Correlation of face mask usage with head posture among adolescents

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Abstract: Introduction: Face masks can limit the lower field of vision, particularly if they are not well fitted, causing people to tuck in their chins, shift their body position and hold their necks and posture stiffly to maintain a line of sight. Use of this posture does not usually mean that there is pain or dysfunction but it suggests that there is potential for developing musculoskeletal problems in future. In such neck positions, the deep neck flexor (DNF) muscles are most commonly recruited to maintain a stable posture of head over the cervical spine. Objectives: To find out the correlation of face mask usage with head posture among adolescents. Methodology: An observational study was conducted with 100 participants that comprised of 88 boys and 22 girls (adolescents) between the age of 18 - 24 years. People who wear any type of mask for at least 6 hours a day were included. Participants were assessed for craniovertebral angle with and without face mask irrespective of gender, types of mask used, hours of mask used (p<0.005). Conclusion: This study concluded that there is no significant influence of face mask on the craniovertebral angle and the head posture.

Keywords: Face Mask, Cranio Vertebral Angle, Neck Pain, Forward Head Posture, Cervical Muscles.

INTRODUCTION

The SARS-CoV-2 virus causes the corona virus disease 2019 (COVID-19), a respiratory disease. On the eleventh of March, 2020, the World Health Organization designated covid-19 an epidemic disease. The new COVID-19 has a known incubation period of two to fourteen days. Throughout the incubation phase, all the affected individuals without any symptoms or with moderate symptoms spread the infection to someone who is not sick. Early isolation and containment are required to prevent community transmission.¹. SARS-CoV-2 is transmitted often through airborne respiratory droplets and aerosols created during coughing or sneezing, which can land on surfaces or be transmitted directly through the eyes, nose, or mouth. To reduce the risk, the government is urging the public to stick to the accepted disease control habits, which includes isolating oneself, using alcohol-based hand sanitizer or soap, movement restriction with lockdown measures, sanitization of surfaces, and the usage of face masks to prevent the virus from spreading.² Wearing protective face masks is considered as a part of personal protective measures and as a public health intervention to limit the occurrence of the corona virus disease pandemic, according to WHO. Wearers of protective face masks may have to move their heads and necks forward, backwards, or side-to-side in order to see their duties.³ Any activity that needs looking down and over the mask, such as walking, using a phone, or sweeping the floor, necessitates a certain degree of neck movement and modifications, as well as modest abnormal postures. The light 'pull' makes us feel as if a burden has been placed around our neck. Some of us sag into a more stooped position, pulling our heads forward, which eventually leads to a forward head posture, putting undue strain on the cervical spine.⁴ To sustain a constant posture of the head above the cervical spine, the deep neck flexor muscles are typically activated in such neck situations. Many people, including health care personnel, shop employees, manufacturing workers, teachers and students, and others, spend the majority of their days wearing masks. We've been obliged to wear the face mask for more than a year now.⁵ It is difficult to breathe when the masks are worn for an extended amount of time (greater than 4 hours). Long-term use of a protective mask increases airflow resistance, which increases effort on the sternocleidomastoid and scalene muscles. It also causes deep cervical flexor fatigue and weakness, as well as increased sternocleidomastoid muscle activation, which can result in forward head posture, headaches, and dizziness. There have been several complaints about the discomforts associated with using face masks for extended periods of time.⁶

I.MATERIALS AND METHODS

An observational study with convenient sampling method was conducted among the adolescents in and around Chengalpattu. Prior to the study, Departmental Ethical committee approval was obtained. **Participants:** This study surveyed adolescents of (N=100) age group between 18 and 24 who were volunteering to participate and being open to communicate excluding those who wear spectacles.

II. PROCEDURE

The study got approved by the Institutional Ethics Committee (IEC) 3137/IEC/2021 of SRM Medical College Hospital and Research Centre. The adolescents were selected based on the inclusion and exclusion criteria. The purpose and complete procedure of the study has been clearly explained and all the subjects gave their consent to participate in this study. Individuals were asked to stand in normal standing position and were asked to focus at a point at the level of their eyes. Lateral view photograph was taken in the morning without wearing the facemask. Lateral view photograph was taken in the evening for 3 times with the participants wearing the face mask to measure the average craniovertebral angle. The craniovertebral angle was measured using the designing program

(AUTOCAD-2021). The craniovertebral angle is measured from the point where a horizontal line crosses the C7 spinous process and a line joining them at the tragus of the ear to the skin covering the C7 spinous process.

III.RESULTS

TABLE 1 depicts the demographics and baseline characteristics of the participants. TABLE 2 and SCATTER PLOT 1 shows that the craniovertebral angle of with and without mask has significant positive correlation with r=0.881 and p=0.000. TABLE 3 and SCATTER PLOT 2 depicts that the craniovertebral angle of women with and without mask has significant direct correlation with r=0.766 and p=0.004. TABLE 4 and SCATTER PLOT 3 depicts that the craniovertebral angle of men with and without mask has significant positive correlation with r=0.889 and p=0.000. TABLE 5 and SCATTER PLOT 4 depicts that the craniovertebral angle with and without surgical mask has significant direct correlation with r=0.902 and p=0.00. TABLE 6 and SCATTER PLOT 5 depicts that the craniovertebral angle with and without N95 mask has significant positive correlation with r=0.899 and p=0.000. TABLE 7 and SCATTER PLOT 6 depicts that the craniovertebral angle with and without cloth mask has significant direct correlation with r=0.790 and p=0.000. TABLE 8 and SCATTER PLOT 7 depicts that the craniovertebral angle of individual those who wear mask for more than 12 hours per day. Their craniovertebral angle with and without mask has significant positive correlation with r=0.790 and p=0.000. TABLE 9 and SCATTER PLOT 8 depicts that the craniovertebral angle of individual those who wear mask for more than 8 hours per day. Their craniovertebral angle with and without mask has significant direct correlation with r=0.878 and p=0.000. TABLE 10 and SCATTER PLOT 9 depicts that the craniovertebral angle of individual those who wear mask for more than 6 hours per day. Their craniovertebral angle with and without mask has significant positive correlation with r=0.885 and p=0.000. The result of the current study shows that there is a significant strong positive correlation between the craniovertebral angles measured with and without mask. This result is consistent with any duration that the mask is worn or any type of mask that is used and also with gender. It implies that there is no significant influence of wearing mask on craniovertebral angle of an individual.

| Demographic Variabl | e | Frequency | Percentage |
|---------------------------|---------------|-----------|------------|
| | 18 | 24 | 24.0 |
| | 19 | 31 | 31.0 |
| Age | 20 | 18 | 18.0 |
| | 21 | 20 | 20.0 |
| | 22 | 6 | 6.0 |
| | 23 | 1 | 1.0 |
| | Mean \pm SD | 19.56 | ± 1.274 |
| Gender | Female | 12 | 12.0 |
| | Male | 88 | 88.0 |
| | Cloth | 25 | 25.0 |
| Types of Mask | N95 | 15 | 15.0 |
| | Surgical | 60 | 60.0 |
| | 6 | 29 | 29.0 |
| Hours Per Day (Face Mask) | 8 | 50 | 50.0 |
| | 12 | 21 | 21.0 |
| | Mean \pm SD | 8.26 ± | 2.121 |

TABLE 1 - DEMOGRAPHIC DATA

TABLE 2 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WITH AND WITHOUT MASK

| | Ν | Mean | Std. Deviation | r-Value | P-Value |
|------------------|-----|-------|----------------|---------|------------|
| CVA WITHOUT MASK | 100 | 51.73 | 5.423 | 0.881 | 0.000 S |
| CVA WITH MASK | 100 | 50.04 | 6.195 | | |

SCATTER PLOT 1 - CRANIOVERTEBRAL ANGULATION OF INDIVIDUALS WITH AND WITHOUT MASK



TABLE 3 - CRANIOVERTEBRAL ANGULATION (CVA) OF WOMEN WITH AND WITHOUT MASK

| WOMEN | n | Mean | Std. Deviation | r-Value | P-Value |
|------------------|----|-------|----------------|---------|---------|
| CVA WITHOUT MASK | 12 | 50.58 | 3.728 | 0.766 | 0.004 |
| CVA WITH MASK | 12 | 49.75 | 4.224 | | 5 |

SCATTER PLOT 2 - CRANIOVERTEBRAL ANGULATION (CVA) OF WOMEN WITH AND WITHOUT MASK



TABLE 4 - CRANIOVERTEBRAL ANGULATION (CVA) OF MEN WITH AND WITHOUT MASK

| Gender(Male) | n | Mean | Std. Deviation | r-Value | P-Value |
|--------------------------------|----|-------|-------------------|---------|------------|
| Angle(Without Face Mask)Degree | 88 | 51.89 | 5.613 | 0.889 | 0.000 S |
| Angle(With Face Mask)Degree | 88 | 50.08 | 6.435 | | |

SCATTER PLOT 3 - CRANIOVERTEBRAL ANGULATION (CVA) OF MEN WITH AND WITHOUT MASK



TABLE 5 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WITH AND WITHOUT SURGICAL

MASK

| Face Mask(Surgical) | n | Mean | Std. Deviation | r-Value | P-Value |
|--------------------------------|----|-------|-------------------|---------|------------|
| Angle(Without Face Mask)Degree | 60 | 51.50 | 6.250 | 0.902 | 0.000 S |
| Angle(With Face Mask)Degree | 60 | 50.03 | 6.839 | | |

SCATTER PLOT 4 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WITH AND WITHOUT SURGICAL MASK



TABLE 6 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WITH AND WITHOUT N95 MASK

| Face Mask(N95) | N | Mean | Std. Deviation | r-Value | P-Value |
|-----------------------------------|----|-------|-------------------|---------|------------|
| Angle(Without Face Mask)Degree | 15 | 52.47 | 4.155 | 0.899 | 0.000 S |
| Angle(With Face Mask)Degree | 15 | 50.00 | 5.332 | | |

SCATTER PLOT 5 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WITH AND WITHOUT N95 MASK



TABLE 7 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WITH AND WITHOUT CLOTH

| | | IVIA, | л | | |
|-----------------------------------|----|-------|-----------|---------|------------|
| Face Mask(Cloth) | Ν | Mean | Std. | r-Value | P-Value |
| | | | Deviation | | |
| Angle(Without Face Mask)Degree | 25 | 51.84 | 3.837 | 0.790 | 0.000 S |
| Angle(With Face Mask)Degree | 25 | 50.08 | 5.171 | | |

SCATTER PLOT 6 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WITH AND WITHOUT CLOTH MASK



TABLE 8 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WHO WEAR MASK FOR MORETHAN 12 HOURS/DAY CORRELATION OF CVA WITH AND WITHOUT MASK

| Hours Per Day Face Mask (12Hrs) | n | Mean | Std. Deviation | r-Value | P-Value |
|----------------------------------|----|-------|----------------|---------|------------|
| | | | | | |
| Angle (Without Face Mask) Degree | 21 | 48.29 | 5.451 | 0.876 | 0.000 S |
| Angle (With Face Mask) Degree | 21 | 46.86 | 7.171 | | |

SCATTER PLOT 7 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WHO WEAR MASK FOR MORE THAN 12 HOURS/DAY CORRELATION OF CVA WITH AND WITHOUT MASK



TABLE 9 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WHO WEAR MASK FOR MORETHAN 8 HOURS/DAY CORRELATION OF CVA WITH AND WITHOUT MASK

| Hours Per Day Face Mask (8 Hrs) | n | Mean | Std. Deviation | r-Value | P-Value |
|---------------------------------|----|-------|----------------|---------|---------|
| Angle(Without Face Mask)Degree | 50 | 52.88 | 4 897 | 0.878 | 0.000 |
| | 50 | 52.00 | 1.077 | 0.070 | S.000 |
| Angle(With Face Mask)Degree | 50 | 50.86 | 5.966 | | |
| | | | | | |

SCATTER PLOT 8 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WHO WEAR MASK FOR MORE THAN 8 HOURS/DAY CORRELATION OF CVA WITH AND WITHOUT FACE MASK



TABLE 10 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WHO WEAR MASK FOR MORETHAN 6 HOURS/DAY CORRELATION OF CVA WITH AND WITHOUT MASK

| Hours Per Day Face Mask (6 Hrs) | Ν | Mean | Std. Deviation | r-Value | P-Value |
|------------------------------------|----|-------|-------------------|---------|------------|
| Angle(Without Face Mask)Degree | 29 | 52.24 | 5.409 | 0.885 | 0.000 S |
| Angle(With Face Mask)Degree | 29 | 50.93 | 5.203 | | |

SCATTER PLOT 9 - CRANIOVERTEBRAL ANGULATION (CVA) OF INDIVIDUALS WHO WEAR MASK FOR MORE THAN 12 HOURS/DAY CORRELATION OF CVA WITH AND WITHOUT MASK



IV.DISCUSSION

The primary objective of the study was to correlate face mask usage and forward head posture. As wearing face mask has become necessary these days, when they do not fit well, it cause us to tuck the chin in and hold the neck stiff to maintain a straight line leading to forward head posture. Neck posture with a forward head is a bad habit. Due to more tensile pressures on the neck joints and high muscle tension, pain is most complained. Forward head posture causes headaches, neck discomfort, temporomandibular disorders. An imaginary vertical line on a horizontal plane penetrates the body centre of mass, and the forward neck posture is anterior to it. Prolonged usage of masks will increase the workload of the sternocleidomastoid muscle causing forward head posture. The result of the current study shows that there is a significant strong positive correlation between the craniovertebral angles measured with and without mask. This result is consistent with any duration that the mask is worn or any type of mask that is used and also with gender. It implies that there is no significant influence of wearing mask on craniovertebral angle of an individual. In this study, out of 100 participants, majority of the participants used surgical masks (60). Because of the loose fitting of the surgical mask when compared to N95 masks there might have not been a significant difference in the craniovertebral angle. This study has few drawbacks that could be taken into account in future works. Firstly, in this study, students were included, who might have not worn the face masks for a long term due to the lockdown, so there might have not been a huge difference in the craniovertebral angle because it takes about months to years for a change to occur in the craniovertebral angle. Therefore a more extended period of usage of mask is recommended to determine the long term effects of the face mask on the craniovertebral angle. According to a study conducted by Sofia Ryman et al (2022), the balance body tape has no effect on the forward head posture due to shorter treatment period. This supports the present study. The present study included only healthy young adults to minimize the influence of health factors on the study results, so future studies should consider health factors with an expanded age range. Jin Hong Kim conducted a study and revealed abstracted the findings of the study is limited due to the small number of subjects, the short duration of the study, and the fact that only healthy adult males and females with no clinical disorders were chosen as subjects. As a result, a long-term study with patients who have forward head posture will be done, and a more thorough effect mechanism will be explored, including difference in muscle activation when using a head-weight device. This study is in accordance with the present study. Prolonged usage of unfitted face masks can be a threat to people who complaints of recurrent neck pain or headache. So it is important for the health professionals to recommend appropriate type of mask for each individual and bring out the awareness on cervical postural correction and strengthening exercise for people who are at high risk of forward head posture. Physiotherapists should focus on muscle relaxation exercises, stretching, improving joint mobility, chin tuck to correct and prevent forward head posture.

CONCLUSION

The craniovertebral angle measured with and without masks has a strong positive correlation with each other indicating that there is no significant influence of mask on craniovertebral angles irrespective of the duration worn and the type of mask used.

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