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Comparison of Smartphone and Computer Usage on Musculoskeletal Pain among Forward Head Posture

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Abstract

Background: Forward head posture is the anterior positioning of the cervical spine. This problem is caused by several factors, including to high head sleep, increased computer and Smartphone usage. Working on computer and operating Smartphone for the long period of time promote repetitive use of certain muscle. This result in muscle fiber injury, cumulative damage from acute trauma, myogenic tonus, which occur often in the neck and shoulders. Repetitive and cumulative trauma to the neck and shoulder causes forward head posture. Muscle activities are increased more in forward head posture than in correct anatomic position.

Objective: To compare the Smartphone and computer usage among forward head posture and the onset of muscle pain in neck and shoulder muscles.

Methodology: Non-experimental study. 60 subjects with 18-28 years, both men and women with forward head posture were included in this study. 60 adults are divided into two groups, GROUP A and GROUP B. Thirty adults with forward head posture were classified into 3 sub-groups by duration of Smartphone use. Computer Use: Thirty adults with forward head posture were classified into 3 sub-groups by duration of computer use. Outcome Measures: Neck Disability Index, Shoulder Pain and Disability Index, Auto CAD 2018.

Results: From the SPADI and NDI scores, it is seen that individuals with forward head posture have a risk of developing musculoskeletal pain.

Conclusion: The study concludes that there is increase in pain and limitation in function in comparing Smartphone and computer usage on musculoskeletal pain among forward head posture. Thus, there exists no significant difference in musculoskeletal pain among computer and Smartphone users based on duration.

Keywords: Forward head posture; Musculoskeletal pain; Neck pain; Smartphone

Introduction

Posture is the position assumed by the body either with the support during inactivity, or by means of the coordinated action of many muscles to maintain the stability. Forward head posture involves increased flexion of lower cervical vertebrae and upper thoracic regions, increased extension of upper cervical vertebrae and extension of occiput on C1 [1]. Forward head posture may result in head, neck and shoulder ache together with reduced range of cervical motion, muscle stiffness and tenderness. It is caused by sitting at a desk for long time maintaining a continuous posture leads to damage to ligaments around the neck or lumbar. Smartphone have small screens, users bend their heads to view the screens, increasing activity in the extensor muscles, overloading the neck and shoulder, increased fatigue of the muscles, reduced working capacity, and affected musculoskeletal systems [2]. Neck pain is one of the major public health problems in society. Duration of time spend in Smartphone has rapidly increased; long-term using can cause neck and shoulder pain [3]. A study by [4,5] the activity of the muscle around the shoulder increase in the small

screen visual display compared to the general desktop computer/ monitor. During Smartphone usage the neck is maintained in smaller cranioveterbrae angle for long period of time causing neck pain and also impairing the proprioceptive sense in neck [6].

It is forecast to increase the number of Smartphone users from 2.1 billion in 2016 to around 2.5 billion I 2019, with Smartphone penetration rates also rising. A little more than 36% of the world's population will use Smartphone by 2018, up from around 10% in 2011.Extensive use of computers will result in computer vision syndrome, and prevalence is increased dramatically. There was an estimate of 3.5 billion internet users worldwide in 2016. This means about 45 percent of the global population accessed the internet that year. Awkward posture while using Smartphone is one of the major risk factors for pain in the neck. Cervical flexion while using Smartphone has contributed to muscle fatigue, abnormality in neck and shoulder region, such as rounded shoulder, forward head posture and trapezitis [7]. Now a days its professional software engineer and office employees engaged in prolonged hours of sitting and operating computers with acute cervical neck flexion resulting muscle fiber injury, repetitive trauma and musculoskeletal responsibility. (Forward head posture) [8]. Forward head posture in which head and upper cervical is extended and lower cervical vertebrae is flexed. Resulting in weakening of deep cervical flexor muscle, mid thoracic muscle and rhomboid muscle and also shortening of pectrolis major and neck extensor muscle. Prevalence of upper trapezius pain is the major complaint of forward head posture, compared to normal anatomical posture [9]. The prolonged use of computers and Smartphone promotes the continuous use of certain muscles. This result in muscle strain, collective damage acute trauma, muscle tone frequently occurring in the neck and shoulders [10].

Aim of the study

To compare Smartphone and computer usage on musculoskeletal pain among forward head posture and the onset of pain in neck and shoulder.

Need for the study

Studies have been done on the posture and motion among laptop, computer, and Smartphone users. However, there is less number of studies available on the appropriate duration of use that causes the pain. Hence this study is formulated.

Methodology

Study Design : Non-Experimental study

Study Type : Comparative type

Sampling Method : Convenient sampling

Sample Size : 60 samples

Study Duration : 6 weeks

Study Setting : SRM Institute of Science and Technology

Inclusion Criteria : Both men and women Aged 18 to 28 years, Adult with forward head posture and no musculoskeletal pain.

Exclusion Criteria : Congenital deformities, Neurological diseases, and Limb injuries.

Procedure

The evaluation started with an interview to collect basic information such as demographic data, past history and present history which included the number of falls in last year. Forward head posture was analyzed using auto CAD 2018. The subjects were [11-20] selected according to the inclusion and exclusion criteria and an informed consent was obtained after the detailed explanation of procedure. Sixty subjects with forward head posture was selected using auto cad 2018 and divided into two groups consisting of 30 subjects in each. Group A- smart phone uses while group B- computer users.

Smartphone users

Group A subjects were instructed to use smart phone without paying much attention on how to maintain neck and lumbar posture for particular duration. Thirty subjects with forward head posture in Group A were subdivided into 3 groups based on the time period of Smartphone usage:

Group A1: Ten subjects were instructed to use a 10-minutes Smartphone

Group A2: Ten subjects were instructed to use a 20-minutes Smartphone

Group A3: Ten subjects were instructed to use a 30-minutes Smartphone

During this procedure, the subjects were made to sit on a stool in a comfortable position, with both the feet in proper contact with the ground. The knee and hip joints were maintained at 90°, and the trunk's position is upright. The arms were raised to the level of clavicle to reduce over flexion of lumbar region. Subjects were permitted to use social media applications, YouTube and all other Internet surfing without restriction while using Smartphone. Pain was assessed, after the end of Smartphone usage using Neck Disability Index and Shoulder Pain and Disability Index (SPADI) Questionnaire for measuring the intensity of pain.

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Computer users

Thirty Subjects in Group B with forward head posture were classified into 3 subgroups based on computer usage. Group B subjects were instructed to use computer without paying much attention on how to maintain neck and lumbar posture.

Group B1: Ten subjects were instructed to use a 10-minutes computer Group

Group B2: Ten subjects were instructed to use a 20-minutes computer Group

Group B3: Ten subjects were instructed to use a 30-minutes computer

During this procedure, the top line of monitor screen was adjusted and angled slightly from (0-30 degrees) which is below the eye level and the armrests of chair was also adjusted so that the shoulders were relaxed. Subjects were allowed to use computer with no limitations. Later, Pain was assessed after using computer for particular duration as instructed. Subjects were asked to fill the Neck Disability Index and Shoulder Pain and Disability Index (SPADI) Questionnaire in order to measure the intensity of pain.

Outcome measures

a) Neck Disability Index

b) Shoulder Pain and Disability Index

c) Auto CAD 2018

Statistical Analysis: The collected data was tabulated, and the Data was analyzed (Tables 1-3 & Figures 1-3) using IBM SPSS version 20.0 software.

Results

When comparing the post-test mean values of group a and group b, both groups shows similar readings where pain as be increased in both the cases. There is no significant difference noted in pain score between the computer usage and smartphone usage.

The Table 1 & Figure 1, shows the mean, standard deviation, t-Test and p-value of NDI (Neck Disability Index) and SPADI (Shoulder Pain and Disability Index) within the Group A1 and Group B1. On comparing the values NDI score has significant value of .259. While SPADI score has significant value of .405. The Table 2 & Figure 2, shows the mean, standard deviation, t-Test and p-value of NDI (Neck Disability Index) and SPADI (Shoulder Pain and Disability Index) within Group A2 and Group B2. On comparing the values NDI has significant value of .001. While SPADI score has significant value of .291. The Table 3 & Figure 3, shows the mean, standard deviation, t-Test and p-value of NDI (Neck Disability Index) and SPGADI (Shoulder Pain and Disability Index) within Group A3 and Group B3. On comparing the values NDI score has significant value of .276. While SPADI score has significant value of .842.

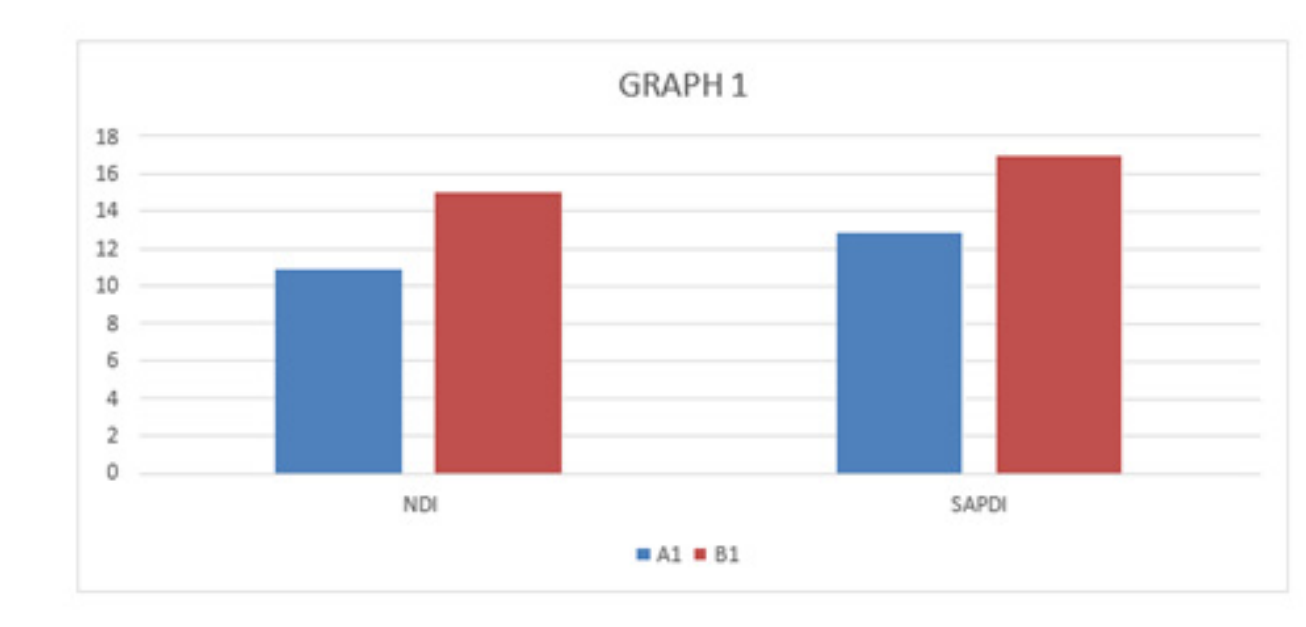

Figure 1: The graph shows the mean value of NDI and SPADI Score between Group A1 and Group B1.

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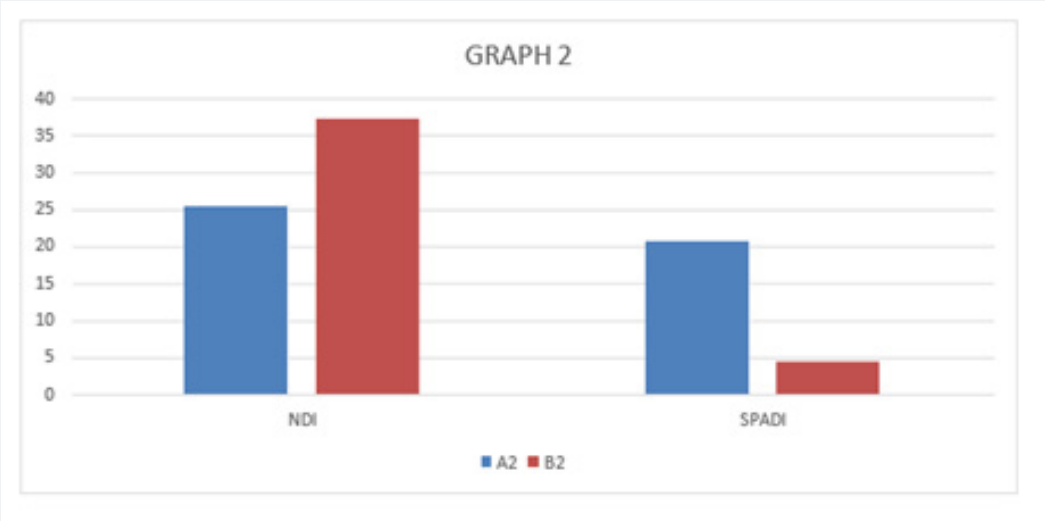
Table 1: Shows that the mean value of NDI G Group A1 is 10.8 and NDI G Group B1 is 14.90 and there is no significant difference between the NDI Group A1 and NDI Group BI value of the group (p<0.05) and also Table 1 shows that the mean value of SPADI Group A1 is 12.83 and SPADI Group B1 is 16.95 and there is no significant difference between the SPADI Group A1 and SPADI Group BI value of the group (p<0.05).

Comparison between the mean value of NDI and SPADI score in Group A1 and B1

Test	Mean	Standard Deviation	T-Value	Significance
NDI Group A1	10.8	7.9	-1.206	0.259
NDI Group B1	14.9	6.5		
SPADI Group A1	12.83	7.9	-0.874	0.405
SPADI Group B1	16.95	10.07		



Figures 2: The graph shows the mean value of NDI and SPADI Score between Group A2 and Group B2.

Table 2: shows that the mean value of NDI Group A2 is 25.40 and NDI Group B2 is 37.20 and there is significant difference between the NDI Group A2 and NDI Group B2 value of the group (p<0.05) and also Table 1 shows that the mean value of SPADI Group A2 is 20.76 and SPADI Group B1 is 23.06 and there is no significant difference between the SPADI Group A2 and SPADI Group B2 value of the group (p>0.05).

Comparison between the mean value of NDI AND SPADI score in Group A2 and B2

Test	Mean	Standard Deviation	T-Value	Significance
NDI Group A2	25.4	6.8	-4.682	0.001
NDI Group B2	37.2	3.5		
SPADI Group A2	20.76	5.8	-1.121	0.291
SPADI Group B2	23.06	5.5		

Comparison between the mean value of NDI and SPADI Score in Group A1 and B1

Table 3: shows that the mean value of NDI Group A3 is 40.20 and NDI Group B3 is 49.70 and there is no significant difference between the NDI Group A3 and NDI Group B3 value of the group (p>0.05) and also Table 1 shows that the mean value of SPADI Group A3 is 36.31 and SPADI Group B3 is 35.45 and there is no significant difference between the SPADI Group A3 and SPADI Group B3 value of the group (p>0.05).

Test	Mean	Standard Deviation	T Value	Significance
NDI Group A3	40.2	8.4	-1.161	0.276
NDI Group B3	49.7	19.2		
SPADI Group A3	36.31	8.2	0.206	0.842
SPADI Group B3	35.45	14.35		

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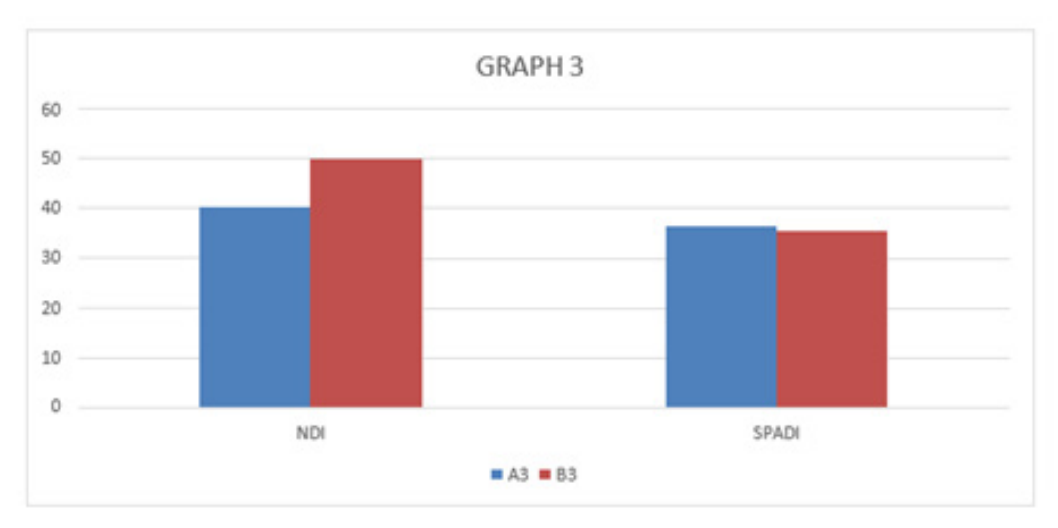

Figures 3: The graph shows the mean value of NDI and SPADI Score between Group A3 and Group B3.

So, on comparing and assessing there is an increase in SPADI score and NDI score on both the groups so there is high risk of developing musculoskeletal pain in both computer and Smartphone usage among forward head posture.

Discussion

The study aimed to find out the comparison of Smartphone and computer usage on musculoskeletal pain among forward head posture. The result of the study support the idea of musculoskeletal pain presents among both computer and Smartphone users. Muscle fatigue and pain occurs in both users. Forward head posture cause change in the alignment of spine, causing overload on muscle and connect tissues which leads to neck pain and shoulder pain due to improper posture with physical and functional limitation. It significantly affects the Craniovertebral angle and active cervical ROM, with decrease in cervical extension and flexion angle relating to pain. In this study, 60 subjects participated and successfully completed the study. This study concerned whether musculoskeletal pain due to usage of computer or Smartphone created more difficulties in postural pain and also to find out the sensitivity of both the test.

Forward head posture is associated with risk factor such as poor postural alignment, poor computer workstation design, low social support at work, age, previous musculoskeletal pain, and lack of awareness of posture and extended use of computer and mobile phone. Forward head posture is caused to tightening of lower cervical extensor and upper cervical flexors. It also occurs as a part of upper crossed syndrome and thoracic outlet syndrome. Stated that neck pain causes mechanical limitations and physical limitations such as loss of range of motion, contraction of muscle fiber and ankyloses but it is not be proved yet Forward Head Posture caused pain and functional limited motion. So furthermore, investigation is needed to be carried out. Analysis of pain was done using functional assessment SPADI and NDI questionnaire. SPADI was designed to measure the level of obstruction an individual face while accomplishing tasks that requires upper extremity use especially shoulder region.

NDI was designed to measure how neck ache affects the ability to manage day to day activities. In this study there were no notable difference was observed in muscle tiredness and pain present among computer and Smartphone usage based on particular duration among two groups. Stated that use of Smartphone in static position with unsupported arm brings abnormal alignment of neck and shoulders causing overloading in neck and shoulders increasing the muscle fatigue and affecting overall musculoskeletal system ,directly affecting work capacity.

However, in this study Group B2 the pain present among computer users resulted in significant increase in pain for duration of 20 minutes of computer usage which is .001 in comparison with Group A2. Nejati p reported that office employees had abnormal posture while working and it was more severe in persons associated with cervical pain in correlating head, cervical and thoracic postures in relation with neck ache.

Conclusion

This study concludes that there is an increase in pain and limitation in function in comparing Smartphone and computer usage on musculoskeletal pain among forward head posture. However, by comparing the duration of usage of both Smartphone and computer there exist no significant difference in musculoskeletal pain.

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Limitations and Recommendations

Limitations

a) Smaller sample size

b) No long term follow up has been studied.

c) Only age group of 18 to 24 years was included.

Recommendations

a) Comparison between forward head posture and normal people associated with neck and shoulder pain can be done.

b) Duration of procedure should be increased in order to make clear pain measurement.

More studies can be carried out to study the effects of musculoskeletal pain present in forward head posture relating to other professions.

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