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Effect of Modern Technology on Upper-Body Posture in Normal Developed Children: Systematic Review

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Abstract

Background: Modern technology plays a key role in daily human life. This involves keeping pace with rapid changes in the field of communication technology. The typical posture when using smartphones (or other touchscreen handheld devices) involves holding the tool with one or two hands below the eye level, looking down at the device and using the thumb to touch the screen. This pattern of use forces the user to adopt forward neck flexion which is often maintained for long periods.

Aim of Study: To determine the effect of the modern technology on upper-body posture in normal developed children.

Patients and Method: This review included normal developed Children aged between 3 to 12 years, received different types of modern technology. A search of electronic databases that included, PubMed, Physical therapy Evidence Database, Google scholar was searched from Jun 2020 ever till May 2021. Total studies after PRISMA screening were Thirteen articlesnonrandom that were retrieved met the inclusion criteria: Descriptive for all studies.

Results: All the selected studies were scored on their methodological rigor with the Pedro scale and methodological index for non-randomized studies (MINORS) and found that modern technology had a harm effect on upper body posture in normal developed children on posture (Increase head, neck flexion and rounded shoulders posture in lying and sitting more in standing) and the more time it takes for two hours, the greater the effect on posture.

Conclusion: From clinical evidence the modern technology had a harm effect on upper body posture in normal developed children but further studies are needed to help the researchers and the parents.

Key Words: *Modern technology – Smart phone – Tablet – Normaldeveloped Children – Upper-body posture – Abnormal posture.*

Introduction

CHILDREN and teenagers today are exposed to both traditional and modern technology as they grow up. The development and widespread use of contemporary technology like smartphones, tablets, and laptops over the past ten years have both benefited and posed health problems for youngsters. Developmental issues, musculoskeletal issues, physical inactivity, obesity, and poor sleep quality are only a few of the health hazards associated with modern technology use in terms of its volume, duration, frequency, and posture **[1]**.

Modern individuals regard their smartphones and mobile phones to be essential items for their daily life because they make it easy and quick to communicate. Newer models of smartphones have also been created to be more efficient and adaptable, making them accessible to all age groups, particularly among primary school students **[2]**.

Children increasingly frequently utilize smart handheld devices (SHHD), such as tablets, smartphones, and game players. Several years ago, SHHD users were becoming more and more prevalent globally. This might be the case right now because of the rapidly expanding smartphone markets, the wide range of models that are readily available, the alluring alternatives, and the affordable rates. Tablets are being used more and more frequently in early childhood settings, including at home for communication, play, and even education. Without one of these contemporary tools, it would have a hard time locating a child **[3]**.

The increased spinal asymmetry caused by the tablet problem may also increase the likelihood that musculoskeletal discomfort may manifest. In computer operators, it was discovered that head rotation away from the midline was associated with more intense discomfort and stiffness in the upper body **[4]**.

Given how frequently people use computers, there may be a health risk associated with it, espe-

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cially in terms of musculoskeletal pain and diseases, and these symptoms may be influenced by ergonomic and postural factors [5].

According to the World Health Organization, neck discomfort and other musculoskeletal conditions are the fourth and tenth most common health issues. Furthermore, due to extended durations of neck flexion, the increased use of smartphones for communication may cause long-term neck pain [2].

Aim of the study was to systematically review the effect of the modern technology on upper-body posture in normal developed children.

Patients and Methods

Searches were performed in the PubMed, Google scholar and Physiotherapy Evidence Database (pedro) using a combination of the following keywords "Modern technology", "Smart phone", "tablet", "Normal developed Children", "Upper-body posture", "Abnormal posture" From Jun 2020 till May 2021. The PRISMA (Preferential Report Items for Systematic Analysis and Meta-Analysis) [6].

Guidelines were followed in assessing literature results Fig. (1) during the study selection process, two independent researchers blindly analyzed titles and abstracts. When the title and abstract did not contain sufficient information to decide for the eligibility, the two researchers scrutinized the full text. In cases of divergence, a third researcher was asked to perform the analysis. Total studies were Thirteen articles nonrandom that were retrieved met the inclusion criteria: Descriptive for all studies.

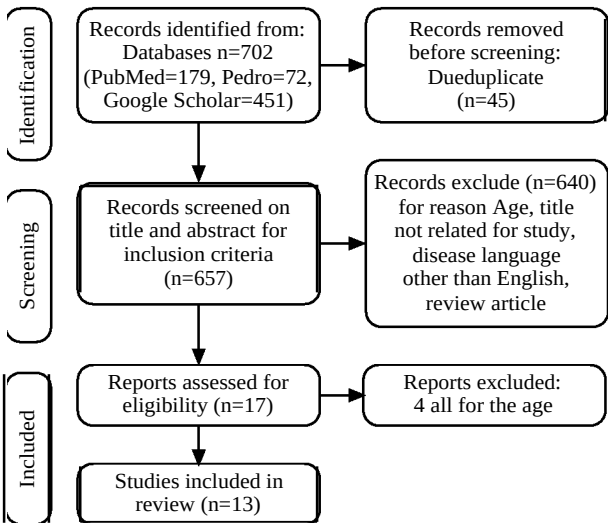

Fig. (1): Prisma flow chart of research results.

The following inclusion criteria were considered: (1) All type of studies published in English; (2) Papers assessing normal developed children; (3) Studies involving ages between 3 to 12 years; (4) Studies demonstrate effect of modern technology (smart phone, mobile phone, tablet, laptop, computer and videogames) o upper body posture; (5) Studies fillable on web research.

Articles were not included if they fell into the following exclusion criteria: (1) Studies published in language other than English; (2) Studies that measured outcomes not related to the scope of this study.

A custom data extraction by American Academy for cerebral palsy and Developmental Medicine's (AACPDM) [7] : (1) Studies, (2) Level of evidence & research design, (3) Quality Assess. Pedro score/level and MINORs, (4) Participants, (5) Ages, (6) Total n, (7) Outcomes, (8) Measures, (9) Interventionof effect of modern technology, Table (1). It wasdecided that a meta-analysis was not appropriate because more heterogeneity between the studies.

Results

A total of 702 articles were initially retrieved. After titles and abstract screening, 657studies were retained for further inspection. Following full-text analysis 4 studies excluded after full screening, 13 studies were included in the review (Fig. 1). Overall, a total of 1,599 subjects were considered. The age of the participants ranged from 3 to 12 years.

All the selected studies were scored on their methodological rigor with the Pedro scale [8] and methodological index for non-randomized studies (MINORS) [9] Comparison between 2 scale show in Table (2).

In the study of Abdel-Aziem et al. [10] to assess the effects of prolonged SVT in sitting and standing positions on the head and neck in two groups, group A used smartphones for more than four hours per day and group B used smartphones less than four hours per day during use and after use for 30 minutes, it was discovered that SVT is linked to increased neck and head flexion posture in children between the ages of five and twelve, particularly in a sitting position and while using. In addition, the limited posture deviations that occurred in the group using a smartphone, about 4 hours per day during phone use, returned to the baseline resting posture within 30 minutes and changed worse during use than after use for 30 minutes.

Table (1): Data extraction for included study BY (AACPDM).

Studies	Level of evidence and design	Q. Assess		Participants	Age	Total n.	Outcome		Measures	Intervention
		Pedro score	MINORS score				Main	Secondary		
Abdel-Aziem A 2021	IV & observational study (cross sectional)	6	10	Normal children All males	5-12 years	34 children	The effect of smartphone using status (while using and after using it for 30 minutes) in standing and sitting positions The effect of body position on head and neck angles while using a smartphone and after using it for 30 minutes.		A digital camera Kinovea software Questionnaire and measurements	Smart phone
Martinsone-Berzkalne 2020	III & Experimental study (quasi)	6	9	Normal children 511 females & 448 males	4-7 years	959 children	Posture symmetry and type.		Questionnaire and measurements	Computer
Mongkonkansai J. 2020	III & Experimental study (quasi)	6	9	Normal children (82 Male and 151 Female)	6-12 years	233 students	Smartphone usage postures of the students The prevalence of musculoskeletal symptoms		General information questionnaire. Questionnaire about smartphone usage Modified Nordic Musculoskeletal Questionnaire and body discomfort map Goniometer	Smart phone
Nandliyah A 2019	VI & observational study (cross sectional)	4	9	Normal children	10-12 years	117 students	Relationship of Game Online Addiction with Body Posture		Questionnaire Flexible curve ruller Indonesian Game Online Addiction instrument	Smart phone
Intolo P 2019	Cross sectional study design	5	8	Normal children 13 males and 12 Females	10-12 years	25 healthy participants	Level and Severity of pain (VAS) during tablet use on the table in three positions Muscle activity during tablet use on the table in three positions		Visual analog scale (VAS) Body pain chart Surface electromyography (EMG)	Tablet

Table (1): Count.

Studies	Level of evidence and design	Q. Assess		Participants	Age	Total n.	Outcome		Measures	Intervention
		Pedro score	MINORS score				Main	Secondary		
Ibrahim M 2018	III & Experimental study (quasi)	7	9	Normal children all females	7-10 years	60 children	Comparison between the mean values of postural parameters in both groups		1- Biophotogrammetric postural analysis. 2- Digital cameras.	Tablet
Pope-Ford R 2018	III & Experimental study (quasi)	5	7	Normal children (11 males and 7 females)	10-12 years	18 participants	Back Flexion/Extension During Use of Mobile Devices	Discomfort or pain	Goniometer Measuring tape Questionnaire Two Sony Handycam CX440 camcorders	Smart phone and tablet
Howie E 2017	III & Experimental study (quasi)	5	12	Normal children (4 Males and 6 females)	3-5 years	10 Children	Description of observed gross postures during Tablet, TV and Toy play Comparison of kinematic outcomes during Tablet, TV, and Toy play, Comparing physical impact of tablet computer use by young children Muscle activity during 3 conditions.		Stadiometer and calibrated scales Three-dimensional motion analysis system, Surface EMG 4 quastionnaire	Tablet
Ciccarelli M 2011	VI & observational study (cross sectional)	3	8	Normal children (Five boys and four girls)	9.1 (0.3) years	9 Children	Postures and muscle activity over the whole day and when using different ICT types Postures and muscle activity variation when using different ICT types.		Bi planar electronic inclinometers Portable computer Surface EMG	Computer
Straker. L 2009	III Experimental study (quasi)	5	7	Normal children (12 male and 12 females)	10-12 years 3- 2-	24 Children 1- 2-	The posture and support effect in two support conditions. Muscle activation and support effect for males and females during the experimental support and no support conditions. Muscle activation during actually not supported and actually forearm supported periods for the support condition.	5- 4- 3- 2- 1-	1- Eight camera, 2-infra-red motion analysis system 3- Surface EMG	Computer

Table (1): Count.

Studies	Level of evidence and design	Q. Assess		Participants	Age	Total n.	Outcome		Measures	Intervention
		Pedro score	MINORS score				Main	Secondary		
Straker. L 2008	III Experimental study (quasi)	5	9	Normal children (9 male and 9 females)	5-6 years	18 Children	The posture and muscle activity in three information technology (IT) type conditions.	Variability of posture and muscle activity in three information technology (IT) type conditions.	Seven-camera, infrared motion analysis system Surface EMG	Tablet computer, desktop Computer
Straker. L 2008	III Experimental study (quasi)	4	7	Normal children (12 girls, 12 boys)	10-12 years	24 children	Alternation in head, neck, arm posture& muscle activity during 3 conditions.		Eight-camera, infrared Peak Motus 3D Optical Capture System and Peak Motus 8 software Surface EMG Self report questionnaire.	Computer
Breen R 2007	III Experimental study (quasi)	5	9	Normal children 30 male and 38 female	9-10 years	68 children	Percentage of observations in each RULA action level. RULA Grand Scores at the beginning and end of the 15-25 min computer sessions.	Association between pain and computer task.	Rapid upper limb assessment (RULA) Body discomfort chart (BDC) and 3-Visual analogue scale (VAS)	Computer

Table (2): Comparison between Pedro scale & MINORS scale.

Studies	Pedro=11	MINROS=16
Abdel-Aziem A 2021	6	10
Martinsone-Berzkalne 1 2020	6	9
Mongkonkansai J.2020	6	9
Nandliyah A 2019	4	9
Intolo P 2019	5	8
Ibrahim M 2018	7	9
Pope-Ford R 2018	5	7
Howie E 2017	5	12
Ciccarelli M 2011	3	8
Straker. L 2009	5	7
Straker. L 2008	5	9
Straker. L 2008	4	7
Breen R 2007	5	9

2- 1-

In the study of Martinsone-Berzkalne et al. [11] when comparing the age groups of 4- and 7-year-old children, we concluded that posture type disorders increase with the child's age and have the tendency to have more typical posture disorders if they watch TV for more than one hour per day. Computer use has a significant effect on posture type and has resulted in more frequent posture disorders in the computer-using group of children.

In the study of Mongkonkansai et al. [2] most smartphone usage postures are in lying positions, with 91.5% of ergonomics risk. Would be more comfortable than sitting and could be used for longer. Smartphone usage postures were unrelated to the prevalence of musculoskeletal symptoms, which is consistent with the students who had the highest rate of head/neck symptoms, and smartphone usage postures were significantly correlated with head/neck symptoms. In order to use a smartphone, more than half of the students bent their heads over 25 degrees and did not have full support. This indicates that the longer students use a smartphone, the higher the risk of developing symptoms in their heads and other body parts.

In the study of Nahdliyah and Martani [12] showing that the occurrence of FHP is four times higher in children with smartphone addiction than in children who are not. The head is placed in an unchanged position due to prolonged smartphone use, which leads to muscle weakness and fatigue (after five minutes) and can quickly progress to chronic cervical pain (after 16min). Long-term use of smartphones while playing online games can cause changes to the cervical and thoracic curves of the spine because the user is more likely to sit and bend while playing these games, increasing the thoracic curve above 450, which is known as hyperkyphosis.

In the study of Intolo et al. [13] the first to examine pain and muscle activity simultaneously while children (aged 10 to 12) used tablets in three different workstation positions. The study's findings were notable in that using a tablet while sitting at a table with a case set significantly reduced neck pain compared to other positions (on the table and in the lap). When using a tablet on a table with a case set, the screen was near eye level, resulting in less neck flexion than when using the tablet in either of the other two workstation positions.In addition, it found that regarding tablet use on the table; upper trapezius muscle activity was significantly higher than when using a lap workstation. Children raised their shoulders and placed their arms on the table to use the tablet comfortably; participants reported significantly more pain in the neck region during tablet use on the table and the lap than at the other workstation. Overuse of neck muscle activity, also known as sustained muscular contraction, occurred as a result of children sitting in 'over flexion' neck postures for a long duration. Sustained muscular contraction may reduce blood flow into that muscle, resulting in pain.

In the study of Ibrahim and Radwan [3] showed that in children aged 7 to 10, prolonged tablet use was associated with a more flexed spine and rounded shoulder in group 2 (use tablet from 3 to 6 hours per day) than in group 1 (those using tablet less than three hours per day). FHP causes upper cervical spine extension and lowers cervical spine flexion by flexing their necks up to 20° or more. As each factor can affect the other, this new alignment increases lower cervical lordosis associated with a decreased or flattened upper cervical spine curvature, rounded shoulders, and an FHP. Long-term sitting posture in both groups resulted in increased lumbar lordosis and anterior pelvic tilting, which contributed to the shortening of the iliopsoas muscles.

In the study of Pope-Ford [14] Continuous use of smartphones, tablets, and other electronic devices will have a cumulative effect that raises the risk of developing musculoskeletal disorders. For example, 22.2% of smartphone users report pain and discomfort after using their device (in the wrist, neck, and lower back), and 5.5% of tablet users report pain (in the wrist, neck, and head/headache). The mean flexion for all participants was (25.58° for phone use & 25.8° for tablet use), the mean flexion/extension for participants seated on the sofa was (29.9° for phone use & 30.1° for tablet use), and the mean back flexion/extension for participants seated on the floor was (31.18° for phone & 28.6° for tablet use).

In the study of Howie et al. [15] when compared to both TV watching and non-screen toy play, children aged 3 to 5 years had altered posture, muscle activity, sitting time, and physical activity while playing with tablet computers, which may lead to potential musculoskeletal and physical activity-related risks (more thorax and head flexion). Children who played with tablets had greater variation in body segment posture and transitions between sitting and other gross body postures than children who watched TV but less than children who played with toys.

In the study of Ciccarelli et al. [16] postures held for prolonged durations (one hour or more)

may increase the risk of musculoskeletal disorders (MSDs) due to sustained contractions of the muscles responsible for posture maintenance. Direct measurement of the head, trunk, and upper arm postures identifies variations in mean postures and some postural variables depending on the type of ICT (for example participants read and wrote on the horizontal surface promoting increased trunk and head flexion, they also read from, and wrote on, the vertical surface promoting postures that were more neutral). There was no significant difference in the mean muscle activity of the bilateral upper trapezius and right forearm extensors between the Old and New ICT tasks.

In study of Straker et al. [17] the use of a forearm or wrist support while using a computer in children aged 10 to 12 years is effective in reducing muscle activity in the neck and shoulder region, as well as reducing musculoskeletal disorders and discomfort and having no alternation of spinal flexion.

In study of Straker et al. [4] children between the ages of 5 and 6 years old's postures and muscle activity when using a tablet compared with a traditional desktop and paper, Tablet computers were found to have a more flexed and asymmetrical spine, as well as a more elevated (left) and flexed (right) shoulder than traditional desktop computers. The increased spinal asymmetry and upper limb posture associated with the tablet condition may also increase the risk of musculoskeletal symptoms developing. There were no differences in mean muscle activity between tablet and paper use, but the left upper trapezius (UT) had a significantly greater amplitude range during paper use compared to tablet or desktop use. Tablet and paper use were both associated with fewer neutral postures and more postural and muscle activity variation than desktop use.

In study of Straker et al. [5] describing 3-D posture and muscle activity (in the head, neck, and arm posture) in children aged 10 to 12 years during reading/data input with common school display conditions: High- and mid-level computer displays, as well as book/paper, displays. The mid position was close to preferred viewing angles and resting head/neck postures, and while it slightly increased cervical erector spinae (CES) activity, it may have been offset by slightly decreased UT activity. As a result, the mid position appears to be a better option than the high position. The book condition was associated with increased head and neck flexion and asymmetry, as well as increased CES and UT activity, subjective physical workload, and musculoskeletal representation.

In study of Breen et al. [18] to investigate the posture of children (mean age 9.5 years) while working at computers and determine whether the postures contributed to reported pain. Found to be unacceptably poor and tended to deteriorate over a 15-25-minute computer session. Posture worsened over time. Poor posture was associated with discomfort, but it is unclear whether this was due to the sitting posture or the computer user. 60% of the children reported discomfort, especially when using a mouse.

Discussion

The articles included in this review are characterized by providing immediate and follow-up results and this helps in determining the immediate and long-run harm effect of modern technology on upper body posture in normal developed children.

Each of all studies received a score of three to seven on PEDro scale. And score of seven to twelve on MINORS scale. The higher the number of points for the aspects measuring the study's quality, Ciccarelli et al. [16] scored three in PEDro scale and eight in MINORS scale, Straker et al. [5] and Nahdliyah and Martani [12] scored four in PEDro scale and seven forStraker et al. [5] and nine for-Nahdliyah and Martani [12] in MINORS scale, Intolo et al. [13], Pope-Ford [14], Howie et al. [15], Straker et al. [17], Straker et al. [4] and Breen et al. [18] studiesscored five in PEDro scale and seven forStraker et al. [17] and Pope-Ford [14], eight forIntolo et al. [13] and nine for Straker et al. [4] and Breen et al. [18], and twelve for Howie et al. [15] in MINORS scale, Abdel-Aziem et al. [10], Martinsone-Berzkalne et al. [11], and Mongkonkansai et al. [2], studiesscored sex in PEDro scale and nine for Martinsone-Berzkalne et al. [11] and Mongkonkansai et al. [2] and ten for Abdel-Aziem et al. [10] in MINORS scale, and Ibrahim and Radwan [3] scored seven in PEDro scale and nine in MINORS scale.

From the above the evidence for studies moderate to low according to PEDro scale and high to moderate according to MINORS scale. Because of PEDro scale use mostly for assessment randomized control trail (RCT) (intervention study) but MINORS scale use for randomized and non-randomized study (comparative ad non comparative) so MINORS scale more eligible assessment in Studies looking at the harm effectlike my study.

Smartphone had an affecting on upper posture (head, trunk and upper & lower arm) especially in laying position due to tilting organs to one side,

[2] musculoskeletal discomfort able and pain, [2,14] Increase head and neck flexion posture in sitting more in standing, [10] and smart phone addiction causes changing on posture leading to hyper kyphosis [12].

Tablet had an effect on upper posture especially neck region (increase head & neck flexion), rounded shoulders and kyphosis, [3,4,15] increasesed entarybehavior and reduce physical activity & posture variation, [15] Tablet with case set more preferable because reduce severity of pain in neck region and activity of cervical erector spinae muscle [13].

Computer had a variation on upper body posture (head, trunk and upper arm), [11] due to holding for long duration leading to increase MSDs and pain, [16] supported forearm during use leading to reduce neck & shoulder load and MSDs ad pain, [17] mid height of computer had more preferable due to decrease posture alternation and muscle activity of UT & increase CES activity [5].

Between the two different positions, there was a substantial difference in the neck and trunk posture (Stand, Seat). Regardless of the activities carried out, a definite rise in the neck and trunk forward angles was observed when the respondents used the smartphones while seated: This evidence may be based on the subjects' inappropriate seating position while using the smartphone [19]. Adolescents' head and neck posture were negatively impacted by heavy smartphone use, and variations in head and neck posture are closely correlated with daily usage hours [20].

Although modern technology becomes essential part In children for distance learning and studying But from all studies in thesis review there were harm effect on upper body posture in head, neck, shoulders and upper trunk due to increase forward flexion angles in sitting position more than standing, develop rounded shoulder to more kyphosis in log time use more than. After only five minutes of use, muscle weakening and tiredness set in, and after fifteen minutes, chronic neck discomfort. Over time, MSDs and ongoing pain result from this steady accumulation of stress [12].

The findings of the study may be limited by High level of heterogeneity between studies, Differentiation between studies design, Studiespublished in language other than English.

Conclusion:

From clinical evidence the modern technology had a harm effect on upper body posture in normal developed children and the number of hours spent using the device directly correlates with postural abnormalities in the head and neck.Further researches are required to clinically found the effect of modern technology on other body parts, different age in normal children and other children disease and help the researchers and the parents.

Recommendations:

- Parents, teachers, administrators, and other caretakers must be cognizant of the hazards of extended and extensive use modern technology and should be limited to 1-2 hours after that encourage children take breaks, move, and change their activity.
- Avoid using the phone in the lying position and Television and technological equipment connected to the internet should be kept away from the child's bedroom.
- Act exercise activities that promote relaxation of the shoulders and a neutral neck and back posture do recommend at least 1h of physical activity daily 3-4 times per week and 8-12h of sleep.
- Ensure adequate traditional toy play with its associated physical activity benefits and parents should be provided with knowledge about the correct postures in using a smartphone should use a tablet on a table with a case set as opposed to on the lap to prevent the risk of musculoskeletal pain and reduce neck muscle activity.
- Care must be taken that children aged 2 years or younger not be allowed to face the screen and smartphones should not be too small and should have at least 5 inches for a screen size.

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تأثير التكنولوجيا الحديثة على وضعية الجزء العلوى من الجسم فى الأطفال الأصحاء : دراسة منهجية

\الهدف من \البحث : تهدف هذه الدراسة المنهجية إلى دراسة تأثير دراسة تأثير التكنولوجيا الحديثة على وضعية الجزء العلوى من الجسم فى الأطفال الأصحاء.

أسلوب \البحث : تم البحث فى قواعد البيانات الالكترونية (Google و PubMed و Direct و Pedro) على التجارب العشوائية المحكمة ذات الصلة المنشورة باللغة الإنجليزية فى الفترة من يونيو ٢٠٢١ إلى مارس ٢٠٢٢، الكلمات الدالة المستخدمة فى البحث التكنولوجيا الحديثة، الهاتف الذكى، الجهاز اللوحى، الأطفال الإصحاء، وضعية الجزء العلوى، الوضع الغير صحيح البحث مقيد بالتجارب العشوائية على الأطفال الأصحاء من سن ٣ سنوات حتى ١٢ سنة.

احتوت الثلاثة عشرة رسالة على مشاركين من الأطفال الأصحاء أعدادهم (١٥٩٩). قاماً مراجعان مستقلان باستخراج البيانات من الدراسات المتضمنة وتم حل الخلاف مع المراجع الثالث. تم اختبار الجودة المنهجية للدراسات بواسطة مقياس PEDro و MINORs وتراوحت جودتها من جيد إلى ضعيف. تم تحديد مستوى الدليل طبقاً لمقياس. PEDro ومن جيد جداً إلى جيد تبعاً لمقياس MINORs. وتم عمل مناقشة توضيحية لكلا لأبحاث.

\النتائج :وفقاً للأبحاث وجدنا تأثير سلبى لإستخدام الأنواع المحتلفة من التكنولوجيا الحديثة على وضعية الجزء العلوى فى الأطفال الأصحاء من حيث زيادة التشوهات فى العمود الفقرى خاصة الفقرات العنقية واحتمالية الإصابة بتقوس فى العمود الفقرى وغيره كما تؤدى إلى الألم واجهاد العضلات وعدم الشعور بالراحة.

\الأستنتاج : أظهرت هذه المراجعة المنهجية دليل ملموس على سوء استخدام الوسائل الحديثة للتكنولوجيا المختلفة على وضعية الجزء العلوى من الجسم لدى الأطفال الأصحاء ولكن هناك الحاجة إلى المزيد من الأبحاث فى هذا المجال للتحديد بالتفصيل مد سوئها على أجزاء الجسم الأخرى والأعمار المختلفة لدى الأطفال العاديين وأمراض الأطفال الأخرى.