The Effect of Modern Smartphone Use on Cervical Spine Biomechanics

Wafa Aldhafeeri¹, Nabeel S. Alshafai ¹
¹Alshafai Neurosurgical Academy (A.N.A), Toronto, Ontario, Canada.
Disclosure

We Have:
• No disclosure
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Introduction

Globally, the use of mobile devices (MD) such as smartphones, tablets, lap tops, gaming consoles and other devices have been progressively increased in the past two decade among both genders and all age groups. It is estimated that around 84% of the world's population will be using MDs by the end of 2018.(1) With this expansion, the concerns of musculoskeletal problems associated with their prolonged use have also gain a magnificent attention. Even though MDs have been proven as the most efficient way for communication between families, friends, and among various professionals, excessive usage of them may adversely affect the health of the individual. The term “Text Neck” attained notable popularity to describe the effect of repetitive stress on cervical spine caused by forward head flexion (FHF) while using MDs. Sustained FHF can cause degeneration to the structure of the cervical spine as well as adjacent structures.
Methods and Materials

MEDLINE database was searched for articles using the keywords: neck pain, musculoskeletal symptoms, cervical spine, cervical biomechanics, mobile phone, cell phone, smart phone, smartphone, mobile device, touchscreen phone. Full-text Articles from 1990 to 2017 were included. Statistical comparisons and tables are provided when appropriate.
Results

43 articles were included for review. First article was published in 2002. Majority of studies were published between 2010 – 2017 (36 vs. 5 in 2000-2010). Studies included were of cross-sectional, experimental, or systemic review design. No longitudinal studies were identified. We categorized articles into 5 subgroups; we found 14 biomechanical studies, 10 electromyographic studies, 5 ergonomical studies, 14 clinical studies, and no surgical studies.
Discussion

Frequent Smart mobiles users tend to maintain a forward head flexion posture while using their devices. This posture was more significantly associated with musculoskeletal symptoms of the neck and shoulders. In addition, the severity of those symptoms was positively correlated with the total duration spent on using mobile devices. Forward head flexion of 30° angle increases compressive loads on cervical spine up to 4 times the load in neutral 0° position. (2) Since the total load shared by the intervertebral disc increase up to 113% in FHF (3), This substantial increase in load could be illustrated by shrinkage of spinal length at a rate of 1 mm over 1 hour of using MDs in this posture, which constitute a considerable 5% of the total diurnal shrinkage. (4) Moreover, anterior-posterior shear loads increased significantly with FHF posture. (5)
The flexion angles showed a significant tendency to increase with time passage. Also, young adults who reported having neck pain showed to experience difficulties in maintaining a neutral neck position while using MDs, and they tend to maintain a flexed position regardless of worsening of their symptoms, which may suggest impaired accuracy of proprioception encouraging abnormal posture. In addition to the drastic raise in loads, numerous reports demonstrate higher muscle activation associated with excessive mobile use. This has been postulated to be a resistance to the greater flexor moment related to the forward head flexion position. This pattern was distinctively shown in cervical erector spinae (CES) and upper trapezius (UT) muscles, and it was significantly consistent with reporting chronic neck pain and higher discomfort score after performing different tasks using MDs.
Discussion
Conclusions

Text-neck posture leads to significant changes in cervical spine biomechanics. Increased compressive load, antero-posterior shear load, and high cervical extensor muscles activity were associated with forward flexed neck posture adapted by smartphones users. The latter may also indicate that the load is at least three times higher than predicted in previous studies. The suggestion that a 20° flexed head carries a minimal risk on cervical spine must be revised. Neurosurgeons need to take the abnormal posture and load distribution into consideration when planning for surgical interventions, especially in young adults with history of excessive use of smartphones.
References


