Effectiveness of Therapeutic Exercise on Forward Head Posture: A Systematic Review and Meta-analysis

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Abstract

Objective: The purpose of this systematic review and meta-analysis was to summarize the results related to the effects of corrective exercises on postural variables in individuals with forward head posture (FHP).

Methods: A systematic review of the electronic literature through February 2017 was independently performed by 2 investigators. The electronic databases searched included PubMed, MEDLINE, Web of Science, ScienceDirect, Cochrane Central Register of Controlled Clinical Trials, Google Scholar, and Scopus. Methodological quality was evaluated using the Physiotherapy Evidence Database scale. Meta-analyses were carried out for craniovertebral angle (CVA), cranial angle (CA), and pain intensity.

Results: Seven randomized clinical trials comprising 627 participants met the study criteria. The between-groups pooled random odds ratios for CVA, CA, and pain were 6.7 (confidence interval [CI] = 2.53-17.9, $P = .0005$), 0.7 (CI = 0.43-1.2, $P = .2$), and 0.3 (95% CI = 0.13-0.42, $P < .001$), respectively. No publication bias was observed. Level 1a evidence (strong) indicates exercise training can effectively modify CVA, and level 1b evidence (moderate) indicates exercise may improve pain but not CA.

Conclusion: The findings suggest that therapeutic exercises may result in large changes in CVA and moderate improvement in neck pain in participants with FHP. The precise nature of the relationship between FHP and musculoskeletal pain, and improvements in both after therapeutic exercise, remains to be established. (J Manipulative Physiol Ther 2018;xx:1-10)

Key Indexing Terms: *Posture; Head; Neck; Exercise; Review*

Introduction

Forward head posture (FHP) is a common postural variation in people of all ages, from childhood to old age.[1,2] Forward head posture is characterized by the head position in the sagittal plane being forward relative to the neck. Forward head posture is associated with hyperextension of the upper cervical spine (C1-C3) and flexion of the lower cervical spine (C4-C7). In some studies, FHP is characterized as pathologic when the craniovertebral angle (CVA) is ≥50°, even though such cutoffs lack rigorous validity.[3-5] Some research has shown that head and neck position are associated with other musculoskeletal disorders, such as neck pain,[6] headache,[7] and masticatory dysfunction.[8] Thus, it has been hypothesized that the treatment of FHP may be helpful in managing these disorders.

Corrective exercise is 1 of the interventional methods that had been suggested for treatment of FHP, including stretching, strengthening, and movement control exercises.[9-13] Moreover, there may be advantages in exercising adjacent body segments to the cervical spine, such as the thoracic spine, to enhance the effectiveness of exercise training on FHP.[14]

Several studies have shown that corrective exercise regimes can improve FHP and potentially related symptoms.[3-5,15-21] For example, exercise training protocols have resulted in improvement of CVA,[4,5,22,23] head tilt,[3] cranial or cervical

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range of motion,[22] neck disability,[22] and pain.[5,22] A systematic review with pooled meta-analysis would clarify the strength of the effect of such exercises on FHP. The purpose of this systematic review and meta-analysis was to summarize the results related to the effects of corrective exercises on postural variables in individuals with FHP.

Methods

Literature Search Strategy

To determine whether a systematic review on this topic had existed, the Cochrane Library and the Database of Abstracts of Reviews of Effectiveness were searched and none were found. An extensive review of the electronic literature was subsequently performed by 2 investigators (R.S. and P.S.). The electronic literature databases included PubMed, MEDLINE, Web of Science, ScienceDirect, Cochrane Central Register of Controlled Clinical Trials, Google Scholar, and Scopus. The keywords were originally selected from MeSH terms and then partially modified to try to ensure all eligible studies were found. These electronic databases were searched using combinations of the following keyword groups: (1) exercise, sport, movement therapy, exercise therapy, physical therapy, and corrective exercise; AND (2) FHP, forward head; AND (3) randomized study, randomized controlled trial, randomized clinical trial, randomized trial, randomized experiment. The "AND" operator was used between the 3 keyword groups, while the "OR" operator was used within each keyword group. The search period covered years from inception to February 2017. The reference lists contained in all eligible studies were checked to identify additional eligible studies.

Selection Criteria

Both reviewers (R.S. and P.S.) independently performed the searches, assessed inclusion criteria, and extracted data on trial design and outcomes, and disagreements were resolved by consensus. Potential publications were selected by screening titles and abstracts for clinical trials that used any kind of exercise intervention for FHP. All potentially eligible studies were retrieved, and the full-text articles were reviewed to determine whether they met the inclusion criteria. Only randomized controlled trials (RCTs) published in peer-reviewed journals were considered. Studies had to include a control group and at least 1 variable aimed at assessing head or neck alignment. Studies were not excluded based on the type of exercise protocol used or the type of measurement used to assess FHP. Studies had to be published in English. Studies were excluded if exercise was not performed or if it was performed in addition to other interventions, such as manipulation or medications, and the measured variables did not include head or neck alignment. Studies that had duplicated data were excluded, with only 1 of them selected for the review.

Data Extraction

Review authors (R.S. and S.S.) extracted study data on the following topics: first author name and date of publication, quality assessment of the study, participants' characteristics (eg, sample size, age, and sex), intervention type, frequency, duration, comparison group, outcome measures, and primary results (Table 1).

Quality Assessment and Level of Evidence

The quality assessment scores of eligible studies were obtained from the Physiotherapy Evidence Database (PEDro).[24] The PEDro[25] has a total score of 10 points, including internal validity evaluation criteria and statistical analyses presentation. The studies with scoring of 6 to 10 were considered methodologically "high," 4 to 5 were considered "fair," and ≤3 were considered "poor."[26] The level of evidence was determined according to Sackett et al.[27] Level 1a of evidence (strong) was given if 2 or more "high" quality RCTs (PEDro ≥6) demonstrated similar findings. Level 1b (moderate) was given when 1 RCT of "high" quality (PEDro ≥6) existed, 2a (limited) was given when at least 1 "fair" quality RCT (PEDro = 4-5) existed, and 2b (limited) was given when at least 1 "poor" quality RCT (PEDro <4) indicated exercise training to be effective.[27]

Statistical Analysis

All relevant outcome data were extracted as provided in the studies. Results of comparable studies were combined using a random effect model of meta-analysis and a forest plot of the relative odds ratio (OR) with 95% confidence interval (CI). Considering the OR interpretation, based on the Cohen's rule of thumb, an effect size of 1.5 is considered to be small, 2.5 medium, and 4.30 large.[28] Heterogeneity between studies was assessed by the standard χ^2 test, which indicates only the presence of heterogeneity and the I^2 coefficient, which measures the percentage of total variation across studies due to true heterogeneity rather than chance.[29] I^2 ranges between 0% and 100%, with higher values indicating higher heterogeneity.[29] Publication bias was checked using both funnel plots and quantitative methods, including the rank correlation test, Egger's test of the intercept, and the trim and fill method.[30] A symmetrical inverted funnel plot, a nonsignificant negative rank correlation, a nonsignificant value of the Egger's regression test of the intercept, and an unchanged effect size using the trim and fill method were considered indicators that publication bias does not exist. Comprehensive Meta-Analysis version 3.0 (Biostat Inc, Englewood, New Jersey) was used for statistical analysis.

Results

Search Results

The search of selected databases provided a total of 3380 citations. Of these, 3333 articles were discarded after abstract review because they did not meet the inclusion