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OBSERVATIONAL STUDY OF CORRELATION BETWEEN ASTHIKSHAYA AND ANIDRATA WITH SPECIAL REFERENCE TO BONE MINERAL DENSITY AND PITTSBURGH SLEEP QUALITY INDEX .

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ABSTRACT

Ashraya Ashrayi Bhava deals with the interdependency of *Dosha*, *Dhatu* and *Mala*. If *Dosha* get vitiated they will vitiate *Dhatu* and *Mala* and cause wide array of diseases i.e. when *Pitta* and *Kapha* increases or decreases respective *Dhatu* will also increase or decrease but the exception is *Vata* and *Asthi*. *Vata* and *Asthi* are inversely proportional i.e. when *Vata* aggravates the *Asthi dhatu* decreases and vice versa.

As *Vata* is located in *Asthi*, due to its lightness, *Vata* keeps the bone light. Bones are basically made up of *Prithvi Mahabhuta* (earth element) *Vata dosha* located in this earthy bone keeps the interior of the bone porous and light. So when due to any reasons *Asthi's* porosity increases i.e. when *Asthikshaya* happens in the body simultaneously *Vatavridhhi* also occurs. *Asthikshaya* may be compared to osteoporosis, in which there is decrease in bone mass and leading to increase in bone fragility and susceptibility to fractures. Osteoporosis is often referred to as 'silent disease', because bone loss occurs without symptoms. Measuring the bone mineral density remains the only important tool in the early diagnosis of Osteoporosis; so that the effective, preventive and therapeutic measures can be initiated.

According to Ayurveda, classical signs and symptoms of *Vatavridhhi* includes *Anidrata* (insomnia), that means *Asthikshaya* indirectly hampers quality of sleep (*Nidra*). Hence foresight of this study is to focus on sleep quality of patient during doing treatment of any *Vatavyadhi*.

INTRODUCTION-

Ayurveda is a system of medicine with historical roots in the Indian subcontinent. The main classical Ayurveda texts begins with accounts of transmission of medical knowledge from gods to sages and then to human physician.

The state of health has been defined as the presence of equilibrium in activities of *Dosha*, *Agni*, *Dhatu*, *Mala* and calm and pleasant state of soul, sense organ and mind.^[1]

Tridosha are the biological entities derived from *Panchamahabhuta*, responsible for regulation of all bodily functions.

The vitiation of the *Dosha* is manifested in their substratum known as *Dhatu*.

which includes *Rasa*, *Rakta*, *Mansa*, *Meda*, *Asthi*, *Majja* and *Shukra*. *Asthi* is the fifth *Dhatu* among the seven *Dhatu*s. *Dehadharana* is the main function of *Asthi Dhatu*.^[2]

We can't quantify *Kshaya* and *Vridddhi* of *Dosha*, as quantitative measures for this are not described in classic Ayurveda texts.

Physiological discordance or *Kshaya Vridddhi* occurs naturally in these biological factors i.e. *Dosha*, *Dhatu*, *Mala*, which is not harmful because they do not produce any disease.^[3] When this *Kshaya Vridddhi* will exceed beyond the physiological limit, disease will be produced.

Asthidhatu Kshaya (decrease in bone tissue mass) is a condition explained in Ayurveda, under the heading *Asthidasha Kshayas*.

AsthiKshaya may be compared to osteoporosis, in which there is decrease in bone mass and leading to increase in

bone fragility and susceptibility to fractures.^[4]

According to Ayurveda, classical signs and symptoms of *Vatavridddhi* includes *Anidrata* (insomnia), that means *AsthiKshaya* indirectly hampers quality of sleep (*Nidra*).

As *Vata* is located in *Asthi*, due to its lightness, *Vata* keeps the bone light. Bones are basically made up of *Prithvi Mahabhuta* (earth element) *Vata dosha* located in this earthy bone keeps the interior of the bone porous and light. So when due to any reasons *Asthi's* porosity increases i.e. when *AsthiKshaya* happens in the body simultaneously *Vatavridddhi* also occurs.

AsthiKshaya may be compared to osteoporosis, in which there is decrease in bone mass and leading to increase in bone fragility and susceptibility to fractures. Osteoporosis is often referred to as 'silent disease', because bone loss occurs without symptoms. Measuring the bone mineral density remains the only important tool in the early diagnosis of Osteoporosis. According to Ayurveda, classical signs and symptoms of *Vatavridddhi* includes *Anidrata* (insomnia), that means *AsthiKshaya* indirectly hampers quality of sleep (*Nidra*).

Hence foresight of this study is to focus on sleep quality of patient during doing treatment of any *Vatavyadhi*.

AIM OF THE STUDY:

To study of correlation between *AsthiKshaya* and *Anidrata* with special reference to Bone Mineral Density and Pittsburgh Sleep Quality Index.

Objectives –

To assess the effect of *AsthiKshaya* on *Nidra*.

To study the relation between *Asthikshaya* and *Vatavriddhi*.

To study the relation between *Vatavriddhi* and *Nidra*.

To study the *lakshanas* of *Asthikshaya*.

To study the *lakshanas* of *Vatavriddhi*.

REVIEW OF LITERATURE:

ASTHIDHATU-

Asthi Dhatu is formed from previous i.e. *Medo Dhatu*. When *Medo Dhatvagni* acts on *Medo Dhatu*, *Poshaka Asthi Dhatu* is produced. *Asthi dhatvagni* acts on this *Asthayi (Poshaka) Asthi Dhatu* in *Asthivaha Strotasa* and thus *Sthayi Asthi Dhatu* is formed along with *Poshaka Ansha* for *Majja Dhatu* from *Sara* part and *Kesha* and *Nakha (Mala)* from *Kitta* part.^[5]

Asthidhatu is predominant in *Prithvi*, *Agni* and *Vata* in opinion of *Charaka Samhita* and *Prithvi* and *Vata* in opinion of *Sushruta Samhita*.^[6]

The dominant *Prithvi Mahabhoota* makes *Asthi Dhatu* strongest among all other *Dhatu*s.

Asthi Kshaya –

Asthi Kshaya means decrease in the bone tissue.

there is falling of hairs of the head and body, nails, mustaches and teeth exhaustion and loosening and pain of joints. *Asthi* becomes weak and light in weight, as well as there is feeling of bones being broken down. Diseases of *Vata Dosh*a always affect such a person. Due to waning *Asthidhatu* falling of head and body hair, nail, beard, and teeth is observed.

Dalhana adds that entire body becomes dry along with nails and teeth. This is

logical as *Vata* and *Asthidhatu* bear interrelationship.^[7]

Asthi and vata dosha relationship

Dosha, *Dhatu* and *Mala* are in close relationship with each other. *Dhatu* provides seat for *Dosha* possessing specific *Guna* and *Mahabhuta* dominance. This relationship is called “*Ashrayashrayi Sambandha*”.

If *Dosha* gets vitiated they will vitiate the *Dhatu* and *Mala* and cause wide array of diseases i.e. when *Pitta* and *Kapha* increases or decreases its respective *Dhatu* will also increase or decrease. But the exception is *Vata* and *Asthi*. *Vata* and *Asthi* are inversely proportional i.e. when *Vata* aggravates the *Asthi Dhatu* decreases.

Vata Dosh Vridhhi Lakshanas –

Vata when increased produces roughness of skin, emaciation of body, darkened complexion, tremors of limbs. Such person longs for hot things. He suffers from insomnia. He feels weak. He passes hard stools.^[8]

AYURVEDIC REVIEW OF ANIDRATA –

Nidra is one among the “*Trayopasthambha*”. *Ayurveda* has described *Nidra* among the primary tripod of life, where the total abstinence of it may harm the life. *Vata* and *Pitta* are the *Pradhana Dosh*as contributing to *Anidra*.

When *Dosha Kapha* encircles *Strotus*, when sense organs are overworked and perform their duty of perception no more, sleep is induced in human body. Heart is main source of *Chetana* or activity. When *Tama* becomes prevalent sleep is induced. Sleep may of any type. Chief inductive factor for sleep is always *Tama*. With *Sattva*, one keeps always well

informed about external and internal environment of living body. Hence sleep is induced whenever *tama* is on higher side due to any reason.^[10]

Happy status of mind, nourishment of body, strength of body, virility, knowledge, and life are the gifts of sleep.^[11]

Anidrata –

There is no direct reference regarding the causative factors of *Anidrata*. In *Charaka Samhita*, *Ashtanga Hridaya* and *Ashtanga Sangraha* the *Acharyas* are explained the *Chikitsa* procedure of *Atinidra* and in this context they mentioned that if any *Atiyoga* occurs to these *Chikitsa* procedures it may leads to *Nidranasha* condition.

Osteoporosis-

Osteoporosis is a condition which is difficult to define accurately. A simple definition is that it is an abnormal reduction in bone tissue mass per unit volume of anatomical bone. Moreover there is another condition termed as Osteopenia, which is a prodromal stage of Osteoporosis in which there is also decrease in Bone Mineral Density, but the decrease is not so remarkable as compared to Osteoporosis.

In this condition there is deterioration of micro architecture of the skeleton leading to increased bone fragility. There are two major determinants of bone mass and mineral density in later life, first is the extent of peak bone mass in early adulthood, and second is the rate of involutional bone loss. There after Both determinants are governed by complex interactions of

genetic, environmental, nutritional, hormonal, age-related, and lifestyle factors. Within the third decade of life the skeletal mass begins to diminish at a rate of about 0.5% per year in both sexes.

According to survey, estimated data suggest that of 230 million Indians expected to be over age of 50yrs in 2015, 20% of them are women with osteoporosis.^[90] In India, the survey claimed to have screen close to 73 lakh men out of which 80% were found to have alarmingly low levels of vitamin D.^[12]

Classifications of osteoporosis

Primary

- a. Post-menopausal: type I
- b. Age related: type II

Secondary

1. Endocrine
2. Inherited
3. Drugs
4. Nutritional
5. Immobility
6. Others

T-scores –

When T score is -1 and above it is considered as normal.

T scores between -1 and -2.5 represents osteopenia.

T score below -2.5 represents osteoporosis and a high risk of fracture.

T score below -2.5 plus one or more fragility fractures is indicative of established osteoporosis.

Bone densitometry measures bone density, not bone turnover or bone stability.^[13]

BMD values are expressed as absolute values in g/cm² (i.e. as an areal density corrected for height or width of bone but not depth) or as SDS related to the young adult (T scores) or age matched (Z scores) reference range.

MODERN REVIEW OF SLEEP -

We now know that our brains are very active during sleep. Moreover, sleep affects our daily functioning and our physical and mental health in many ways. During sleep, we usually pass through five phases of sleep: stages 1, 2, 3, 4, and REM (rapid eye movement) sleep. These stages progress in a cycle from stage 1 to REM sleep, then the cycle starts over again with stage 1. We spend almost 50 percent of our total sleep time in stage 2 sleep, about 20 percent in REM sleep, and the remaining 30 percent in the other stages.

About half of all people over 65 have frequent sleeping problems, such as insomnia, and deep sleep stages in many elderly people often become very short or stop completely. This change may be a normal part of aging, or it may result from medical problems that are common in elderly people and from the medications and other treatments for those problems.^[14]

MATERIALS AND METHODS

Materials:

- Literary reviews of various *Asthikshaya* and *Anidrata* were taken from various *Samhitas* including *Bruhatrayis* and *Laghutrayis* and their concerned commentaries.
- Literary reviews of Osteoporosis and sleep quality assessment were collected from various modern literatures and Internet.
- Assessment of sleep quality with the help of Pittsburgh Sleep Quality Index(PSQI).

Methods:

Patient had clinical signs and symptoms of *Asthikshaya* were selected for the study from outdoor patient department and indoor patient

department of our hospital by arranging Bone Mineral Density (BMD) check up camp in hospital, for age group 40 years to 70 years. Patients having classical signs and symptoms of *Asthikshaya* were subjected for the study.

Type of study:

Observational cross-sectional type of study.

Place of Study:

Patients reported in the OPD and IPD of our Hospital were carefully selected according to the diagnostic, inclusive criteria.

Consent:

An informed written consent of all patients included in my study was taken before starting the study.

Ethical clearance:

Clearance from ethical committee of the institution was taken.

Plan of Study:

The study was carried out under two headings, viz. Conceptual study and Observational study.

1. Conceptual Study

For this study, the conceptual and basic materials have been collected from *Ayurvedic* classics as *Bruhatrayee* and *Laghutrayee*, mainly the *Charaka Samhita*, *Sushruta Samhita* and other classics with available commentaries as well as various reference books to be reviewed.

Various Publications, Research papers, Text books, proceedings of seminars have been referred to collect literary material. All these collected literary materials have been critically analysed and also assessed and evaluated as per hypothesis and problem selected here. Related portion of the modern medical science has also been compiled and

considered. Discussions with Senior and renowned academicians have paved the way to reach to some fruitful conclusions.

2. Observational Study

For this Observational study the materials and methods include registration of the Patients as per criteria of inclusion as well as exclusion. The special research proforma or case record form incorporating all required examinations and the investigations conducted with the use of *Ayurvedic* and Modern techniques had made. For the present study, 60 diagnosed patients of *Asthikshaya* had taken from the Outdoor Patient Department and Indoor patient Department of our Hospital. Patients were selected as per the inclusion and exclusion criteria. Patients were observed on the basis of classical signs and symptoms of *Asthikshaya*, *Anidrata* and *Bone Mineral Density*.

Sample Size: 60 Patients.

Inclusion criteria

Age group between 40yr-70yr.
Individuals irrespective of gender, caste, religion, economic status.
Subject ready to give informed consent.
Pre-diagnosed case of Osteoporosis.

Exclusion criteria

Physically handicapped individual.
Individuals with present or past history of psychiatric illness.
Asymptomatic healthy individuals.
Those with age less than 40 years and more than 70 years will be excluded.
Patients with Osteoarthritis, Rheumatoid arthritis, Gouty arthritis.
Patients having any other major illness like major cardiac disorder, malignancy, HIV, HBsAg.

Withdrawal criteria

Those who are not willing for participation in this study at any stage of study can be withdrawn.

Instrument –

Bone Mineral Densitometer.
Pittsburgh Sleep Quality Index.

Criteria for Assessment of *Asthikshaya*:

1.Criteria for Diagnosis of *Asthikshaya* by classical sign and symptoms:

Grading and scoring of *Asthikshaya lakshanas*-

- *Danta vikara/paat* (Dental deformity/fall):
 - 1) No dental deformity -0
 - 2) Occasional dental pain with dental caries or loosening of at least one tooth-1
 - 3) Dental pain that don't responds to analgesics along with caries/loosening / loss of 2-4 teeth-2
 - 4) Loosening / loss of 4-8 teeth-3
- *Asthi shula/tod* (Pain in bones)
 - 1) No piercing pain in bones-0
 - 2) Mild piercing pain in bones not affecting daily activities-1
 - 3) Occasional moderate piercing pain in bones not affecting daily activities. Pain can be relieved by rest no need of medication-2
 - 4) Frequently severe piercing pain in bones affecting daily Activities, Patient needs medication-3
- *Kesha paat* (Hair fall):
 - 1)No hair fall-0
 - 2) Hairs fall once in the morning while washing / combing-1
 - 3) Hair fall even without combing and raised hairline in frontal region (mild baldness)-2
 - 4) Visible or significant baldness in frontal or vertex region-3

- *Nakha vikara/paat*- Nail deformity
 - 1) No Nail deformity-0
 - 2) Mild loss of natural texture & malleability of nails-1
 - 3) Moderate loss of texture & malleability of nails-2
 - 4) Visible brittleness of nails (which breaks easily)-3
- *Rukshata (Dryness)*
 - 1) No dryness-0
 - 2) Occasional dryness without winter season-1
 - 3) Visible dryness, mild dull white streaks after scratching on the skin which disappears after sometime-2
 - 4) Dryness/roughness, bright white streaks on the skin remaining for a considerable time-3
- *Sandhishaitilya*
 - 1) No pain on walking-0
 - 2) Mild pain but no difficulty in walking-1
 - 3) Walking with severe pain and difficulty-2
 - 4) Unable to walk-3
- *Shrama*
 - 1) No fatigue-0
 - 2) Fatigue occasionally in doing heavy work-1
 - 3) Fatigue in doing some extra work and not otherwise fatigue In carrying out routine work-2
 - 4) Fatigue even without doing work-3

Table: 1- Gradation of *Asthikshaya*

Grade	<i>Asthikshaya</i>	Score Range
1	<i>Pravara</i>	0-7
2	<i>Madhyama</i>	7-14
3	<i>Avar</i>	14-21

2. Assessment of *Nidra* will be done with help of Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates “poor” from “good” sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

Objective Parameter of *Asthikshaya* – Bone Mineral Density:

Bone density measurements of healthy young adults in a population are taken as the reference measurement (called a T-score). Osteoporosis is diagnosed when a person’s BMD is equal to or more than 2.5 standard deviation below this reference measurement. Osteopenia is diagnosed when the measurement is between 1 and 2.5 standard deviation below the young adult reference measurement.

OBSERVATIONS AND RESULTS

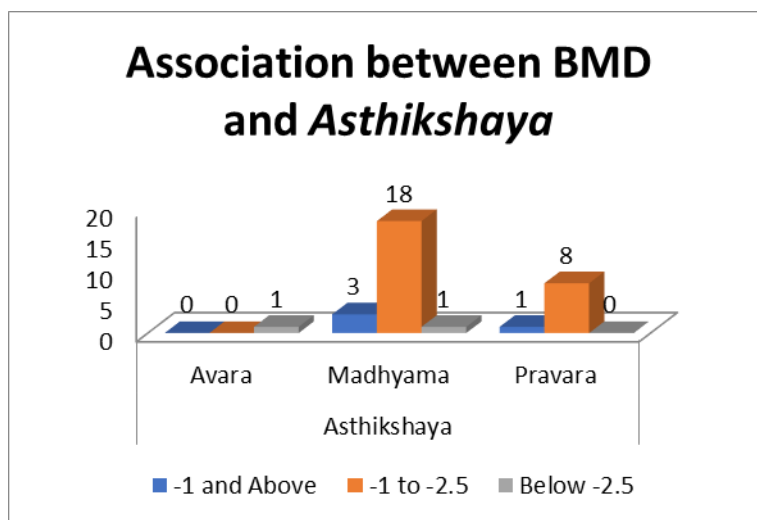
- The above said objective parameters of the study were recorded without any bias and the gained results were arranged in the tabular, pie chart format and the outcomes were evaluated statistically.

Statistical Analysis Association between BMD and Asthikshaya

Chi square test for association between BMD and Asthikshaya

BMD	Asthikshaya			Total	X ²	DF	P
	Avara	Madhyama	Pravara				
-1 and Above	16	3	1	20	12.7634	4	.012491 (Significant)
-1 to -2.5	12	18	8	38			
Below -2.5	1	1	0	2			
Total	29	22	9	60			

Association between BMD and Asthikshaya



As value of p is less than 0.05, significant difference was found between BMD and Asthikshaya.

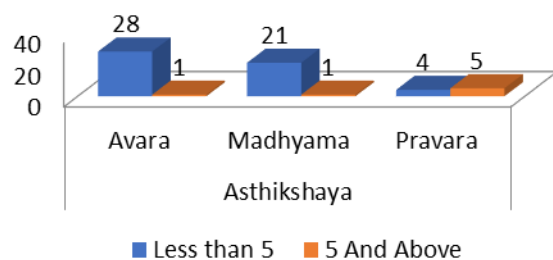
Association between PSQI and Asthikshaya

Chi square test for association between PSQI and Asthikshaya

PSQI	Asthikshaya			Total	X ²	DF	P
	Avara	Madhyama	Pravara				
Less than 5	28	21	4	53	19.805	2	.00005004 (Significant)
5 And Above	1	1	5	7			
Total	29	22	9	60			

Association between PSQI and Asthikshaya

Association between PSQI and Asthikshaya



As value of p is far less than 0.05, significant difference was found between *Asthikshaya* and BMD Score whereas significant difference was also found between *Asthikshaya* and PSQI Score.

After comparing data statistically by Chi-Square test, there is significant difference observed between *Asthikshaya* and PSQI Score.

Hence it is concluded that,

1. There is significant association between *Asthikshaya* and BMD Score.
2. There is significant association between *Asthikshaya* and PSQI Score.

6. DISCUSSION

Plan of study –

In this study, total 60 patients were observed. *Asthikshaya Lakhanas* were assessed with the help of subjective criteria and Bone Mineral Densitometry. *Nidra* is assessed with the help of Pittsburgh Sleep Quality IDEX (PSQI). The obtained result is statistically analysed and calculated. Further the result obtained in the study is discussed as follows.

1. Sample Size

Total number of students is 60. The sample size is taken according to the need of the study.

2. Age

In present study maximum i.e. 55% of patients were from age group 55-60. While 38.33% patients were from age group 40-50. 6.67% of patients from age group 61-70. Because of diminishing *Agni* in older age, all the *Dhatu*s decrease in quantity and quality. Bone favors synthesis in youth and in old age favors resorption. Also peak bone mass is achieved at the age of 20 years and then bone loss begins which is accelerated in old age. As *Aacharya Sushruta* said that age of *Hani* (40 years) i.e. last phase of *Madhyamawastha* when *Kshaya* of all *Dhatu* begins, and that is why this age group is selected for the study.

3. Gender

Out of 60, 60% of patients observed were male and remaining 40% were female. osteoporosis is explained by the fact that women possess genetically low Postmenopausal bone mass than men. References related to this are available in our classic literature also, while mentioning specific characteristics of female like *Bala Kshaya*, *Asamhanana*, *Shaithilya*, *mardava*. Osteoporosis is an Age related degenerative disease which affects both the sexes equally but in the women's it manifests early because of menopausal stage.

4.Height

In the present study, 28.33% of patients were of ranging between 166-170 Cm. 26.67 % of patients having height between 156-160 Cm. 18.33 % of patients having height between 150-155 Cm. 18.33 % of patients having height between 161-165 Cm. And 8.33% of patients having height between 171-175 Cm. Many studies have concluded that there is a positive correlation between height of an individual and his bone mass, so excessive height loss does reflect low bone mass and may predict osteoporosis related fractures. In Ayurveda, *Ashtavidh Sara* concept is explained, in which *Asthi Sara Purusha* (individual) *Lakshanas* were mentioned which includes *Parvasthoola-Sthoolasthi* means these individuals have large bones so ultimately *Asthisara* individuals possess more height.

5.Weight

In the present study, 51.67 % of patients have weight between 61-70 Kg. 31.67% of patients having weight between 71 to 80 kg. 13.33% of patients having weight between 50-60 Kg. and 3.33% of patients having weight between 81-90 Kg. In modern sciences it is observed that overweight individuals have a higher bone mineral density than individuals of lesser body weight. Therefore, the general consensus has been that heavier individuals are more protected against bone fractures and osteoporosis than lighter individuals. In Ayurveda, *Asthisara purush Lakshanas* have mentioned by different Acharyas which states, *Parshni* (heel), *Gulph* (ankle), *Janu* (knees), *Aratni* (forearm), *Jatru* (neck), *Chibuk* (), *Shir* (head) are *Sthool* (large) as well as they have *Sthool Asthi-Nakha-Danta*; this

suggests that as all these parts are comparatively large then these individuals may possess higher body weight.

6.Occupation

The present study shows that maximum number of patients i.e.26.67% are housewives. 25% of patients are in private sector. While govt. servants and farmers contribute 16.67% each out of 60 patients. 6.67% of patients were teacher by occupation. While labourer and retired category of occupation contributes 3.33% each in this study group. And 1.67% of patients were bankers. Exercises, mobility etc illuminate *Dhatavagni* and bone responds to mechanical stimuli. When placed under mechanical stress, bone tissue increases deposition of mineral salts. As house wife and service group patients are less in mechanical activity; hence, more prone to osteoporosis.

7.Religion

In our study 86.67% of the patients were Hindu, 11.67% were Muslim and 1.67% were Jain by religion. Different religions have the different food culture. And different food habits show different effects on human body, so Bone health may vary according to this.

8.Desha

In the present study, 88.33% of patients were residents of *Sadharan Desha* and 11.67% of patients were residents of *Jangal Desha*. In Ayurveda, three types of *Desha* (Habitat) were mentioned as *Jangal-Aanup-Sadharan*. According to Ayurveda, these *Desha* have different environment which affect the health and body built of an individual belonging to that *Desha*. As different localities have different crop production specialities e.g.

Punjab state grows large amount of wheat crop, this shows effect on food culture of that particular Desha. The environment of these Desha affect the Guna (properties) of crops produced here.

9. Economical Status

In the present study, 58.33% of patients were belonging to middle economic status, while 21.67% of patients were belonging to upper Economical status. As economical status hugely affect the type and quality of food taken by that individual, it ultimately affect the bone health.

10. Family History

In the present study, 51.67% of patients had negative family history, while 48.33% of patients had positive family history. Osteoporosis does run in families, probably because there are inherited factors that affect bone development.

11. Past illness

In the present study, 67% of total patients were having no any past illness, 8% of patients were having DM, 20% of patients were having HTN, and 5% of total patients were having both DM and HTN. In hypertension patients, excess urinary calcium secretion induces Secondary Parathyroidism to increase serum calcium level by calcium release from bone, which may accelerate osteoporosis. Diabetes mellitus (DM) increases osteoclast function but decreases osteoblast function, thereby leading to accelerated bone loss, osteopenia and osteoporosis.

12. Diet

In the present study, 63.33% of patients were having mixed type of diet and 36.67% of patients were having pure vegetarian diet. *Asthi* is formed from

Ahara Rasa in the process of formation of *Dhatu*. Hence quality and quantity of *Ahara Rasa* can interfere with quality and quantity of *Asthi Dhatu*. Calcium and vit-D (*Asthi Dhatu Poshaka Ansha*) plays an important role in bone formation. Decreased lifetime calcium intake is a factor causing risk for developing osteoporosis

13. Agni

In this study, 40% of patients were of *Tikshnagni*, 35% of patients were of *Mandagni*, while 25% of patients were having *Madhyamagni*. When *Jatharagni* of an individual is in *Samyak Avastha* then it digests food material properly and forms *Aharrasa* devoid of *Aam*, which further provide nutrition to *Asthi Dhatu*. Also *Dhatwagni* is highly dependent on *Jathragni* it is important to watch for *Agni* of an individual.

14. Addiction

In the present study, 35% of patients were not addicted to anything, while 35% were addicted to tea, 18.33% were addicted to chewing tobacco, and 11.67% of patients were addicted to alcohol. Smoking reduces the amount of calcium that your bone absorbs. Vitamin D helps bones to absorb calcium, but smoking interfere with how your body uses vitamin D. Less calcium is available to build strong bones.

15. Nidra

In the present study, 35% of patients were having satisfactory sleep, while 65% were having not so satisfactory sleep.

16. Menstrual history

In the present study, out of all 60 patients 21.67% of female patients i.e. 13 female patients were attained menopause.

17. BMD-T score

In the present study, 63.33% of patients were osteopenic, 33.33% of patients were having normal bone mineral density, while 3.33% of patients were osteoporotic. It is more reliable to compare statistical data of *Asthi Kshaya Lakshana* with BMD T-score rather than plain radiograph for correlation of osteoporosis and *Asthi Kshaya*.

18. Discussion on Observations of Subjective Criteria

A) Dantvikara

In assessment of *Asthi Kshaya Lakshanas*, out of 60 patients 63.33% of patients shows Grade 1 of *Dantvikara*, 23.33% of patients shows Grade 2 of *Dantvikara Lakshanas*, and 11.67% of patients shows Grade 3 of *Dantvikara*. While 1.67% of patients were having no *Dantvikara Lakshanas*. Acharya Sharangdhara mentioned *Danta* as a *Updhatu* of *Asthidhatu* and *Poshana* (nutrition) of *Updhatu* depends upon *Poshana* (nutrition) of *Asthidhatu*; means individuals having *Asthi Kshaya* will surely develop *Dantvikara* if not treated at early stage. Osteoporosis impacts all the bones of the body including jaw bones. Loss of bone density in the jaw compromises tooth stability, increasing the loss of tooth loss and periodontal diseases.

B) Asthishoola

During assessment of *Asthi Kshaya Lakshanas*, 66.67% of patients shows Grade 1 *Asthishoola*, 18.33% of patients shows Grade 3 *Asthishoola*, 11.67% of patients shows Grade 2 *Asthishoola*, while 3.33% of patients don't show any *Asthishoola*. In *Asthi Kshaya*, *Vata Dosh* *Vridhhi* Occurs simultaneously due to *Ashraya Ashrayi Sambandha* of *Vata Dosh* and *Asthi Dhatu*. At the place of *Sthanvaigunya* when *Vivruddha Vata*

accumulates it causes *Shool* (Pain) at that place, as *Vedana* or pain is said to be the *Pratyatma Lakshana* of *Vata Dosh*. So here excessively accumulated *Vata* in *Asthi* causes *Asthishoola*. Vitamin D status influences musculoskeletal health. Low Vitamin D level may lead to low bone mass and eventually bone pain.

C) Keshpata

In the present study, during assessment of *Asthi Kshaya Lakshanas*, 50% of patients were having Grade 1 *Keshpata*, 28.33% of patients were having Grade 2 *Keshpata*, 11.67% of patients were having grade 3 *Keshpata*, 21.67% of patients were having no *Keshpata*. Since the *Dhatu* metabolism involves two *Pakas* Viz. *Prasad Paka* and *Kitta Paka*, the *Dhatu* when gets affected simultaneously affect the *Updhatu* and *Malas* as a common group. When there is defect in *Dhatu* metabolism due to improper supply of nutrients, naturally the *Prasad Paka* and *Kitta Paka* are affected leading to *Vikaras* of *Dhatu*, *Updhatu* and *Mala* also. *Kesha* (hairs) are explained as *Mala* of *Asthidhatu* in Ayurveda. So quality of *Kesha* may vary according to the *Poshana* (nutrition) of *Asthi Dhatu*, as they gain *Poshak Ansh* (nourishing factor) from it.

D) Nakhvikara

In the assessment of *Asthi Kshaya Lakshanas*, 55% of patients were having Grade 1 *Nakhvikara*, 15% of patients were having Grade 2 *Nakhvikara*, 30% of patients were having no *Nakhvikara*. *Kesha*, *Roma*, *Nakha* and *Smashru* are the *Malas* of *Asthi Dhatu*. As explained in *Dhatu Utpatti*, by the action of *Asthyagni* the *Kitta* part is produced during *Kitta paka* nourishes the *Malas* of *Asthi*. In *Asthi Kshaya*, there is lack of proper

nourishment to the *Asthi Dhatu* due to *Poshak Ansh Alpata.Nakha* (nails) are explained as *Mala* of *Asthidhatu* in Ayurveda. So health of nails may vary according to the *Poshana*(nutrition) of *Asthi Dhatu*, as they gain *Poshak Ansh* (nourishing factor) from it. In modern science, brittle and weak nails are mentioned as the early signs of osteoporosis.

E) *Rukshata*

In the assessment of *Asthi Kshaya lakshanas*, 41.67% of patients were having Grade 1 *Rukshata*, 26.67% of patients were having Grade 2 *Rukshata*, 5% of patients were having Grade 3 *Rukshata*, while 26.67% of patients were having no *Rukshata*. *Vata Dosha* is said to be having *Ruksha, Laghu, Daruna, Khara* and *Vishada* *Gunas* (characteristic properties). *Ruksha Guna* among these has utmost capability to elicit the *Vata Dosha*. This *Gunataha Vriddhi* of *Vata Dosha* leads to *Rukshata* in whole body by decreasing *Snigdhatu* in *Sharira*.

F) *Sandhishaitilya*

In the assessment of *Asthi Kshaya*, 46.67% of patients were having Grade 1 *Sandhishaitilya*, 26.67% of patients were having Grade 2 *Sandhishaitilya*, 3.33% of patients were having Grade 3 *Sandhishaitilya*, while 23.33% of patients were having no *Sandhishaitilya*. *Shleshak Kapha* which is situated in the *Sandhi* aids in *Sandhi Bandhan* and also in the normal functions of *Sandhi* by lubricating it. One of the *Lakshanas* of *Vata Vriddhi* and *Kapha Kshaya* specially *Shleshak Kapha* is *Sandhishaitilya*. *Sandhis* are made by

21. Association between BMD and *Asthi Kshaya*

BMD	<i>Asthi Kshaya</i>			Total
	<i>Avara</i>	<i>Madhyama</i>	<i>Pravara</i>	

the articulation of the *Asthi* and in *Asthi Kshaya*, *Prakupit Vata* makes *Sthansanshraya* in the *Asthi* and affects the *Sandhi* causing the *Shoshan* (drying) of the *Shleshak Kapha*. The *Vata* Dries up the *Shleshak Kapha* because of its *Ruksha, Khara* etc. *Gunas* leading to *Sandhishaitilya*.

G) *Shrama*

In the assessment of *Asthi Kshaya lakshanas*, 51.67% of patients were having Grade 1 *Shrama*, 13.33% of patients were having Grade 2 *Shrama*, 5% of patients were having Grade 3 *Shrama*, while 30% of patients were experiencing no *Shrama*. The resistance of the body against workload produces the *Lakshanas* like *Shrama*. The feeling of tiredness and weakness in the body produced even while performing mild activities is called as *Shrama*. It is explained that there will be *Bala Kshaya* in *Asthi Kshaya* due to *Vata Prakopa* and *Vata Kshaya*.

19. Overall *Asthi Kshaya* Gradation

In the overall assessment of *Asthi Kshaya lakshanas*, 48.33% of patients were having *Pravara Asthi Kshaya lakshanas*, 36.67% of patients were having *Madhyam Asthi Kshaya lakshanas*, 15% of patients were having *Avar Asthi Kshaya lakshanas*.

20. PSQI Score

In this study, 11.67% of patients were having significant sleep quality disturbances, while 88.33% of patients were having less significant sleep quality disturbances.

-1 and Above	16	3	1	20
-1 to -2.5	12	18	8	38
Below -2.5	1	1	0	2
Total	29	22	9	60

After applying chi-square test as value of p is less than 0.05, significant difference was found between BMD and *Asthikshaya*. So statistically it was concluded that there is significant association seen between BMD and *Asthikshaya*.

22. Association between PSQI and *Asthikshaya*

PSQI	<i>Asthikshaya</i>			Total
	Avara	Madhyama	Pravara	
Less than 5	28	21	4	53
5 And Above	1	1	5	7
Total	29	22	9	60

As value of p is less than 0.05, significant difference was found between PSQI and *Asthikshaya*. So, statistically it was concluded that there is significant association seen between BMD and *Asthikshaya*.

8. CONCLUSIONS

The following conclusions had drawn from the present study topic-

"Observational Study of Correlation Between *Asthikshaya* And *Anidrata* With Special Reference to Bone Mineral Density And Pittsburgh Sleep Quality Index."

1. There is correlation between *Asthikshaya* and *Anidrata* exists which was the primary objective of the study.

2. During clinical assessment of *Lakshanas* of *Asthikshaya*; *Dantavikara*, *Asthishoola*, *Keshpaat*, *Nakhvikara*, *Rukshata*,

Sandhishaitihilya, *Shrama* were present minimally in patients having BMD T-Score above -1.

3. Past family history of *Asthikshaya*, Past history of DM or HTN or both, Addiction like alcohol and tobacco, sedentary job are the risk factors for development of *Asthikshaya*.

4. During comparison of *Asthikshaya* and PSQI score; patients having severe complaints of *Asthikshaya Lakshanas* were majorly facing night time sleep disturbances.

5. The amount of bone gained during adolescence should equal the amount of loss during the rest of adult life, if you do not build enough bone in adolescence, you will have, too little to "draw from" during the later part of life. Low-lifetime calcium intake, underweight, menopause

and sedentary life style were the risk factors found in majority.

6. Osteoporosis is an age related degenerative disease which affect both sexes equally but in women, it is manifested early because of menopausal stage.

7. Although hereditary and certain unchangeable factors such as race, body built, gender, play a vital part in determining peak bone mass. Upto maximum extent can be attributed to life style behavior and dietary habits.

8. After comparing data statistically by Chi- Square test, there is significant difference observed between *Asthikshaya* and PSQI Score. We should reject the null hypothesis H_0 and accept the alternate hypothesis H_1 i.e. there is effect of *Asthikshaya* on *Nidra*.

9. For minimizing *Asthikshaya* and preventing bone loss, ideal period of intervention can be the beginning of age of Hani (40 years) i.e. last phase of *Madhyamavastha* when *Kshaya* of all *Dhatu* begins.

As value of p is far less than 0.05, significant difference was found between *Asthikshaya* and BMD Score whereas significant difference was also found between *Asthikshaya* and PSQI Score. After comparing data statistically by Chi-Square test, there is significant difference observed between *Asthikshaya* and PSQI Score. We should reject the null hypothesis H_0 and accept the alternate hypothesis H_1 i.e. there is effect of *Asthikshaya* on *Nidra*.

Hence it is concluded that, There is significant association between *Asthikshaya* and BMD Score and also between *Asthikshaya* and PSQI Score.

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