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## Effect of forward head posture on swallowing: Review of Literature

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### Abstract

Along with the electronic development of the present world, physical activity has decreased to a great extent. This reduction in the physical activity has aided us with a lot of deformities. Forward head posture is one of the commonest for those using computers, smart phones, backpacks, televisions etc. regularly. The purpose of this study was to determine the effect of forward head posture on swallowing. The resource utilized included indexed/referenced journal articles, text & reference books. PubMed & Research Gate were databases used to find journals articles & publication related to effects of forward head posture on efficiency of swallowing. We are living in an electronic world. Everybody of us is surrounded by ample of gadgets to be used in daily life. And without their usage we feel incomplete. Long term usage causes disastrous postural changes in neck causing compensatory changes in the kinesiological chain leading to tightness of one group & weakness of other group of muscles. It leads to affection of visceral physiological function of swallowing. Video fluoroscopy and Endoscopy are the measures to assess swallowing objectively. Thus by the virtue of this study, we can conclude that chronic forward head posture affects the efficiency of swallowing negatively.

**Keywords:** Forward head posture, swallowing, neck posture

### 1. Introduction

Technology has become an essential tool in every field and seemingly inseparable part of our lives. With the frequent development of global electronic technology and explicit usage of internet, there has been an evolution of various visual display devices from computer desktops to laptops, mobile phones, digital gears etc. and a concomitant increase in usage of such gadgets is quite prevalent among young adults. The excessive inclusion of electronic gadgets has decreased physical activity to a great extent. This is making our lifestyle sedentary even at workplace. Longer working hours prevent the professional from leaving their work stations, thereby making human-computer interface no free from health hazards. This overuse of electronic gadgets has hazardous effects on health. An online survey conducted by India bytes in 2008 reported about 64.4 million computer users in India either at home or work.

Computer usage has been associated with various musculoskeletal disorders and posture is thought to have an etiological role. Evidently posture affects health of an individual. The functions easily influenced by posture include headache, blood pressure, pulse, lung capacity and spinal pain. Forward head posture (FHP) is one of the most common postural problems. As we live in a forward facing world, the repetitive use of mobile phones, computers and even back packs have forced the body to adopt a forward head posture. Normally, the head should be placed directly on the neck and shoulders<sup>[1]</sup>. But forward head posture places the head out of alignment and puts strain on neck and upper back muscles resulting in muscle fatigue and neck pain<sup>[2]</sup>. Schuldt *et al.* reported a significantly higher activity of upper trapezius muscle in subjects with head positioned forwards. The weakness anterior neck flexors cause tightness of sternocleidomastoid resulting in a forward head posture. Also, FHP has been associated with weakness of deep cervical flexors, scapular retractors and pectoral muscle tightness. Taking into account the hazardous effects of regular overuse of visual display gadgets and devices on the musculoskeletal system, major concentration of studies done till now has focussed on neck and rest of the spine. Very few studies have concentrated towards other joints and effect on visceral functions of the body<sup>[3]</sup>.

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Followed by chewing of food, swallowing is the next digestive function in the cycle. Being an important function of digestion, swallowing is carried out by a set of complicated movements of pharynx, larynx, epiglottis & skeletal muscles like suprahyoid and infrahyoid muscles [4, 5]. There have been a few studies conducted to establish a relation between forward head posture and swallowing. Epidemiological evidences appropriate to forward head posture associated with swallowing is reviewed; individual, social, psychological issues relevant to forward head posture are presented.

## 2. Material and Method

This review of literature review was accomplished by selecting 47 published research papers which included randomised controlled trials (RCTs), systematic review, Meta-analysis. The resource utilized included indexed/referenced journal articles, text & reference books. PubMed & Research Gate were databases used to find journals, articles & publications from the earliest dates of inclusion through 1974 related to effects of forward head posture on swallowing & relative biomechanics. Search terms included "forward head posture," along with the following: computer, video display terminal, VDT, video display unit, VDU, workstation, smart phones and backpacks. Papers were excluded that did not pertain to forward head posture associated with the use of a computer, smart phone or backpacks; were not English language sources; and were not from peer-reviewed publications. References from the papers located were also used.

### 2.1 Predisposing factors and its incidence

**1. Backpack** [6, 7, 8, 9]: Various researches and epidemiological studies have identified strong association between backpack usage and spinal posture. A variety of backpacks are widely used by hikers, soldiers and school children. Soldiers carry extremely heavy backpack loads and walk for long distances, whereas hikers carry shelter and subsistence items in the backpacks. Christie *et al* conducted a study focussing on the physiological, biomechanical and medical aspects in South African soldiers. School children are using back packs to carry school books weighing up to 36 – 40 pounds. As a result the head is forced forwards to counterbalance the weight resulting in abnormal stress on soft tissues and joints of neck, shoulder and lower back.

**2. Computer Usage** [10, 11]: An online survey conducted by India bytes in 2008, estimated about 64.4 million users in India. Estimation, of new cases of neck pain attributed to computer usage is difficult, since most researches regarding computer usage and neck pain are retrospective. Croft *et al* reported a 17.9% incidence of neck pain in general population. Cote *et al* have reported an incidence between 36 - 57.5 per 100 worker years among office workers and computer users.

**3. Smartphone** [14, 15, 16]: During smartphone use, neck flexion is done to stare at the lowered objects and maintaining forward head position for prolonged duration of time. With increasing forward position of head, the force imposed on the neck increases to 27 pounds at 15 degrees gradually reaching up to 60 pounds at 60 degrees.

### 2.2 Evaluation

#### 1. Evaluation of Swallowing

##### I. Instrumental Examination: Imaging Procedures [17, 18].

- a) Ultrasound images tongue and hyoid bone using

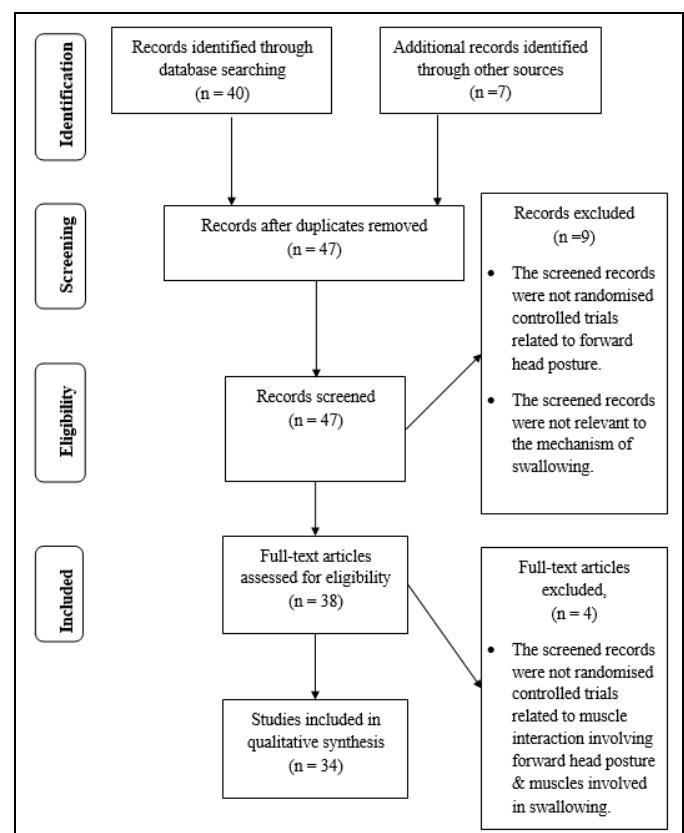
- sound waves
- b) Video endoscopy (FEES) allows visualization of pharynx/larynx using fiberoptic endoscope
- c) Video fluoroscopy (MBS) is a radiological procedure allowing visualization of all stages of swallow
- d) Scintigraphy quantifies bolus volume using ingestion of radioactive material

#### II. Instrumental Examination: Non-Imaging Procedures

- a) EMG measures electrical activity in muscles of swallowing
- b) EGG can be used to track laryngeal elevation
- c) Cervical auscultation is used to detect presence of swallow & aspiration by listening to the sounds of swallowing and respiration.
- d) Pharyngeal manometry examines pressure dynamics in the pharynx and the timing of the pharyngeal contractile wave.

#### 2. Evaluation of Forward Head Posture [19].

- a) It can be efficiently done by taking pictures in the sagittal plane and analysing it on image tool software with a valid version.
- b) Forward head posture can also be analysed using Electronic head posture instrument.



As we have learnt from earlier mentioned sources, there are various predisposed causes of forward head posture. Most common now days being computer and smartphone usage. Not only these two but forward head posture can result from excessive reading, driving, using heavy backpacks etc. The review shows that the selected studies indicate the effect of forward head posture on swallowing or on various components and phases of swallowing. This review has shown a few RCT's which shows any direct and indirect effect of forward head posture on swallowing or its components.

There have been a lot of studies performed, which explains the muscle imbalance caused due to forward head posture. Maintenance of a forward head posture places the centre of mass of both head, and head and neck combined, anterior to the respective centres of rotation, thus requiring extensor moments about both Atlanto-occipital and cervical joints [20]. While the length/tension characteristics of individual fascicles are unknown, it is possible that this shortening reduces the tension-generating capabilities of these muscles. The requirement for cervical flexion reduces the possible contribution to Atlanto-occipital extensor moment by muscles which extend the cervical vertebrae and, consequently, a contribution to Atlanto-occipital extension moment is required of suboccipital muscles [21]. Many electromyographic studies have been performed in the direction of analysis of muscle firing and firing patterns during the process of swallowing. Contributions of mylohyoid, anterior belly of digastrics, geniohyoid and electrical activity of other suprathyroid and infrathyroid muscles were seen as well [22, 23, 24, 20] but there are a few electromyographic and video fluoroscopic clinical studies which shows minimal electrical activity of Genioglossus and suprathyroid muscle [32].

The normal mechanics involved in the 4 phases namely Oral preparatory, Oral, Pharyngeal and Esophageal phase of swallowing involves propulsion of bolus by suprathyroid pull exerted on the hyoid bone, posterior epiglottis fold over larynx to prevent aspiration [25, 26, 27] and the pharyngeal pull by suprathyroid to open esophagus by the movement of cricopharyngeus muscle also known as upper esophageal sphincter [17, 28, 29] which later on is closed by the virtue of infrathyroid pull thus preventing regurgitation [30].

A lot of objective analysis studies have been performed to show ill-effects of abnormal head and neck posture on various components of swallowing. Video fluoroscopic study performed by Longemann *et al.* on 5 patients of lateral medullary syndrome (LMS) concluded that the upper esophageal sphincter (UES) opening is increased by 2mm diameter on complete head rotation along with significant decrease in upper esophageal sphincter pressure by 18 mm Hg or 35%. Another important finding of this study was, a face forward position or forward head position, the patients presented with reduced upper esophageal opening therefore aiding to dysphagia [31]. One more electromyographic and video fluoroscopic study revealed that neck flexed position widens the vallecular space to prevent the bolus from entering the airway, narrows the airway entrance, pushes the tongue base backward toward the pharyngeal wall [32]. Another video fluoroscopic study revealed abnormal head posture to be a potential cause of aspiration as tested by different amount of liquid barium swallow in 32 post head/neck surgery patients [33].

In another study Ekerberg *et al.* concluded to have defective closure during swallowing (laryngeal vestibule) in extension of head while swallowing improved with flexion of atlanto-occipital joint when seen in 53 dysphagic patients [34]. As contribution for future research the author would recommend for objective analysis of strength of swallowing to be related with the extent of forward head posture.

### 3. Conclusion

The contributions of the review suggests that forward head posture may have hazardous effects on various components of swallowing. More studies are required in this direction so as to objectively assess the correlation between forward head posture and swallowing classifying amount of affection of

swallowing per degree forward translation of head.

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