gouty arthritis, Rheumatoid arthritis, Parkinsons disease etc. were excluded. Patients suffering from any anatomical deformities like genu valgum / genu varum and other systemic disease like Cardiac disease, renal disease, severe Anaemia, Malignancy and infectious diseases. Studies which worked only on external uses of drugs were also excluded.



Flow chart 1: Selection process of manuscripts for the Systematic review**Outcomes**

- (1) Primary Outcomes: Cardinal features of Osteoarthritis such as Pain, Swelling, Stiffness and difficult ROM. (2) Secondary Outcomes: WOMAC Pain, WOMAC Stiffness, WOMAC Function

Assessment criteria

The diagnosis is mainly based on clinical presentation of the patient according to signs and symptoms of *Sandhigatavata* mentioned in classical texts, which are *Shula* (~Pain), *Shotha* (~Swelling), *Sthambha* (~stiffness), *Sparshasayyata* (~tenderness), *Sphutana* (~crepitus), *Aakunchan Prasaran vedna* (~painful movement including extension and flexion) etc. Certain gradations and declarations are made about the data and all these parameters of baseline data to post-medication data will be compared for clinical assessment of the results in most of the RCTs. The parameters are as follows:

1. *Sandhi Vedana* (Pain)

Gradation	Symptoms
0	No complaints
1	Tells on enquiry grade
2	Complaints frequently
3	Excruciating condition

2. *Stambha* (Stiffness)

Gradation	Symptoms
0	Absent
1	Present

3. *Sandhi Shotha* (swelling)

Gradation	Symptoms
0	No complaints
1	Slightly obvious
2	Covers well over the bony prominence
3	Much elevated

4. *Sparshasayyata* (Tenderness)

Gradation	Symptoms
0	No complaints
1	Says the joint in tender
2	Winces the affected joint
3	Winces and withdraws the affected joint

5. *Sandhi Atopa* (Crepitations)

Gradation	Symptoms
0	None
1	Felt
2	Heard

6. Range of motion

Gradation	Symptoms
0	Full movement 120° - 140°
1	Limited 70° - 90°
2	Nil

Study Design

Randomized Controlled Trials (RCTs)

Observation and results: In included manuscripts most of the intervention shows Statistically Highly Significant results ($p < 0.001$) in Cardinal features of Sandhivata such as Pain, Tenderness, Swelling, Stiffness and Crepitations. Description of these research studies were discussed in details are as under [Table 1 and 2]-

Table No-1: The details of selected RCT's for the meta-analysis of Sandhivata

S. No.	Authors	Sample Size			Intervention		
		Group A	Group B	Group C	Group A	Group B	Group C
1.	Dr. Nishant Kaushik, Dr. Poonam Bhojak, Dr. R. V. Shettar and Dr. Rishu Sharma ^[28]	15	-	-	<i>Abhadi vati</i> , 2 tablets (500 mg each) for 3 times per day	-	-
2.	Aneesh Vasudeva Sharma, Tukaram Sambhaji Dudhamal, Sanjay Kumar Gupta, Vyasadeva Mahanta ^[29]	18	15	-	<i>Agnikarma</i> with <i>Panchdhatu Shalaka</i>	<i>Agnikarma</i> along with <i>Panchtikta Guggulu</i> 500 mg, 2 tablets for 3 times per day	-
3.	Mayuri R. Shah, Charmi S. Mehta, V. D. Shukla, Alankruta R. Dave, N. N. Bhat ^[30]	16	17	-	<i>Sarvang Abhyanga</i> and <i>Sarvang Swedana</i> with <i>Matra Basti</i> (60 ml <i>Bala Taila</i>)	Same as Group A with Indigenous compound	-
4.	Kshipra Rajoria, Sarvesh Kumar Singh, R.S. Sharma, S.N. Sharma ^[31]	10	10	10	<i>Laksha Guggulu</i> (2 gm twice a day)	<i>Snehana</i> and <i>Swedana</i> with knee joint traction	Combined intervention of both groups
5.	Sarvesh Kumar Singh, Kshipra Rajoria ^[32]	10	10	10	<i>Lakshadi Guggulu</i> (500 mg twice a day)	<i>Panchtikta Ksheer Basti</i> (420 ml)	Combined intervention of both groups
6.	P. K. Rai, A. K. Singh, O. P. Singh, N. P. Rai, A. K. Dwivedi ^[33]	32	-	-	Leech therapy	-	-
7.	Vineeta K. Negi, Renu Singh, Anubha Chandla, Omraj Sharma, Surinder K. Sharma, Rakesh Rana, Richa Singhal, Bhagwan S. Sharma, Shruti Khanduri, Adarsh Kumar,	63	-	-	<i>Panchamrit Lauha Guggulu</i> (250 mg twice a day) with external application of <i>Panchguna</i> oil	-	-

	Narayanam Srikanth [34]						
8.	Babul Akhtar, Raja Ram Mahto, A. R. Dave, V. D. Shukla [35]	26	14	-	<i>Panchtikta Ghrit Guggulu vati</i> (2 vati twice a day) along with <i>Abhyanga (Bala taila)</i> and <i>Nadi Swedana (Dashmool Kwath)</i>	Only <i>Abhyanga (Bala taila)</i> and <i>Nadi Swedana (Dashmool Kwath)</i>	-
9.	Banamali Das, Sanjay K. Singh, Sudhanshu K.Meher, Alok K. Srivastav, Sarada Ota, Rakesh Rana, Richa Singhl, Bhagwan S. Sharma, Shruti Khanduri, Adarsh Kumar, Meda M. Rao, Narayanam Srikanth [36]	120	-	-	<i>Rasnadi Gutika</i> (1 gm twice a day) and external application of <i>Chandrakala Lepa</i>	-	-
10	P. K. Gupta, S. M. S. Samarakoon, H. M. Chandola, B. Ravishankar [37]	29	23	-	Capsule <i>Shallaki</i> (6 gm in 3 divided doses)	Capsule <i>Shallaki</i> (6 gm in 3 divided doses) along with external application of <i>Shallaki ointment</i>	-
11	Anil Mangal, M.N. Shubhasree, Pramila Devi, A.D. Jadhav, Sai A. Prasad, Kisore Kumar, Sarada Otta, K.S. Dhiman [38]	142	-	-	<i>Vatari Guggulu</i> (500 mg, thrice a day) and <i>Maha Rasnadi Kwath</i> 20 ml with local application of <i>Narayan oil</i>	-	-
12	Nilesh G. Jethava, Tukaram S. Dudhamal, Sanjay Kumar Gupta [39]	15	15	-	<i>Agnikarma</i> with <i>Rajat Shalaka</i>	<i>Agnikarma</i> with <i>Lauha Shalaka</i>	-
13	Pradeep L. Grampurohit, Niranjan Rao, Shivakumar S. Harti [40]	30	-	-	<i>Anuvasan Basti</i> with <i>Ksheer Bala Taila</i> (120 ml)	-	-

Table 2: The details of selected RCT's for the meta-analysis of Sandhivata

S. no.	Authors	Journal and Year of publication	Duration of study
1.	Nishant Kaushik, Dr. Poonam Bhojak, Dr. R. V. Shettar and Dr. Rishu Sharma ^[28]	IJRR, 2017 April; 04 (04):3967-3971	60 days
2.	Aneesh Vasudeva Sharma, Tukaram Sambhaji Dudhamal, Sanjay Kumar Gupta, Vyasadeva Mahanta ^[29]	AYU 2016; 37: 38-44	1 Month
3.	Mayuri R. Shah, Charmi S. Mehta, V. D. Shukla, Alankruta R. Dave, N. N. Bhat ^[30]	AYU, Apr-Jun 2010; 31(2): 210-217	4 Weeks
4.	Kshipra Rajoria, Sarvesh Kumar Singh, R.S. Sharma, S.N. Sharma ^[31]	AYU, Jan-Mar 2010; 31(1): 80-87	28 days
5.	Sarvesh Kumar Singh, Kshipra Rajoria ^[32]	JoAYUSH, 2014; 3(2): 68-79	1 Month
6.	P. K. Rai, A. K. Singh, O. P. Singh, N. P. Rai, A. K. Dwivedi ^[33]	AYU, Apr-Jun 2011; 32 (2): 213-217	6 weeks with a weekly interval
7.	Vineeta K. Negi, Renu Singh, Anubha Chandla, Omraj Sharma, Surinder K. Sharma, Rakesh Rana, Richa Singhal, Bhagwan S. Sharma, Shruti Khanduri, Adarsh Kumar, Narayanam Srikanth ^[34]	J Res Ayurvedic Sci 2022; 6:152-9	12 weeks
8.	Babul Akhtar, Raja Ram Mahto, A. R. Dave, V. D. Shukla ^[35]	AYU, Jan-Mar 2010; 31(1): 53-57	30 days
9.	Banamali Das, Sanjay K. Singh, Sudhanshu K. Meher, Alok K. Srivastav, Sarada Ota, Rakesh Rana, Richa Singhl, Bhagwan S. Sharma, Shruti Khanduri, Adarsh Kumar, Meda M. Rao, Narayanam Srikanth ^[36]	J Res Ayurvedic Sci 2022; 6:46-52	12 weeks
10.	P. K. Gupta, S. M. S. Samarakoon, H. M. Chandola, B. Ravishankar ^[37]	AYU, Oct-Dec 2011; 32 (4): 478-482	2 Months
11.	Anil Mangal, M.N. Shubhasree, Pramila Devi, A.D. Jadhav, Sai A. Prasad, Kisore Kumar, Sarada Ota, K.S. Dhiman ^[38]	Journal of Ayurveda and Integrative Medicine 8 (2017) 200e204	12 weeks
12.	Nilesh G. Jethava, Tukaram S. Dudhamal, Sanjay Kumar Gupta ^[39]	AYU, Jan-Mar 2015; 36(1): 23-28	4 sittings with a weekly interval
13.	Pradeep L. Grampurohit, Niranjana Rao, Shivakumar S. Harti ^[40]	AYU, Apr-Jun 2014; 35(2): 148-151	10 days

Effect of Ayurvedic treatment modalities on cardinal features of Sandhivata in details are as under [Table 3]-

Table 3: Effect of Ayurvedic treatment modalities on primary outcomes of study

Study	Groups	Outcomes	Mean		S.D.	t	P value
			B.T.	A.T.			
Nishant Kaushik ^[28]	A	Pain	2.73	1.66	0.617	10.45	<0.001
		Swelling	1.000	0.400	0.516	4.00	<0.001
		Tenderness	1.733	0.867	0.516	6.500	<0.001
		Crepitations	0.867	0.867	0.00	0.00	1.00
		Stiffness	0.467	0.133	0.488	2.646	0.019
Aneesh Vasudeva Sharma ^[29]	A	Pain	2.611	0.388	0.4895	171	<0.0001
		Swelling	38.36	37.50	0.589	6.20	<0.001
		Tenderness	1.000	0.166	0.6183	91	0.0002

Aneesh Vasudeva Sharma ^[29]	B	Crepitations	1.222	0.888	0.4851	21	0.0313
		Stiffness	2.500	0.611	1.132	120	<0.0001
		Pain	2.600	0.467	0.6399	120	<0.0001
		Swelling	39.26	38.00	0.458	10.71	<0.001
		Tenderness	1.467	0.267	0.414	120	<0.0001
		Crepitations	1.733	0.867	0.516	78	0.0005
		Stiffness	2.467	1.000	0.640	105	0.0001
Mayuri R. Shah ^[30]	A	Pain	3.31	1.18	1.31	6.48	<0.001
		Swelling	1.38	0.46	0.64	5.19	<0.001
		Tenderness	1.72	0.45	0.64	6.52	<0.001
		Crepitations	1.87	0.26	0.44	11.18	<0.001
		Stiffness	2.28	0.64	1.08	5.68	<0.001
Mayuri R. Shah ^[30]	B	Pain	3.05	1.23	1.18	6.34	<0.001
		Swelling	1.90	0.63	0.78	5.36	<0.001
		Tenderness	1.4	0.6	0.63	4	<0.01
		Crepitations	1.93	1.31	0.5	5	<0.001
		Stiffness	2.28	0.78	1.22	4.58	<0.001
Kshipra Rajoria ^[31]	A	Pain	3.50	0.80	0.632	14	<0.001
		Swelling	1.67	1.0	0.87	2.31	>0.05
		Tenderness	2.10	1.3	0.42	6.0	<0.001
		Crepitations	1.8	0.8	1.11	2.0	<0.1
		Stiffness	2.1	1.2	0.32	9.0	<0.001
Kshipra Rajoria ^[31]	B	Pain	2.1	0.4	0.48	11.12	<0.001
		Swelling	1.22	0.33	0.6	4.44	<0.01
		Tenderness	2.3	1.4	0.32	9.00	<0.001
		Crepitations	2	0.08	0.447	6.0	<0.01
		Stiffness	2.4	1.3	0.57	6.13	<0.001
Kshipra Rajoria ^[31]	C	Pain	3.4	0.4	0.94	10.06	<0.001
		Swelling	1.0	0.2	0.45	4.0	<0.02
		Tenderness	2.6	1.2	0.7	6.33	<0.001
		Crepitations	1.16	0.33	0.408	5.0	<0.01
		Stiffness	2.2	1.1	0.32	11	<0.001
Sarvesh Kumar Singh ^[32]	A	Pain	3.50	0.80	0.632	14	<0.001
		Swelling	1.67	1.0	0.87	2.31	>0.05
		Tenderness	2.10	1.3	0.42	6.0	<0.001
		Crepitations	1.8	0.8	1.11	2.0	<0.1
		Stiffness	2.1	1.2	0.32	9.0	<0.001
Sarvesh Kumar Singh ^[32]	B	Pain	2.1	0.4	0.48	11.12	<0.001
		Swelling	1.22	0.33	0.6	4.44	<0.01
		Tenderness	2.3	1.4	0.32	9.00	<0.001
		Crepitations	2	0.08	0.447	6.0	<0.01
		Stiffness	2.4	1.3	0.57	6.13	<0.001
Sarvesh Kumar Singh ^[32]	C	Pain	3.4	0.4	0.94	10.06	<0.001
		Swelling	1.0	0.2	0.45	4.0	<0.02
		Tenderness	2.6	1.2	0.7	6.33	<0.001
		Crepitations	1.16	0.33	0.408	5.0	<0.01
		Stiffness	2.2	1.1	0.32	11	<0.001
P. K. Rai ^[33]	A	Pain	4.28±0.73	0.81±0.64		24.45	<0.001
		Swelling	1.38±0.49	0.22±0.42		10.42	<0.001
		Tenderness	1.84±0.72	0.93±0.30		12.99	<0.001
		Crepitations	1.75±0.67	0.44±0.67		15.77	<0.001
		Stiffness	1.72±0.46	0.22±0.42		10.42	<0.001
Babul Akhtar ^[35]	A	Pain	2.38	0.54	0.54	16.82	<0.001
		Swelling	1.50	0.17	0.48	12.09	<0.001

		Tenderness	1.44	0.12	0.60	08.73	<0.001
		Crepitations	1.91	0.65	0.45	14.00	<0.001
		Stiffness	1.44	0.11	0.50	07.82	<0.001
Babul Akhtar ^[35]	B	Pain	2.29	0.71	0.65	09.23	<0.001
		Swelling	1.90	0.30	0.52	10.00	<0.001
		Tenderness	1.50	0.25	0.50	5.00	>0.05
		Crepitations	1.67	0.83	0.39	7.54	<0.001
		Stiffness	1.83	0.17	0.52	7.95	<0.001
P. K. Gupta ^[37]	A	Pain	Lt-2.47 Rt-2.48	Lt-0.56 Rt-0.68		Lt-9.34 Rt-9.50	Lt- <0.001 Rt- <0.001
		Swelling	Lt-1.25 Rt-1.58	Lt-0.50 Rt-0.50		Lt-4.58 Rt-7.29	Lt- <0.001 Rt- <0.001
		Tenderness	Lt-1.27 Rt-1.72	Lt-0.31 Rt-0.33		Lt-9.24 Rt-9.52	Lt- <0.001 Rt- <0.001
		Crepitations	Lt-1.98 Rt-1.95	Lt-1.50 Rt-0.85		Lt-5.78 Rt-5.77	Lt- <0.001 Rt- <0.001
		Stiffness	Lt-1.37 Rt-1.72	Lt-0.47 Rt-0.50		Lt-18.0 Rt-11.76	Lt- <0.001 Rt- <0.001
P. K. Gupta ^[37]	B	Pain	Lt-2.64 Rt-2.24	Lt-0.77 Rt-0.68		Lt-10.23 Rt-9.79	Lt- <0.001 Rt- <0.001
		Swelling	Lt-1.60 Rt-1.65	Lt-0.20 Rt-0.29		Lt-10.69 Rt-11.32	Lt- <0.001 Rt- <0.001
		Tenderness	Lt-1.42 Rt-1.47	Lt-0.26 Rt-0.35		Lt-6.53 Rt-7.68	Lt- <0.001 Rt- <0.001
		Crepitations	Lt-1.93 Rt-1.67	Lt-1.13 Rt-0.94		Lt-4.52 Rt-4.08	Lt- <0.001 Rt- <0.001
		Stiffness	Lt-1.69 Rt-1.59	Lt-0.37 Rt-0.35		Lt-8.66 Rt-7.67	Lt- <0.001 Rt- <0.001
Nilesh G. Jethava ^[39]	A	Pain	2.71±0.13	0.64±0.17		16.33	<0.001
		Swelling	40.40±1.44	38.70±1.24		4.54	<0.05
		Crepitations	1.50±0.52	0.643±0.13		6.00	<0.001
Nilesh G. Jethava ^[39]	B	Pain	2.64±0.17	0.429±0.14		14.31	<0.001
		Swelling	41.08±0.80	39.17±0.80		3.56	<0.05
		Crepitations	1.357±0.13	0.571±0.14		6.90	<0.001

Banamali Das ^[36]	A	WOMAC pain	10.6 (4.94)	5.22 (2.99)		16.83	<0.001
		WOMAC stiffness	4.57 (1.753)	2.49 (1.34)		18.57	<0.001
		WOMAC physical functioning	38.26(9.85)	24.09 (6.262)		16.525	<0.001
Anil Mangal ^[38]	A	WOMAC pain	10.30±0.27	3.33±0.25			<0.001
		WOMAC stiffness	03.11±00.1	0.68±0.1			<0.001
		WOMAC physical functioning	35.39±0.71	15.39±0.95			<0.001
Vineeta K. Negi ^[34]	A	Pain	48.10±13.852	66.032±12.0620			<0.001
		Stiffness	12.857 (20.940)	46.905 (31.539)			<0.0001
		Physical functioning	64.13±14.716	80.32±15.289			<0.001
Pradeep L ^[40]	A	Pain	1.20±0.1	0.520±0.978		7.494	<0.05
		Swelling	1.180±1.163	0.660±0.122		5.316	<0.05
		Tenderness	1.060±0.127	0.540±0.108		4.734	<0.05
		Crepitation	1.280±0.091	1.040±0.640		2.918	<0.05

B.T.= Before treatment, A.T.= After treatment, S.D.= Standard deviation

DISCUSSION:

This systematic review including the 13 RCTs analyzes the effectiveness and safety of the Herbal and Herbo-mineral medicines, *Panchkarma* therapies and para surgical *Ayurvedic* procedures for Osteoarthritis. It illustrates that the *Ayurvedic* remedies are statistically Highly Significant in improving the Pain, Swelling, Stiffness and painful movements of joints in Patients of Osteoarthritis. Thus, although based on current evidences we consider that *Ayurvedic* modalities are relatively safe treatment and has less adverse effects, we cannot assure it. Further clinical trials are required to re-supplements on OA. Here is a detailed description of treatment modalities, which helps to understand how the treatment works in cases of OA.

Role of *Abhadi Vati*: *Acharya Yogaratnakara* has mentioned *Abhadi Vati* in context of *Vatavyadi Chikitsa*.^[41] The ingredients such as *Ashwagandha* (*Withania somnifera*), *Shatavari* (*Asparagus racemosus*), *Guduchi* (*Tinospora cordifolia*), *Vidhara* (*Argyreia nervosa*) act as *Rasayana* (~rejuvenation) and very beneficial in the *Dhatu Kshaya*. *Shunthi* (*Zingiber officinale*), *Ajmoda* (*Apium graveolens*), and *Shatpushpa* (*Foeniculum vulgare*) does *Deepana* (~enhancing metabolic fire) and *Pachana* (~digestion) through its *Katu Rasa* (~pungent taste), and relieves the obstruction in *Srotas* (~structural or functional channels) along with analgesic effect of *Rasna* (*Pluchea lanceolata*). It can be concluded that the ingredients of this compound have properties such as *Shoolahara*, *Balya*, *Deepana*, *Pachana* and *Rasayana*. Bio phenols isolated from *Acacia arabica* plants are recognized to alter the creation of (COX) cyclooxygenase and (LOX) lipoxigenase, thus inhibiting bradykinin, prostaglandins, and leukotriene production, correspondingly. These enzymes inhibition generally results in analgesic, anti-inflammatory, and antipyretic activities.^[42]

Role of *Agnikarma*: The temperature generated by red hot *Shalaka* (~rod) causes painful peripheral skin stimulation that specifically activates myelinated low threshold nerve fibres. Because of the stretching of nerve fibres in OA, the afferent input from these fibres prevents nociception from spreading through unmyelinated fibres. This causes the release of particular hormones or chemicals, such as met enkephalin and beta endorphin, which can have analgesic effects and either reduce or inhibit pain perception. This results in a descending inhibitory pathway that modulates pain perception. The hypothalamus is the part of the brain that triggers the release of these hormones. Applying heat to the affected area improves blood flow, which helps to eliminate

inflammatory substances and minimises swelling.^[43] A rise in temperature causes muscles to relax and increases the effectiveness of its action by boosting blood circulation. Muscle fibres also contract and relax more quickly, enabling efficient use of the extremities.^[44]

Role of *Basti* (~medicated enema): *Basti* can work via either the nervous system or the receptors in the stomach. It might cause a rise in the local enzyme or neurotransmitter secretion. *Basti* stimulates the endogenous synthesis of vitamins B12, K, and other nutrients by influencing the normal bacterial flora.^[45] *Basti*, as stated by *Acharya Charaka* in "*Vastih Vataharanam*," is the best remedy for *Vata*.^[46] The *Basti* drug initially enters the large intestine, or *Pakvashaya* which is the principal location of *Vata Dosha*. Thus, *Basti* gains control over *Vata* throughout the body by acting on the primary site. *Purishadharakala* (~mucosa of colon and rectum) is located in *Pakvashaya* (~large intestine). Commentator *Dalhana* says that *Purishadhara* and *Asthidhara Kala* are the same thing.^[47] Since *Basti* drugs directly affect *Purishadharakala*, we can also directly affect *Asthidharakala* with them. *Sushruta* states that the sixth *Basti* supplies *Mamsa Dhatu* (~muscle tissue), the seventh *Basti* supplies *Meda Dhatu* (~fat tissue), the eighth *Basti* supplies *Asthi Dhatu* (~bone tissue), and the ninth *Basti* supplies *Majja Dhatu* (~bone marrow).^[48] Thus *Vata Dosha Shamana* (~pacification) and *Snehana* (~oleation) of *Asthi Dhatu* can be attained through *Basti*.

Osteoarthritis causes damage to the cartilage by disrupting the glue that holds the cells together. *Taila's Tikshna* and *Suksma* qualities allow it to penetrate cartilage, while its *Snigdha* and *Guru* qualities provide the glue that holds the cartilage cells together. *Taila's* action is referred to as "*Sandhaniya*" (~tissue binding).

Role of Indigenous compound: This compound is formulation of *Guggulu* (*Commiphora mukul*), *Shallaki* (*Boswellia serrata*), *Yastimadhu* (*Glycyrrhiza glabra*), *Pippali* (*Piper longum*), *Guduchi* (*Tinospora cordifolia*), *Nirgundi* (*Vitex negundo*), *Kupilu* (*Strychnos nuxvomica*) and *Godanti* (Calcium Sulfate Dihydrate). It contains qualities such as *Shothahara* (~anti-inflammatory), *Balya*, *Rasayan*, *Sandhaniya*, *Deepana*, *Anulomana* (~regularizing physiological movements), and *Vedanasthapana* (~analgesic). Pharmacologically, it has anti-inflammatory, analgesic, antioxidant, and immunostimulant properties, among others.^[49] *Godanti Bhasma* is an excellent source of naturally occurring calcium. Piperlongumine (PL), a novel alkaloid found in *Piper longum* fruits, has the potential to strongly inhibit the development and activation of osteoclasts.^[50] *Vitex negundo* (Verbenaceae) seeds has potent anti-inflammatory, analgesic, antitumor and antioxidant activity. phenylanthralene-type lignans are the main anti-inflammatory components in the extract of *V. negundo* seeds.^[51]

Role of *Laksha Guggulu*: *Laksha* (*Laccifer lacca*), *Ashwagandha* (*Withania somnifera*), *Arjun* (*Terminalia arjuna*), purified *Guggulu* (*Commiphora mukul*), and *Nagabala* (*Sida veronicaefolia*) are among the ingredients of *Laksha Guggulu*. The majority of these medications possess qualities such as *Vata-Kaphanashaka*, *Deepana*, *Balya*, *Rasayana*, *Tridoshanashaka*, *Pachana*, *Shothaghna*, *Vedanashamaka*, and *Shoolaprashamaka*.^[52] This compound has the potential to enhance the metabolism of bone and cartilage formation by acting on multiple levels, including hormonal, enzyme, immune, psychotropic, mineral and nutrient absorption, and bone and cartilage remodelling. This could potentially check the etiopathogenesis of *Sandhigata Vata* disease and halt its progression.^[53] *Guggulu* has *Katu* and *Tikta Rasa* (~bitter taste), *Katu Vipaka* and it is *Ushna* in *Veerya*. It contains properties such as *Laghu*, *Ruksha*, *Tikshna*, *Vishada*, *Sukshma*, and *Sara*. It is widely used as an emmenagogue, carminative, aphrodisiac, astringent, antiseptic, and expectorant. *Guggulu* is one of the best drugs for treating *Vata* and *Medoroga* disorders.^[54] *Guggulu* inhibits degenerative changes in bones and joints and has anti-inflammatory and analgesic properties.^[55]

Role of *Abhyanga* (~massage) and *Swedana* (~sudation): *Abhyanga* strengthens muscles by acting directly upon them. The roots of *Mamsavaha Srotas* (~channels carrying muscle tissue) are *Raktavahini* (blood vessels), *Tvacha* (skin), and *Snayu* (ligaments). Thus, in this case, *abhyanga* is performed over *Tvacha*, *Snayu* (~includes connective tissue elements such as ligaments, tendons, nerves etc.), and *Raktavahini*. Therefore, *Mamsavaha Srotas* benefits directly in this situation. Additionally, *Abhyanga* nourishes deeper *Dhatu*s. Heat administration by *Swedana* may produce hypno analgesic effect by diverted stimuli and it decreases the stiffness.^[56]

Role of Leech therapy: Anti-inflammatory compounds found in leech saliva, such as bdellins and eglins, help to reduce inflammation, which in turn reduces joint swelling.^[57] Additionally, leech saliva contains compounds that resemble hirudin, calin, and destabilase, which promote microcirculation by lowering blood viscosity.

Carboxypeptidase A inhibitor promotes blood flow at the bite site. Leech saliva also contains substances that resemble histamine and have vasodilator properties.^[58]

Role of Panchamrit Lauha Guggulu: Its constituents include *Lauha Bhasma* (calcined iron), *Makshik Bhasma* (calcined chalcopyrite), *Rajat Bhasma* (calcined silver), and *Kajjali* (black sulphide of mercury). Not only does *Kajjali* (~black mixture of mercury and sulphur) have rejuvenating properties, it also makes the prepared formulation more potent.^[59] According to studies, calcined silver has anti-inflammatory and analgesic properties that prevent protein denaturation.^[60] Fe, Ca, Se, Mg, and K found in calcined biotite mica function as nerve tonics and assist in healing the tissues.^[61] Chalcopyrite is a powerful rejuvenating substance as well.^[62]

Role of Shallaki (*Boswellia serrata*): *Shallaki* possesses *Tikta* (~bitter), *Madhura* (~sweet) and *Kashaya* (~astringent) *Rasa* (~taste); *Ruksha* (~dry), *Laghu* (~light) and *Tikshna Guna*; *Katu* (~pungent) *Vipaka* (~post-digestive effect), whereas *Virya* (~strength or effect) is *Ushna* (~hot).^[63] Classics claim that *Shallaki* possesses strong *Vata-Kaphahara* qualities.^[64] The main ingredients in *Shallaki* are gum (20–36%), acid resin (56–65%), and volatile oil (4–8%). The active ingredients are triterpenoids, which are also referred to as Boswellic acids collectively. Boswellic acids, which comprise a combination of six major constituents, primarily 3 acetyl, 11 keto, boswellic acids (AKBA), are typically found in 43% of *B. serrata* gum resin. These constituents help to preserve the structural integrity of joint cartilage and maintain a healthy immune mediator cascade at the cellular level.^[65] By blocking the synthesis of leukotrienes, boswellic acids works to reduce pain and inflammation. In particular, it blocks the action of the enzyme 5 lipoxygenase via a non-redox process in OA.^[66]

Role of Rasnadi Gutika: it has *Rasna* (*Pluchea lanceolata*), *Guggulu* (*Commiphora mukul*), and *Go-Ghrita* (cow ghee) as ingredients. *Rasna* is having *Ushna Veerya* and alleviates *Kapha-Vata*. The ethanolic extract of the aerial part of *Pluchea lanceolata* exhibited significant anti-inflammatory activity.^[67] Cow ghee is *Rasayana*; it alleviates all the three *Doshas* and pain.^[68] cow ghee can increase nourishment to the bones and joints due to its slimy and unctuous properties.

Role of Vatari Guggulu: Composition of *Vatari Guggulu* is collectively having *Vatashamaka*, *Kaphashamaka*, *Aamapachana*, *Dipana*, *Vedanasthapana* and *Rasayana* properties. Due to *Ushna Virya* and *Vatanulomana* properties, it normalizes the movement of *Apana Vaayu* and *Vyana Vaayu* which in turn helps to relieve pain. Furthermore, the *Kaphashamaka* properties of *Eranda* (*Ricinus communis* Linn) and *Guggulu* (*Commiphora mukul*) by its *Laghu* (lightness), *Ushna* (hot), *Sukshma*, *Sroto shudhikara* properties; it checks blockage of path occurred due to *Kapha Dosha* and so helps to relieve *Stambha* (~stiffness) and *Shotha* (~inflammation).^[69]

Role of Panchtikta Ghrith Guggulu: It is the compound formulation of *Nimba* (*Azadirachta indica*), *Patola* (*Tricosanthes dioica*), *Kantakari* (*Solanum virginianum*), *Guduchi* (*Tinospora cordifolia*), *Vasa* (*Adhatoda vasica*). The majority of the ingredients in *Panchatikta Ghritha Guggulu* include *Madhura- Katu Vipaka*, *Ushna Virya*, and *Tikta Rasa*. The metabolic stage, or *Dhatvagni*, is elevated by *Tikta Rasa*. All of the *Dhatus* will receive more nourishment as *Dhatvagni* increases. As a result, *Majja Dhatu* and *Asthi Dhatu* may stabilise, and *Kshaya* of *Majja Dhatu* and *Asthi Dhatu* will decline. Additionally, *Tikta Rasa* possesses the qualities of *Jwaraghna* and *Daha Prashamana*, which may function as an anti-inflammatory and lessen joint pain and swelling. *Ghritha* is *Vata* and *Pitta Dosha Shamaka*, *Balya*, *Agnivardhaka*, *Madhur*, *Sheeta Virya*, *Shula*, *JwarAhara*, and *Vayasthapaka* also. As a result, it calms *Vata*, enhances the body's general health, and revitalises the body.

Conclusion:

It can be concluded that this critical review of the mentioned clinical trials provides the scientifically proven therapies for the management of *Sandhivata* (Osteoarthritis). It shows that *Ayurveda* remedies can be the choice of drug for these type of ailments as well as these are cost effective and the promising therapies. This literature can be the primary data for the future clinical trials in the field of clinical trials related to Osteoarthritis.

References:

1. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, et al. (1994) The effect of specific medical condition on the functional limitations of elders in the Framingham study. *Am J Public Health* 84(3): 351- 358.
2. Keuttner KE, Goldberg VM (1995) Introduction. In: Kuettner, KE, et al. Osteoarthritis disorders. Rosemont IL. American Academy of Orthopaedic Surgeons, pp: 21-25.

3. Sharma MK, Swami HM, Bhatia V, Verma A, Bhatia SP, et al. (2010) An Epidemiological study of correlates of osteo-arthritis in geriatric population of UT Chandigarh. *Indian J Community Med* 32(1): 77-78
4. Tanuja Mehta et al: Efficacy Of Panchakarma In Sandhivata W.S.R. To Knee Arthritis. *International Ayurvedic Medical Journal* {online} 2021 {cited January, 2021} Available from: http://www.iamj.in/posts/images/upload/212_218.
5. Vagbhatta/ Vagbhatta/ Ashtanga Hridayam/ Sutrasthana/ Ayushkamiya Adhyaya/ 1/7. /English translation by KRS Murthy/Vol. 1./ Varanasi/ Chaukhambha Sanskrit Samsthan/ 2009/ p. 6.
6. Kaviraj ambikadutta Shastri, Editor, Sushruta Samhita, Nidanasthana, Chapter 1, Shloka 28, 11th Edition, Chaukhamba Sanskrit Samsthan; Varanasi: 1997; P. 230.
7. Shah MR, Mehta CS, Shukla VD, Dave AR, Bhatt NN. A Clinical study of Matra Vasti and an ayurvedic indigenous compound drug in the management of Sandhigatavata (Osteoarthritis). *Ayu.* 2010 Apr;31(2):210-7. doi: 10.4103/0974-8520.72399. PMID: 22131712; PMCID: PMC3215366.
8. Mangal A, Shubhasree MN, Devi P, Jadhav AD, Prasad SA, Kumar K, Otta S, Dhiman KS. Clinical evaluation of Vatari guggulu, Maharasnadi kwatha and Narayan taila in the management of osteoarthritis knee. *J Ayurveda Integr Med.* 2017 Jul-Sep;8(3):200-204. doi: 10.1016/j.jaim.2017.02.001. Epub 2017 Jul 28. PMID: 28757225; PMCID: PMC5607387.
9. Singh P, Pandey SD, Narang D, Role of Ayurveda in Osteoarthritis – A Ray of Hope. *Journal of Research in Indian Medicine*, January to June 2022-Vol. 17, Issue-1, p.n.13-19
10. Singh Harishkumar, Varma SA, Dubey J and Nandwane A, AYURVEDIC OVERSIGHT OF MSD (MUSCULOSKELETAL DISORDERS), *World Journal of Pharmaceutical Research*, 2022, 11 (14), 116-124
11. Meena A, Choudhary M, Verma P, Mishra PK, Sharma B, Gautam VK, An Ayurvedic Approach to Sandhivata or Osteoarthritis (OA), *Journal of Pharma and Ayurved Research*, 2021, Volume 1 (2), p.n.26-36
12. Rohilla P, Naik R and Acharya RN, Single herbal remedies for Sandhivata (Osteoarthritis): A review on evidence-based researches in Dravyaguna department of IPGT & RA, Jamnagar, *IJHM* 2016; 4(5): 97-101
13. Tanuja Mehta et al: Efficacy of Panchakarma in Sandhivata W.S.R. To Knee Arthritis. *International Ayurvedic Medical Journal* {online} 2021 {cited January, 2021} Available from: http://www.iamj.in/posts/images/upload/212_218.pdf
14. Sharma P, Sharma R and Zahir R, A LITERARY REVIEW ON SANDHIVATA W.S.R. TO OSTEOARTHRITIS, *World Journal of Pharmaceutical Research*, 2022, 11 (3), 1130-1135.
15. Patil SS, and Rangnekar SS, A review on ayurvedic management of Sandhivata with respect to Osteoarthritis, *World Journal of Advanced Research and Reviews*, 2022, 16(02), 1032–1036.
16. Madan P, Dhaaniya A, Agarwal A and Singh NR, A REVIEW STUDY ON SANDHIGATA VATA AND ITS MANAGEMENT THROUGH AYURVEDA, *World Journal of Pharmaceutical Research*, 2021: 10 (5), 508-518.
17. Sagar S, Dudhamal TS. Systematic review on the management of Sandhivata vis-à-vis Osteoarthritis through para surgical procedures in Ayurveda w.s.r. to Agnikarma and Jalaukavacharan /Leech therapy: A Review. *Journal of Ayurveda Campus*, 2022; 3(1): 69-80.
18. Katara PK. Sawarkar P. Systematic review of Management of Janu Sandhigata Vata (Knee Osteo Arthritis), *Journal of pharmaceutical negative results*, 2022; 13(6): 4396-4404.
19. Wadnerwar N, Prasad KSR, Meena Deogade, Amol Kadu. Comparative study of efficacy of Gunja Beeja lepa and Shunthi Churna lepa in Inflammatory Conditions of Arthritis - A Randomized Controlled Single Blinded Clinical Study, *International Journal of Ayurvedic Medicine*, Vol 11 (2): 200-204
20. Gogia R, Dash NC, Das BK. A CLINICAL APPROACH ON SANDHIV ATA (O.A.) WITH CITRULLUS COLOCYNTHIS COMPOUND, *JR.A.S.* 2003; Vol. XXIV, No. 3-4: 31-47
21. Das B, Padhi MM, Singh OP, Deep VC, Tewari NS, Panda N. CLINICAL EVALUATION OF NIRGUNDI TAILA IN THE MANAGEMENT OF SANDHIVATA, *Ancient Science of Life*, July-Aug-Sep. 2003; XXIII (1): 22-34.
22. Prakash S, Sevatar BK, Godatwar PK. Efficacy of Dashmool taila and Shulahara tail in management of Sandhi-Vata, *Journal of Ayurveda physicians and surgeons*, Oct. 2015; 2 (4): 98-101.
23. Kumar P, Jyoti R. PATRAPINDA SVEDA IN THE MANAGEMENT OF SANDHIVATA W.S.R TO ANKYLOSING SPONDYLITIS, *World Journal of Pharmaceutical Research*, 2018; 7(13): 1116-1122.

24. Patil Rupali Ramadas. Efficacy of Patrapinda Sweda and Matra Basti (Combined therapy) in the Management of Sandhivata (Osteo Arthritis). *International journal of research in AYUSH and pharmaceutical Sciences*, 2017; 1(3): 123-127
25. Rathod D, Dattani K. Effect of Yoga Basti in Sandhivata w.s.r. to Osteoarthritis of Knee joint, *International Journal of Ayurvedic Medicine*, 2017; 8(2): 73-79
26. Chopra A, Saluja M, Tillu G, Sarmukkaddam S, Venugopalan A, Narsimulu G, Handa R, Sumantran V, Raut A, Bichile L, Joshi K and Chopra BP. Ayurvedic medicine offers a good alternative to glucosamine and celecoxib in the treatment of symptomatic knee osteoarthritis: a randomized, double-blind, controlled equivalence drug trial, *Rheumatology* 2013;52:1408-1417.
27. Singh SK, Rai NP, Srivastava VK. Role of an Ayurvedic Compound drug and Brimhana Basti in the management of Sandhivata vis-à-vis Osteoarthritis. *International Journal of Research in Ayurveda and Pharmacy*, 2015; 6(4): 429-434.
28. Kaushik N, Bhojak P, Shettar RV and Sharma R. A clinical trial of abhadi vati in sandhigatavata w.s.r. to osteoarthritis, *IJIRR*, April 2017; 4(4): 3967-3971.
29. Sharma AV, Dudhamal TS, Gupta SK, Mahanta V. Clinical study of Agnikarma and Panchatikta Guggulu in the management of Sandhivata (osteoarthritis of knee joint). *AYU* 2016; 37:38-44.
30. Shah MR, Mehta CS, Shukla VD, Dave AR, Bhatt NN. A Clinical study of Matra Vasti and an ayurvedic indigenous compound drug in the management of Sandhigatavata (Osteoarthritis). *Ayu*. 2010 Apr;31(2):210-7. doi: 10.4103/0974-8520.72399. PMID: 22131712; PMCID: PMC3215366.
31. Rajoria K, Singh SK, Sharma RS, Sharma SN. Clinical study on Laksha Guggulu, Snehana, Swedana & Traction in Osteoarthritis (Knee joint). *Ayu*. 2010 Jan;31(1):80-7. doi: 10.4103/0974-8520.68192. PMID: 22131690; PMCID: PMC3215328.
32. Singh SK & Rajoria K. Clinical Study on Lakshadi Guggulu and Panchatikta Ksheer Vasti in Osteoarthritis of Knee Joint. *JoAYUSH*, 2014; 3(2): 68-79.
33. Rai PK, Singh AK, Singh OP, Rai NP, Dwivedi AK. Efficacy of leech therapy in the management of osteoarthritis (Sandhivata). *Ayu*. 2011 Apr;32(2):213-7. doi: 10.4103/0974-8520.92589. PMID: 22408305; PMCID: PMC3296343.
34. Negi VK, Singh R, Chandla A, Sharma OR, Sharma SK, Rana R, et al. Efficacy of Ayurveda formulations, Pancharmit Lauha Guggulu and Panchguna Taila in the management of Cervical Spondylosis (Greevagraha): A prospective single-arm clinical trial. *J Res Ayurvedic Sci* 2022; 6:152-9
35. Akhtar B, Mahto RR, Dave AR, Shukla VD. Clinical study on Sandhigata Vata w.s.r. to Osteoarthritis and its management by Panchatikta Ghrita Guggulu. *Ayu*. 2010 Jan;31(1):53-7. doi: 10.4103/0974-8520.68210. PMID: 22131685; PMCID: PMC3215322.
36. Das B, Singh SK, Meher SK, Srivastav AK, Ota S, Rana R, et al. Therapeutic evaluation of Rasnadi Gutika and Chandrakala Lepa in Janusandhigata Vata (osteoarthritis knee): A single-arm prospective multicenter clinical study. *J Res Ayurvedic Sci* 2022;6:46-52.
37. Gupta PK, Samarakoon SM, Chandola HM, Ravishankar B. Clinical evaluation of Boswellia serrata (Shallaki) resin in the management of Sandhivata (osteoarthritis). *Ayu*. 2011 Oct;32(4):478-82. doi: 10.4103/0974-8520.96119. PMID: 22661840; PMCID: PMC3361921.
38. Mangal A, Shubhasree MN, Devi P, Jadhav AD, Prasad SA, Kumar K, Otta S, Dhiman KS. Clinical evaluation of Vatari guggulu, Maharasnadi kwatha and Narayan taila in the management of osteoarthritis knee. *J Ayurveda Integr Med*. 2017 Jul-Sep;8(3):200-204. doi: 10.1016/j.jaim.2017.02.001. Epub 2017 Jul 28. PMID: 28757225; PMCID: PMC5607387.
39. Jethava NG, Dudhamal TS, Gupta SK. Role of Agnikarma in Sandhigata Vata (osteoarthritis of knee joint). *Ayu*. 2015 Jan-Mar;36(1):23-8. doi: 10.4103/0974-8520.169017. PMID: 26730134; PMCID: PMC4687233.
40. Grampurohit PL, Rao N, Harti SS. Effect of anuvasana basti with ksheerabala taila in sandhigata vata (osteoarthritis). *Ayu*. 2014 Apr;35(2):148-51. doi: 10.4103/0974-8520.146225. PMID: 25558159; PMCID: PMC4279320.
41. Kumari A, Tewari P, Yogaratnakara. Editor & Translator, Part-1, Ch. 25/ verse 199-203, 1st edition, Varanasi, Chaukhambha Visvabharati, 2010, p.599.
42. Pandit, Bibhas & Singh, Ritika & Jajo, Honey & Satapathy, Trilochan. (2022). REVIEW ON THE RESTORATIVE IMPACT OF ACACIA ARABICA. *International Research Journal of Pharmacy*. 12. 7-15. 10.7897/2230-8407.1212173

43. Sharma AV, Dudhamal TS, Gupta SK, Mahanta V. Clinical study of Agnikarma and Panchatikta Guggulu in the management of Sandhivata (osteoarthritis of knee joint). AYU 2016;37: 38-44
44. Dwivedi AP. An Overview on Agnikarma – A Minimal Invasive Procedure. Ayurveda Today Magazine; 2011. p. 15
45. Shah MR, Mehta CS, Shukla VD, Dave AR, Bhatt NN. A Clinical study of Matra Vasti and an ayurvedic indigenous compound drug in the management of Sandhigatavata (Osteoarthritis). Ayu. 2010 Apr;31(2):210-7. doi: 10.4103/0974-8520.72399. PMID: 22131712; PMCID: PMC3215366
46. Sharma P, Caraka- Samhita. Editor- Translator, Vol.1, Sutra Sthan, Ch.25/ verse 40, Varanasi, Chaukhamba Orientalia, 2011, p.168.
47. Vd. H.S Kasutre, Ayurved Panchkarmavijnana, Published by Baidynath Ayurveda Bhavan, 6th edition;471
48. Ibidem, Sushruta Samhita (2), Anuvasanauttarbastichikitsa Adhyaya, 37/1- 76,164
49. Shah MR, Mehta CS, Shukla VD, Dave AR, Bhatt NN. A Clinical study of Matra Vasti and an ayurvedic indigenous compound drug in the management of Sandhigatavata (Osteoarthritis). Ayu. 2010 Apr;31(2):210-7. doi: 10.4103/0974-8520.72399. PMID: 22131712; PMCID: PMC3215366.
50. Liu X, Diao L, Zhang Y, Yang X, Zhou J, Mao Y, Shi X, Zhao F, Liu M. Piperlongumine Inhibits Titanium Particles-Induced Osteolysis, Osteoclast Formation, and RANKL-Induced Signaling Pathways. *International Journal of Molecular Sciences*. 2022; 23(5):2868. <https://doi.org/10.3390/ijms23052868>
51. (Rui Jing, Yanfei Ban, Weiheng Xu, Hua Nian, Yaoli Guo, Yiya Geng, Yuan Zang, Chengjian Zheng, Therapeutic effects of the total lignans from Vitex negundo seeds on collagen-induced arthritis in rats, *Phytomedicine*, Volume 58, 2019, 152825, ISSN 0944-7113, <https://doi.org/10.1016/j.phymed.2019.152825>.)
52. Rajoria K, Singh SK, Sharma RS, Sharma SN. Clinical study on Laksha Guggulu, Snehana, Swedana & Traction in Osteoarthritis (Knee joint). Ayu. 2010 Jan;31(1):80-7. doi: 10.4103/0974-8520.68192. PMID: 22131690; PMCID: PMC3215328.
53. Singh, S.K., & Rajoria, K. (2014). Clinical Study on Lakshadi Guggulu and Panchatikta Ksheer Vasti in Osteoarthritis of Knee Joint. *Journal of AYUSH* (2014); 3 (2): 68-79.
54. Shastri AD, Susruta Samhita. Editor, Part-1, Chikitsa Sthan, Ch. 5/ verse 40-45, Varanasi, Chaukhamba Sanskrit Sansthan, 2020, p.45
55. Shalaby MA, Hammouda AA. Analgesic, anti-inflammatory, and antihyperlipidemic activities of Commiphora molmol extract (Myrrh). *J Intercult Ethnopharmacol* 2014;3: 56-62.
56. Shah MR, Mehta CS, Shukla VD, Dave AR, Bhatt NN. A Clinical study of Matra Vasti and an ayurvedic indigenous compound drug in the management of Sandhigatavata (Osteoarthritis). Ayu. 2010 Apr;31(2):210-7. doi: 10.4103/0974-8520.72399. PMID: 22131712; PMCID: PMC3215366
57. Rai PK, Singh AK, Singh OP, Rai NP, Dwivedi AK. Efficacy of leech therapy in the management of osteoarthritis (Sandhivata). Ayu. 2011 Apr;32(2):213-7. doi: 10.4103/0974-8520.92589. PMID: 22408305; PMCID: PMC3296343.
58. Michalsen A, Klotz S, Lüdtke R, Moebus S, Spahn G, Dobos GJ. Effectiveness of leech therapy in osteoarthritis of the knee: A randomized, controlled trial. *Ann Intern Med* 2003; 139:724-30.
59. Krishna JM, Gaude R, Yeriswamy H, Sudhindra AN, Yernal R, Bondre H, et al. Significance of Parad in Rasashastra—A review. *J Ayu Herb Med* 2017;3: 169-74
60. Prasad SB, Yashwant, Aeri V. In-vitro anti-inflammatory activity of Raupya (Silver) Bhasma. *J Chem Pharm Res* 2013;5: 194-7
61. Subedi RP, Vartak RR, Kale PG. Study of general properties of Abhraka Bhasma: A nanomedicine. *Int J Pharm Sci Rev Res* 2017;44: 238-42.
62. Mohapatra S, Jha CB. Evaluation of the effect of conventionally prepared Swarnamakshika Bhasma on different biochemical parameters in experimental animals. *J Ayurveda Integr Med* 2011;2: 187-91
63. Bhava Prakasha, Karpooradi-varga51, 2006, Ganga Sahaya Pande and Krishna Chandra Chunekar, Chaukhamba Bharti Academy, Varanasi, 221001:212.
64. Bhava Prakasha, Vatadi-varga 22-23, 2006, Ganga Sahaya Pande and Krishna Chandra Chunekar, ChaukhambaBharti Academy, Varanasi, 221001:521

65. Kimmatkar N, Thawani V, Hingorani L, Khiyani R. Efficacy and tolerability of *Boswellia serrata* extract in the treatment of osteoarthritis of knee: A randomized double-blind placebo-controlled trial *Phytomedicine*; Jan, 10, 2003. p. 37.
66. Dev SA, Selection of Prime Ayurvedic Plant Drugs: Ancient-modern Concordance. New Delhi: Anamaya Publishers; 2006. p. 113-7.
67. Manisha and Garg NK, THERAPEUTIC USES OF RASNA (*PLUCHEA LANCEOLATA*): A REVIEW ARTICLE, *wjpmr*, 2020,6(7), 109-112.
68. Agnivesha. Charaka Samhita. Commented by Chakrapanidatta Ayurveda Dipika Commentary, by Acharya YT, 4th ed. Varanasi: Chaukhambha Sanskrit Sansthan; Sutra Sthana 13/14, p. 82.
69. Mangal A, Shubhasree MN, Devi P, Jadhav AD, Prasad SA, Kumar K, Otta S, Dhiman KS. Clinical evaluation of Vatari guggulu, Maharasnadi kwatha and Narayan taila in the management of osteoarthritis knee. *J Ayurveda Integr Med*. 2017 Jul-Sep;8(3):200-204. doi: 10.1016/j.jaim.2017.02.001. Epub 2017 Jul 28. PMID: 28757225; PMCID: PMC5607387

