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Prevalence of Neck Flexion Angle in Smartphone Users due to the Effect of Posture and Duration of Smartphone Usage

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ABSTRACT

BACKGROUND: Smartphone users are at higher risk of musculoskeletal problems like forward head posture and turtle neck posture. So, neck pain is a common problem in people using smartphones. Much of the musculoskeletal problems are due to the duration of smartphone usage and the posture taken while using smartphones. For E.G., smartphone tasks require users to stare sharply downwards or to hold their arms out in front to read the screen, which causes head to move forward and causes an excessive anterior curve in lower cervical vertebrae and excessive posterior curve in upper thoracic vertebrae and which places a stress on the cervical curve.
AIM: Prevalence of neck pain in smartphone users due to effect of posture and duration on neck flexion angle.
MATERIAL AND METHODOLOGY:
Number of subjects – 100
Test – craniovertebral angle
Questionnaire – smartphone addiction scale (SAS)
RESULT: result of this study shows that out of 100 subjects ,by taking craniovertebral angle in range of 30-40 % cva was 39.5,in range of 40-50% cva was 47.9,in range of 50-60% cva was 51.5 on first day and after five days ,in range of 30-40 % cva was 38.5 ,in range of 40-50% cva was 41.5 ,in range of 50-60% cva was 55.6.By taking (SAS) Smartphone addiction scale on first day , grade 1 – 1.9%,grade 2 – 10 %,grade 3 – 20 % ,grade 4 – 30 % ,grade 5 – 18 %,grade 6 – 11 %.And on fifth day the values were as follows ,grade 1 -0 % ,grade 2 -0% ,grade 3 -25 %,grade4 – 18 %,grade 5 – 44 %,grade 6 – 38 %.
CONCLUSION: This study concluded that a significant number of people experienced neck pain and forward head posture was observed in smartphone users due to the effect of posture and duration on neck flexion angle.

Keywords: Craniovertebral angle, neck pain, forward head posture, smartphone usage

INTRODUCTION

The number of smartphone users has continuously increased around the world. (1)
In the past decades, using smartphones became more prevalent. (2)
Smartphones as multifunctional devices rapidly became the most favourite and common version of mobile phones among users. (3)
Smartphones are popular devices capable of processing more information than any other phones, they include many other features such as games, access to internet and social networks, messaging, videos, multimedia,

navigation in addition to their use for communication. (4)

In modern society, multifunctional smartphones are frequently used in daily life. smartphones serve not only as a multimedia collection, camera lens and global and satellite navigation system but also a means for sending and accepting email, storing data and engaging in learning interactions. (2)

The number of mobile cellular use is constantly increasing over the years. (2)

Along with rise in smartphone use, potential risks have also been reported. (1)

Over the past 10 years, both time and frequency of smartphone use have increased rapidly. (4)

In 2016, there were more than 7 billion users worldwide, the percentage of internet usage also increased globally 7 – fold from 6.5% to 4.3% between 2000 and 2010. (3)

The percentage of households with internet access also increased from 18% in 2000 and 46 % in 2010. (5)

In 2012, new time mobility poll reported that 84 % 0f people couldn't go on a single day without mobile devices. (6)

In 2023, the number of smartphone users in world today is 6.92 billion, which translates to 86.29% of the world's population owing a smartphone. In total, the number of people that own a smart and feature phone is 7.33 billion, making up to 91.40% of the world's population. (4)

Prevalence is a useful indicator of extent of musculoskeletal and neurological complaints in a population and risk factors serve as a basis for prevention and intervention. (10)

Several factors included excessive repetitions, high physical and psychological demands, sustained awkward postures and poor workstation design are identified as occupational factors. (13)

Along with smartphone use, the number of people who complain of pain in neck and upper extremity has also increased. (6)

Prolonged smartphone usage cause faulty posture such as forward neck posture, slouched posture or rounded shoulders. (15)

Sustained forward neck posture can cause injury to structure of cervical and lumbar as well as ligaments. (10)

Most smartphone tasks require users to stare sharply downwards or to hold their arms out in from tog them to read the screen, which makes head move forward and causes an excessive anterior curve in lower cervical vertebrae and excessive posterior curve in upper thoracic vertebrae to maintain balance placing stress on cervical spine and neck muscles and change the cervical curve. (11)

Smartphone users commonly maintain head flexion of 33 -45 degree from vertical when using a smartphone. When using a smartphone, the weight on spine dramatically increases when flexing the head forward at varying degrees. (15)

The video display terminal, which has a small screen require users to bend their neck more, thereby also increase activity of shoulder muscles. (17)

When using a small screen, there is increased muscle activity required to stabilize neck in more flexed position. To keep the neck balanced, extensor muscles are activated, thereby increasing the load placed on cervical erector spinae and trapezius. (5)

With increased smartphone use, young people often operate smartphones while standing for e.g. When waiting for a bus, travelling via public transport or walking down the street. This indicates a common posture which includes standing with both feet on floor and leaning back against a wall without arm support. (8)

The gravitational moment of neck is also an important factor in neck discomfort and pain related to head and neck posture, it can be used to analyse force acting on cervical spine in different postures. (9)

It is estimated as product of head weight and distance between centre of gravity of head and C6-C7intervertebral joint centre. Gravitational moment of neck increases when head is forward [distance increases] and higher gravitational moment indicates that a greater proportion of maximum moment generating capacity is needed to

hold head in static posture. A possible mechanism is that the length of external moment [gravitational moment arm] increases when user is in forward head position and neck flexed posture by moving the gravitational centre of head weight ahead of load bearing axis. (10)

Constant load on craniovertebral extensor muscles causes change in biomechanical movement and increases stress on joint. (8)

Forward head posture limit functional movement in head and neck, these limitations are caused by irregular rotation and gliding movement inside articulation capsule while moving joint. (4)

Forward head posture result in decreased number of sarcomeres as shortening of muscle fibre, which can affect muscle contraction. (12)

MATERIALS & METHODS

100 subjects were taken who have neck pain , demographic data was taken (name, age, height, weight),on the first day (CVA) craniovertebral angle and (SAS) smartphone addiction scale questionnaire was taken ,subjects were asked to use smartphone for 5 days according to their daily usage, again on 6 th day (CVA) craniovertebral angle and (SAS) smartphone addiction scale questionnaire was obtained ,data was analyzed and results were obtained ,Subjects were recruited if they have decreased range of motion , forward head posture ,subjects experiencing pain in neck and shoulder regions ,subjects aged 16-50 years ,and subjects with fractures around neck ,cervical spondylosis, torticollis , and those with surgery to neck and / or upper limbs (clavicle and scapula).

Craniovertebral angle (CVA) - The angle formed between the line joining tragus of ear to C7 and horizontal line at C7.

SMARTPHONE ADDICTION SCALE: 33 item questionnaire scale [SAS-SV], This scale is done to identify level of smartphone addiction risk and to distinguish high risk population. It has total 6 grades and they are as follows: 1 = strongly disagree, 2 = disagree,3 = weakly disagree ,4 = weakly agree ,5 = agree ,6 = strongly agree.

RESULT

The interpretation for (CVA) craniovertebral angle in people using smartphones is as follows:

30-40%	39.5
40-50%	47.9
50-60	51.5

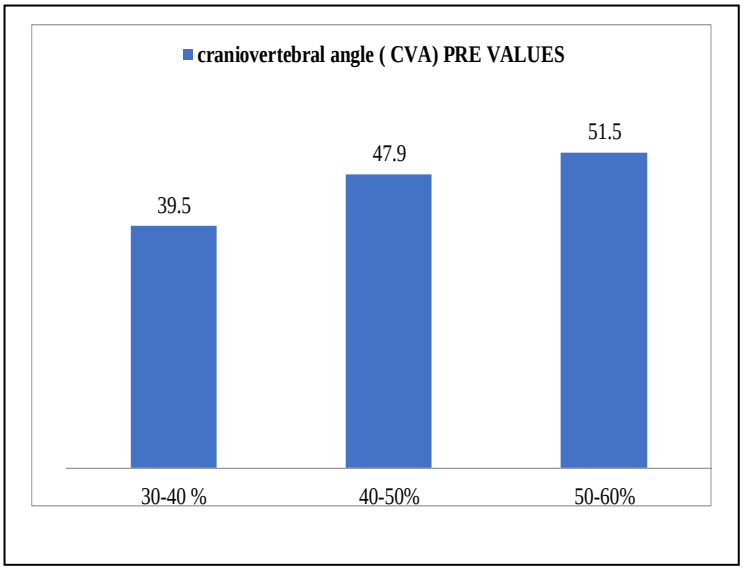
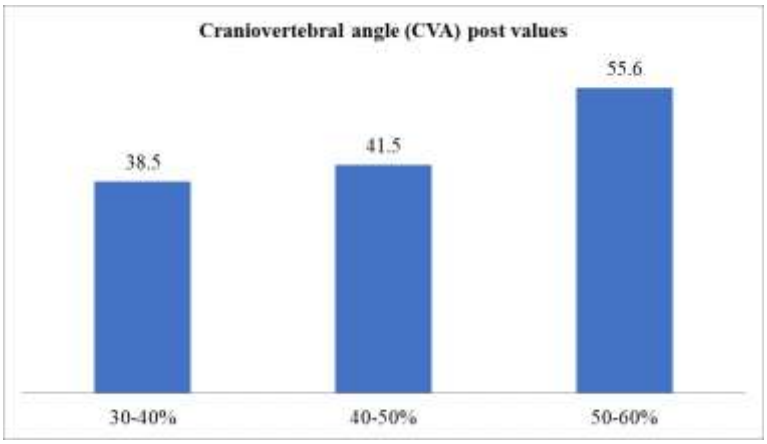
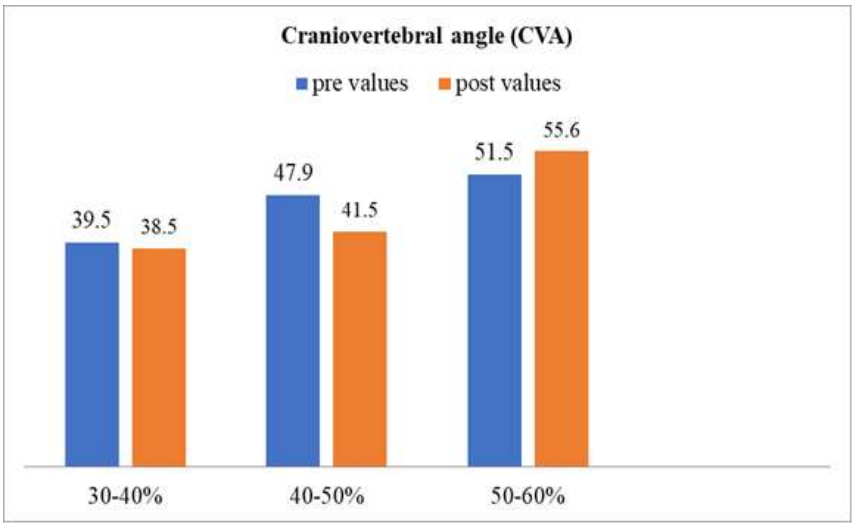


Table no -1 (CVA) craniovertebral angle. (PRE VAUES) Graph no -1 (CVA) craniovertebral angle (PRE-VALUES)

30-40 %	38.5
40-50 %	41.5
50-60%	55.6



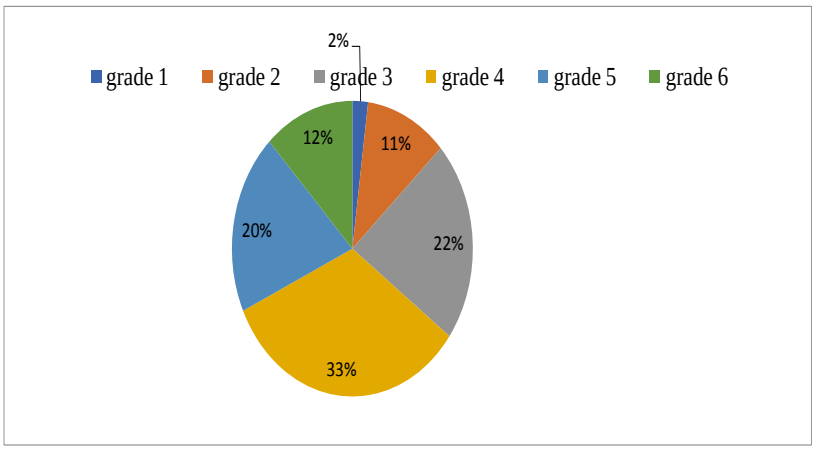
(CVA) CRANIOVERTEBRAL ANGLE (POST VALUES) GRAPH NO – 2



Graph no .3 craniovertebral angle (pre and post values) in sitting and standing posture. The interpretation for (SAS) smartphone addiction scale questionnaire is as follows:

Pre values

GRADE	PERCENTAGE
1 – Strongly agree	1.9%
2 – disagree	10 %
3 – weakly disagree	20 %
4 – weakly agree	30 %
5 – agree	18 %
6 – strongly agree	11 %



Post Values

GRADE	PERCENTAGE
1-Stronglyagree	0%
2-disagree	0%
3-weakly disagree	25 %
4-weakly agree	18 %
5-agree	44%
6-strongly agree	38 %

Table no .4 smartphone addiction scale (pre values)

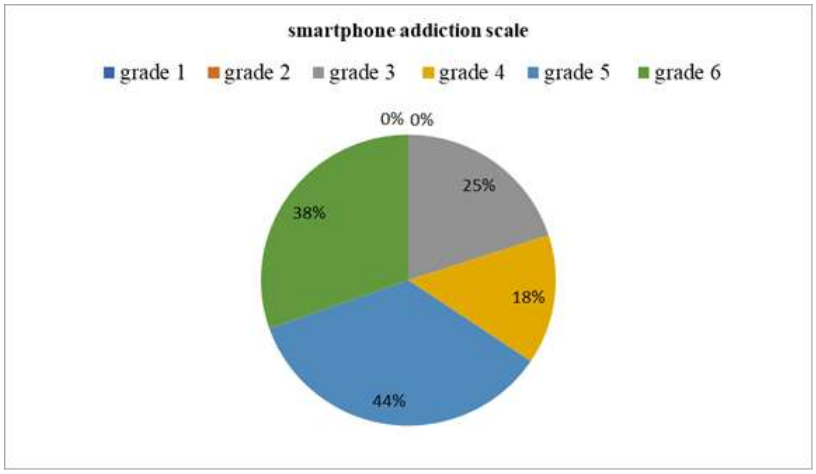


Table no .5 smartphone addiction scale (post values)

DISCUSSION

A study was conducted on 100 people in age group of 16 – 50 years of age. This study was done to check the prevalence of neck pain in smartphone users due to the effect of posture and duration on neck flexion angle. Subjects were selected based on inclusion and exclusion criteria, procedure was explained and a written consent form was taken. craniovertebral angle was measured to check the neck flexion angle and (SAS) smartphone addiction scale questionnaire was taken to determine smartphone usage. (1)

In our study we found out that by taking craniovertebral angles (CVA) pre values in ranges of 30-40% the mean value obtained was 39.5, in the range of 40-50% the mean value obtained was 47.9, in the range of 50-60% the mean value obtained was 51.5. And after 5 days the post values in the range of 30-40% the mean value obtained was 38.5, in the range of 40-50 % the mean value obtained was 41.5, and in the range of 50-60% the mean value obtained was 55.6.(5)

IN 2016, there were more than 7 billion users worldwide, the percentage of internet usage also increased globally 7-fold from 6.5% to 4.3% between 2000 & 2010. (12)

The percentage of households with internet access also increased from 18 % in 2000 and 46 % in 2010. (6)

in 2012, new time mobility polls reported that 84% of people couldn't go on a single day without mobile devices. (10)

according to a systematic review, prevalence of musculoskeletal complaints among smartphone users ranges from 1.0% to 67.8% and neck complaints have highest prevalence rates ranging from 17.3% to 67.8%. (15)

Most frequent musculoskeletal symptoms experienced among university students were found in neck (59.6%), shoulders (51.82 %) and upper back regions (54.4%). (9)

CONCLUSION

The above study shows that people in age group of 19-50 years who frequently used smartphones suffer from neck pain and fatigue in which there is seen an excessive anterior curve in lower cervical vertebrae and excessive posterior curve in upper thoracic vertebrae which place a stress on

cervical muscle sand which leads to change in the cervical curve.

On taking smartphone addiction scale in pre values ,33 % subjects show grade 4 (weakly agree) and in post values 44% subjects shown grade 5 (agree) 38% subjects show grade 6 (strongly agree).

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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