The Relationship Between Nearsightedness and Forward Head Posture

Zunitasari Kholifah Islamiatun(✉), Adnan Faris Naufal,
and Atikah Itsna Zulfatirrohman

Physiotherapy Study Program, Faculty of Health Sciences, Muhammadiyah University of
Surakarta, Surakarta, Indonesia
j120190006@student.ums.ac.id

Abstract. Introduction: Nearsightedness is one of the most common eye refractive errors in the world. The development of technology has led to an increase in the use of gadgets and a decrease in outdoor activities. This is the cause of *nearsightedness* sufferers among students. As a result of blurring when seeing something far away, *nearsightedness* sufferers have to squint and tilt their head forward so that they can see something far away more clearly. This abnormal posture causes the Forward Head Posture to occur. **Method:** To find out whether there is a relationship between nearsightedness and Forward Head Posture, a study was conducted using a literature review with a scoping review approach because the articles obtained have various research methods. **Results:** A total of four articles that met the inclusion criteria were selected for review. Two articles stated that there was a relationship between *nearsightedness* and forward head posture and the other two did not, but showed that *nearsightedness* has an abnormal distance to perform certain tasks.

Keywords: Nearsightedness or Myopia or Vision or Eye · Forward Head Posture or Neck Posture or Posture

1 Introduction

Nearsightedness is one of the most common eye refractive errors in the world. The prevalence of nearsightedness globally occurs in 2.56 billion people at the end of 2020 (Bourne et al., 2013). Holden et al. (2016), estimates that in 2050 the prevalence of myopia will occur in five billion people in the world. This estimate can be accelerated by the current pandemic. Henson (2021), stated that the prevalence of Nearsightedness during the Covid-19 pandemic increased by up to three times.

With the development of technology, there is an increase in the use of gadgets in all circles, especially students. Especially during the Covid-19 pandemic, there was a very significant increase in the use of gadgets for online classes and entertainment (Pandya & Lodha, 2021). This is what causes the gadget screen time on students to be longer than usual and reduced activities outside the home. Increased time to use gadgets especially with non-ergonomic positions such as screen brightness that is too dark or too bright and

dark ambient light, viewing distance that is too close, and rarely resting when looking at the screen can cause eye problems, one of which is myopia or Nearsightedness (Ganne et al., 2021). With reduced outdoor activities so that more time spent indoors is one of the main risk factors for Nearsightedness (He et al., 2015).

Nearsightedness, also called myopia or nearsightedness, is a condition in which excessive elongation of the eye causes images of distant objects to focus in front of the retina, thus affecting distance vision to become blurred. (Baird et al., 2020). A person with Nearsightedness generally squints their eyes, and leans their head forward in an unnatural position in order to see clearly. This can cause some common musculoskeletal problems such as neck pain, and neck stiffness (Kolhatkar & Rayjade, 2020). Using an inappropriate head posture for a long period of time and repeatedly, especially accompanied by a work attitude that tends to bend or lean the neck forward can cause forward head posture (Pangestu et al., 2021).

Forward head posture is defined as the position of the head that is tilted forward excessively from the vertical line (Kang et al., 2012). This posture causes the deep cervical flexor and mid-thoracic scapular retractor muscles to experience elongation and weakness and the cervical extensors and pectoralis muscles to experience shortening or shortness and tightness (Manoj & Meenas, 2021). The result is pain, trigger points, tingling, numbness, headaches, and neck pain (Patel & Yadav, 2020). From the results of the previous explanation, the researcher is interested in conducting research with the title "Relationship between Nearsightedness Sufferers and Forward Head Posture in Students" using the literature review research method.

2 Method

This study uses a type of Literature review research method, namely by reviewing or critically analyzing knowledge, ideas, or findings contained in articles, journals or other literature to provide an overview of information related to the topic. (Cahyono et al., 2019). The approach in this study uses a scoping review approach because the literature according to the topic has different research methods. According to Widiasih (2020), scoping review is a method for identifying literature from various reference sources with different research methods and having links to the research topic without using a checklist to evaluate it. The scoping review protocol consists of (1) identifying research questions, (2) identifying relevant studies, (3) selecting studies, (4) mapping data, and (5) compiling, summarizing, and reporting results to achieve the objectives of the study. The purpose of this Literature review method is to help researchers better understand the relationship between Nearsightedness sufferers and Forward Head Posture in students and understand how the results of the study can be used as a reference for new research.

A literature search was carried out based on inclusion criteria, namely international research articles related to Nearsightedness and Forward Head Posture, using randomized control trial (RCT), quasi-experimental, prevalence studies, and cross-sectional studies designs. The articles you are looking for are research articles published within the last 10 years, namely from 2011–2021, and these articles can be accessed in full (full text), and have a minimum Quartile of Q4 which is known through the Scimago Journal & Country Rank. Data search referred to 3 database sources, namely PubMed,

Google Scholar, and Science Direct using the keywords: "Nearsightedness" or "Myopia" or "Vision" or "Eye", and "Forward Head Posture" or "Neck Posture" or "Posture". The results of the data search were compiled using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analyzes) method. After obtaining the results from searching for articles to be reviewed, they are then analyzed using the PICO method, and reviewed by summarizing and reporting the results of each journal, then conclusions are drawn.

3   Results and Discussion

3.1   Results

The search results for research articles using the combined keywords mentioned above in the Pubmed database contain 126 articles. 55 of these articles were published in the last 10 years from 2021. The Science Direct database found 420 results with 133 publications in 2011–2021 and only 28 of them were research articles. In the Google Scholar database of 17,700 which includes publications from 2011 there are 8,850 and 158 of them are included in the title of the research article and can be accessed in full text and in accordance with the research method taken. So that a total of searches from three databases with criteria for the last 10 years there are 241 research articles. Then filtered according to the research topic on nearsightedness and Forward Head Posture, there were 13 articles. After checking journal quartiles through Scimago Journal & Country Rank 7, they were dropped out of the study because the research articles were not quartile, 2 articles did not explain the measurement of posture angles. So that the results obtained were 4 articles that were reviewed. Search using keywords through the Science Direct database: 420 articles. Published in 2011–2021: 8,850 article (Fig. 1).

Based on Table 1. Above, after checking the quartiles using the schimago journal, the results of Q1 and Q2 are 1 journal, and 2 journals are worth Q4. The selected journals have 3 different research methods, namely prevalence study and quasi-experimental research methods, each of which amounts to 1 journal, and 2 other journals using the RCT (Randomized Control Trial) method. Participants in the selected journals are sufferers of nearsightedness or nearsightedness, with different ages but are still students, that is, there are those aged 1st grade elementary school to tertiary students aged 38 years, but 1 journal does not explain the age criteria studied, but only referred to as young
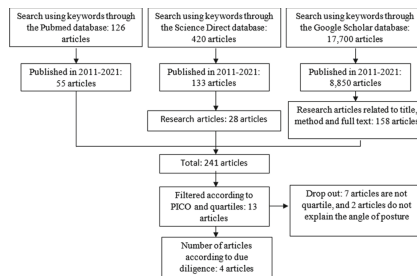

Fig. 1. Articles Search Results Using the Prism Method

Table 1. Article Analysis Using PICO

No	Title	Quartil	Research methods	Population	Intervention	Comparison	Outcome
1	A Study of Relation Between Myopia and Head Posture in Young Adult Population (Kolhatkar & Rayjade, 2020)	Q4	Prevalence study	95 people with myopia with a total of 69 women and the remaining 26 men. The inclusion criteria were not explained.	Head posture is assessed using the forward shoulder angle (FSA) and cranioverbral angle (CVA). Individuals are asked to stand as usual and relax. Then photographed from the lateral and angle needed for measurements using photogrammetry.	- Forward Head Posture with myopia degree. - Forward Head Posture with myopia duration	Pearson Correlation Coefficient Test, Forward Head Posture with myopia duration found (-0.3252) with a significant p value of 0.0013 Pearson Correlation Coefficient Test, Forward Head Posture with degree of myopia found (-0.4893) with p value <0.0001 which is significant
2	Analysis of head position used by myopes and emmetropes when performing a near-vision reading task (Hartwig et al., 2011)	Q1	Quasi experimental	54 subjects (20 men and 34 women). Age ranged between 19 and 38 years. 32 myopia and 22 normal eyes	Two web cameras that take photos simultaneously are used to monitor head position. One image is taken from the side to record pitch and a second image is rendered	Normal eye, Myopia develops with myopia does not develop	there was no significant difference in head posture or reading distance between the myopic and emmetropic groups (p > 0.05) but there is some evidence that the downward slope angle was greater in developing myopia than in non progressing myopia (p = 0.03).
3	Effectiveness of Occular Muscle Exercises on Myopic Individuals with Forward Head Posture (Patel & Yadav, 2020)	Q4	RCT	46 people were selected according to the inclusion criteria age 18-32 years, myopia duration for 1 year and above and myopia degree	palming exercises, swinging exercises, eye muscle exercises, cross crawl, tibetan eye chart	Not given exercise, Postural assessment before and after the intervention	There was a significant effect of eye exercise on the cranioverbral angle in myopia patients compared to the control group (p = 0.0219). But not too significant effect on the forward shoulder angle (p = 0.0519).
4	Influence of Near Tasks on Posture in Myopi Chinese Schoolchildren [Bao et al., 2015]	Q2	RCT	120 children suffering from myopia consisting of 54 boys and 66 girls (grades 1-6 and ages 6-13 years).	Use of Electromagnetic Systems motion-tracking to measure between the working distance and the angle of the subject's head while they are playing video games or reading or writing at a desk.	Comparison between the working distance and angle of the subject's head while they are playing video games, reading or writing at a desk.	Children with myopia had significantly decreased working distance over time for reading and writing tasks (p < 0.001). Head angle increased significantly over time only for the reading task (p < 0.001). Working distance is negatively correlated with head declination (r = 0.53, p < 0.001).

adulthood. In the Intervention section, of the four journals, three of them were not given intervention, but only showed how nearsightedness patients measure head posture when performing certain tasks. In one article there was an intervention using exercise, so the data taken was before the intervention was given, because this study only looked at the relationship between nearsightedness and forward head posture before taking any action (Naufal, 2022). Measurements in these articles use different methods, some use photogrammetry, CrANIoverbral Angle (CVA) and electromagnetic motion-tracking to measure their posture. Comparisons in the 4 selected journals are a comparison between the duration of nearsightedness and posture, degree of nearsightedness and posture, comparison of working distance with head angle, habit of doing tasks with head posture, comparison of wearing glasses, and comparison between normal eyes, nearsightedness develops and nearsightedness does not develop in doing the task. Outcomes or results obtained from the 4 selected journals, three of which stated that there was a significant relationship between nearsightedness and head distance or posture in carrying out certain tasks, while the other one did not.

3.2   Discussion

3.2.1   The Relationship Between Nearsightedness and Head Posture

In the first article, research conducted by Kolhatkar & Rayjade (2020), entitled "A Study of the Relation Between Myopia and Head Posture in Young Adults", Myopia is associated with various posture changes due to abnormalities in the process of seeing clearly. The sample in the article was from 95 nearsightedness sufferers, 56 of whom had Forward Head Posture as measured using the CVA (Craniovertebral Angle). Based on the degree of nearsightedness suffered by the occurrence of Forward Head Posture, a relationship value was obtained (-0.4893) with a p value < 0.0001 which means a very significant relationship. This can occur due to the increasing severity of the degree of nearsightedness, causing greater tension to be exerted on the eye muscles and head

and neck muscles, causing errors in head posture and resulting in increased postural adaptations such as squinting and tilting the head.

Other results in the article, related to the relationship between the duration of nearsightedness and the occurrence of Forward Head Posture, obtained a value of (-0.3252) with a significant p value of 0.0013. This shows that the longer you suffer from nearsightedness, the more advanced and fixated the postural adaptations will be, thus worsening your overall posture. In accordance with research conducted by (Manoj & Meenas, 2021), which states that the high prevalence of Forward Head Posture in people who wear glasses depends on the length of time they wear glasses.

Based on the results of the first review of this article, it is in accordance with the topic of the research undertaken by the author, and supports that nearsightedness is related to forward head posture. Both the relationship between the degree of nearsightedness and the duration of nearsightedness.

3.2.2   Analysis of the Head Position of Nearsightedness Sufferers When Reading

In the second article, research conducted by Hartwig et al. (2011) with the title "Analysis of Head Position Used by Myopes and Emmetropes When Performing a Near-Vision Reading Task", analysis of head position during a reading task using the photogrammetric method from two angles and an eye-tracker to see roll and pitch angles. Head posture data were compared with data on refractive errors, binocular vision conditions and the degree of development of myopia. The results showed that there was no significant correlation between reading distance and refractive errors ($p = 0.53$) or myopia progression rate ($p = 0.87$). The pitch angle is larger than the roll angle, so it correlates significantly in emmetropes but not in nearsightedness. This suggests a greater reliance on the head, rather than the eyes, on movement to move fixation down the page of text. Activities carried out by people with nearsightedness such as reading will adapt incorrect posture compensation in order to see objects with focus (Manoj & Meenas, 2021). Rapidly progressing myopia makes use of relatively greater head movements when scanning text, and thus tends to change pitch angle more rapidly during reading than low-grade myopia during desk-writing tasks. Uncorrected myopia has an average working distance of 15 cm, while emmetropes have an average working distance of 30 cm. Thus posture plays several roles in the development of nearsightedness. Changes in head angle reflect a compensatory response to eye movement. The influence of the extraocular muscles on the eyeball can cause nearsightedness. In this second article, it does not support the relationship between nearsightedness and forward head posture, but the development of nearsightedness has a closer working distance.

3.2.3   Nearsightedness Individual with Forward Head Posture

Research conducted by Patel & Yadav (2020), with the title "Effectiveness of Occular Muscle Exercises on Myopic Individuals with Forward Head Posture" because intervention is given, so it will affect the results of the nearsightedness relationship with forward head posture, so the data taken is before it is given intervention to find out whether there is a relationship between nearsightedness individuals and forward head posture. Subjects in this study had inclusion criteria aged 18–32 years with a degree of

nearsightedness of 0.25–6.0 D for a duration of 1 year or more. The data shown before the intervention is the average data of forward shoulder angle and crinovertebral angle measurements along with t-value and p-value data. The results of the data for the forward shoulder angle after being combined between group A (which will be given the intervention) and Group B (which will not be given the intervention) have an average of 60.545 with a t-value of 1.846 and a p-value of 0.0797. This shows that there is no significant relationship between nearsightedness sufferers and forward shoulder angle. While the results of research data related to crinovertebral angle have an average of 50.52 with a t-value of 1.542 and a p-value of 0.1302 so that the results obtained are that there is a significant relationship between nearsightedness individuals and craniovertebral angle as a measurement of their Forward Head Posture. This is due to the high degree of nearsightedness which is affected by the higher close workload, stress on the eyes and exposure to electronic devices as well as improper postural adaptations that affect forward head posture. In this third article, the results support the author's research, namely that there is a relationship between nearsightedness and forward head posture in terms of craniovertebral angle measurements.

3.2.4 Effect of Close Working Distance on Nearsightedness Posture

The fourth article that was reviewed was research by (Bao et al., 2015) entitled "Influence of Near Tasks on Posture in Myopic Chinese Schoolchildren". This study contains three tasks, namely playing video games and reading and writing at the table on students who suffer from nearsightedness from the same elementary school. The measurement uses the recording of working distance parameters and head declination which are measured using an electromagnetic motion-tracking system for close posture measurements. The result is that different tasks have a significant effect on working distance ($F = 31.45$, $p < 0.001$). Playing video games has the smallest average working distance of 21.3 cm, the second is writing which is 24.9 cm and reading is 27.2 cm. Even though the normal eye distance for a certain task is 30 cm, the three tasks studied have a distance of less than 30 cm. The relationship between time and head distance when carrying out tasks, the result is that the longer the time used to complete the task the lower the working distance used. The decrease in working distance did not change significantly during gaming but decreased significantly during reading and writing tasks. Class level also shows the effect of working distance on the value ($F = 7.61$, $p = 0.001$). The visual hazard of video games can be worse than traditional near vision tasks (reading and writing on paper) by inducing higher levels of accommodative lag and visual fatigue. According to (Pristianto et al. (2021), incorrect positioning when carrying out tasks results in problems with posture and eyes, moreover the duration of using the screen for too long is associated with eye fatigue. Working distance does not correlate with head declination ($r = -0.53$, $p < 0.001$) Children who used close working distances had greater head declination during reading and writing tasks than when playing video games.

In this fourth article, it does not support nearsightedness related to forward head posture, because the result is that the working distance with head declination is not related, but nearsightedness sufferers have a working distance that is not normal or less than 30 cm.

Authors' Contributions. Based on the review results of the four selected articles according to the topic, two articles stated that there is a relationship between nearsightedness and forward head posture. Two other articles discussed that there was no relationship between nearsightedness and forward head posture, but showed that nearsightedness sufferers have an abnormal distance when performing certain tasks.

References

Baird, P. N., Saw, S. M., Lanca, C., & Guggenheim, J. A. (2020). Myopia. *Nature Reviews Disease Primers*, *6*(1). https://doi.org/10.1038/s41572-020-00231-4

Bao, J., Drobe, B., Wang, Y., Chen, K., Seow, J., & Lu, F. (2015). Influence of Near Tasks on Posture in Myopic Chinese Schoolchildren. In *Optometry and Vision Science* (Vol. 92, Issue 8). https://doi.org/10.1097/OPX.0000000000000658

Bourne, R. R. A., Stevens, G. A., White, R. A., & Smith, J. L. (2013). *Causes of vision loss worldwide, 1990â€"2010: a systematic analysis.* https://doi.org/10.1016/S2214-109X(13)70113-X

Cahyono, E. A., Sutomo, & Harsono, A. (2019). Literatur Review: Panduan Penulisan dan Penyusunan. *Jurnal Keperawatan*, *12*(2), 12. https://e-journal.lppmdianhusada.ac.id/index.php/jk/article/view/43

Ganne, P., Najeeb, S., Chaitanya, G., Sharma, A., & Krishnappa, N. C. (2021). Digital Eye Strain Epidemic amid COVID-19 Pandemic–A Cross-sectional Survey. *Ophthalmic Epidemiology*, *28*(4), 285–292. https://doi.org/10.1080/09286586.2020.1862243

Hartwig, A., Gowen, E., Neil Charman, W., & Radhakrishnan, H. (2011). Analysis of head position used by myopes and emmetropes when performing a near-vision reading task. *Vision Research*, *51*(14), 1712–1717. /https://doi.org/10.1016/j.visres.2011.05.014

He, M., Xiang, F., Zeng, Y., Mai, J., Chen, Q., Zhang, J., Smith, W., Rose, K., & Morgan, I. G. (2015). Effect of time spent outdoors at school on the development of myopia among children in China a randomized clinical trial. *JAMA - Journal of the American Medical Association*, *314*(11), 1142–1148. https://doi.org/10.1001/jama.2015.10803

Henson, B. (2021). COVID-19 pandemic increases myopia prevalence in children First pill to treat COVID applies for FDA approval. 21–23. https://doi.org/10.1136/bjophthalmol-2021-319307.2

Holden, B. A., Fricke, T. R., Wilson, D. A., & Jong, M. (2016). Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. *Ophthalmology*, *123*(5), 1036–1042. https://doi.org/10.1016/j.ophtha.2016.01.006

Kang, J. H., Park, R. Y., Lee, S. J., Kim, J. Y., Yoon, S. R., & Jung, K. I. (2012). The effect of the forward head posture on postural balance in long time computer based worker. *Annals of Rehabilitation Medicine*, *36*(1), 98–104. https://doi.org/https://doi.org/10.5535/arm.2012.36.1.98

Kolhatkar, A., & Rayjade, A. (2020). A Study of Relation between Myopia and Head Posture in Young Adult Population. *Indian Journal of Public Health Research & Development*, *11*(05), 49–54. https://doi.org/10.37506/ijphrd.v11i5.9289

Manoj, A., & Meenas, M. S. (2021). Study on Prevalence of forward head posture among young individuals wearing eye glasses admin. *Ijmaes*, *7*(3), 1072–1079. https://doi.org/10.36678/IJMAES.2021.V07I03.005

Naufal, A. F. (2022). Postur Abnormal dan Keseimbangan Pada Anak: Literature Study. FISIO MU: Physiotherapy Evidences, 3(2), 113-119.

Pandya, A., & Lodha, P. (2021). Social Connectedness, Excessive Screen Time During COVID-19 and Mental Health: A Review of Current Evidence. *Frontiers in Human Dynamics*, *3*. https://doi.org/10.3389/fhumd.2021.684137

Pangestu, R. G. H. B., Nugraha, M. H. S., & Saraswati, P. A. S. (2021). *Risk Factors of Forward Head Posture*. *5*(2), 141–151. https://doi.org/10.33660/jfrwhs.v5i2.140

Patel, S., & Yadav, T. (2020). Effectiveness of occular muscle exercises on myopic individuals with forward head posture. *Indian Journal of Forensic Medicine and Toxicology*, *14*(3), 693–698. https://doi.org/10.37506/ijfmt.v14i3.10336

Pristianto, A., Panggabean, H., Zulfatirrohman, A. I., Hidayah, F. N., Ulayya, F. K., & Mulyawati, N. I. (2021). Education on Prevention of Physical and Psychological Problems From Study From Home During the Covid-19 Pandemic Edukasi Pencegahan Permasalahan Efek Dari Study From Home Pada Masa Pandemi Covid-19. *Proceeding of The URECOL*, 30–40. http://repository.urecol.org/index.php/proceeding/article/view/1553