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Survey on the Current Status of Upper Crossed Syndrome among Students at a Special School in Beijing

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Abstract: This study investigated the current status of the development and occurrence of Upper Crossed Syndrome (UCS) among students at a special school in Beijing. We employed static posture assessment, cervical spine range of motion testing, and shoulder and neck functional testing to evaluate the current status of Upper Crossed Syndrome in 40 students aged 7-15 years at a special education school in Beijing. Significant differences were found between the distance of the acromion from the wall for students aged 7-9 years compared to those aged 10-12 and 13-15 years ($P < 0.001$). There were no significant differences in the test results between students of different genders ($P > 0.05$). A significant difference in head protraction angles was observed between students with autism and those with multiple disabilities ($P < 0.05$). Students at the special education school exhibited a more severe head protraction posture than typically developing students. Students in different age groups showed a progressive increase in the prevalence of rounded shoulders and chest retraction annually. Students with multiple disabilities had the most severe head protraction symptoms, followed by those with intellectual disabilities.

1. Introduction

Upper Crossed Syndrome (UCS), initially conceptualized by Vladimir Janda[1], is a postural distortion syndrome characterized by an imbalance of muscle strength and flexibility, predominantly affecting the upper body[2]. It is marked by the overactivity of the pectoralis major and upper trapezius muscles, coupled with the weakness of the rhomboids, middle and lower trapezius, serratus anterior, and deep cervical flexors. This imbalance leads to a cluster of postural deviations such as rounded shoulders (kyphosis), protracted scapulae, and forward head posture [3][4].

The prevalence of UCS has been increasingly recognized in various populations, including schoolgoing children and adolescents, due to the modern sedentary lifestyle and the extensive use of electronic devices[5]. In the context of special education schools in Beijing, where children with diverse needs are educated, the incidence and characteristics of UCS may present unique challenges and implications for the students' physical and mental well-being.

The significance of addressing UCS lies not only in its immediate postural consequences but also in the long-term health implications. If left unattended, individuals with UCS are at a higher risk of developing conditions such as nerve-root type cervical spondylosis, periarthritis of the shoulder, and a range of symptoms including dizziness, headaches, and numbness in the neck, arms, and fingers[6][7]. These symptoms can severely impact the quality of life and the ability to participate in daily activities, including educational pursuits[8].

Despite the growing body of literature on the subject, there is a paucity of research focusing on the current state and characteristics of UCS among students in special education schools in Beijing. Understanding the prevalence, risk factors, and the specific manifestations of UCS in this population is crucial for the development of targeted interventions and educational strategies to mitigate its effects.

Special schools in Beijing cater to a wide array of students with special needs, many of whom may be predisposed to developing postural syndromes like UCS due to their specific conditions and the nature of their educational requirements.

This study aims to investigate the current state of Upper Crossed Syndrome among students in a special school in Beijing, with a focus on identifying the prevalence, associated factors, and the distinctive characteristics of the syndrome within this demographic. The research will provide valuable insights into the physical health challenges faced by these students and contribute to the broader understanding of how UCS manifests in special education settings.

2. Methods

2.1. Participants

Students from a special education school in Beijing were selected. The research employed a stratified random sampling method to test 49 students aged between 7 and 15 years from nine different grades across the school. The overall list of students was obtained; the grades were divided into three strata, namely grades one to three, grades four to six, and grades seven to nine; from each stratum, samples were randomly drawn at a ratio of 50%. After excluding samples with missing data, a total of 40 individuals (n=40) were included in the study. The general information statistics of the sample are detailed in Table 1.

Table 1: Participant information

	n	age(y)	gender (male/female, n)	autism	Intellectual disability	Multiple Disability
7-9y	17	7.88±0.78	12/5	7	6	4
10-12y	11	11.4±0.67	10/1	6	4	1
13-15y	12	14±0.74	10/2	2	8	2
total	40	10.68±2.73	32/8	15	18	7

2.2. Procedures

2.2.1. Assessment

2.2.1.1. Range of Motion

The study involves testing the maximum range of motion (ROM) for various movements of the cervical spine, including flexion, extension, lateral flexion, and rotation. The measurement method is as follows:

1) Participants are seated and actively move the cervical spine to the maximum range of motion upon the tester's verbal command (if the participant fails to understand the instructions or is unable to complete the required movement, the tester may demonstrate, have the participant mimic, or passively move the joint to its maximum range).

2) Once the maximum range is reached, a photograph is taken to capture the midline angle, and each direction is operated three times.

3) All tests are conducted by the same tester.

Image Processing Using Apple Pencil and iPad iOS Operating System:

1) The images are initially cropped and corrected. The necessary part (cervical joint) is zoomed in and selected, and the line connecting the participant's acromions (the bony processes of the shoulder blades) is corrected to be parallel to the horizontal line (using the device's reference grid), and then the image is cropped.

2) The tool panel is opened for drawing. The ruler tool, which has an angle measurement function, is selected. Using the Apple Pencil, a horizontal and a vertical baseline are drawn, and a third line is drawn using the visual estimation method.

3) An image with drawn traces, measured angles, and test numbers is obtained. The average of the degrees obtained from three images for each angle is taken.

2.2.1.2. Static posture assessment

Posture Screen software is used to perform static pose measurement analysis, using a camera to take pictures of the front, left and right sides of the subject, and all tests are taken by the same tester and the same equipment at the same fixed position. The distance between the device and the subject is 205 cm, ensuring that the device carrying the software is photographed on the same horizontal plane while perpendicular to the ground.

The image is uploaded to the Posture Screen software for static posture measurement analysis of the measured object. Manually mark the reference datum points one by one, and automatically analyze four sets of data to evaluate the subject's body posture indicators, namely the head deviation distance and angle in the front view, left and right view, and back view. The degree of head tilt refers to the angle between the human earlobe and the ipsilateral acromial line and the midaxillary line. A head tilt greater than 5 °is one of the telltale signs that the subject has upper cross syndrome.

2.2.1.3. Shoulder and neck functional testing

Thoracic flexibility, acromial and wall distance, and prone push-ups were tested separately. The purpose of the test is to see if the subject will have any wrong movements due to lack of muscle strength or imbalance in the relevant area.

1) Thoracic spine flexibility test. Measuring tool: Protractor. Test method: Standing position holding PVC pole frame on both shoulder peaks, actively rotating left and right to measure and note the angle.

2) The distance between the shoulder and the wall. Measuring tool: Tape measure. Measurement

method: Standing against the wall in a natural state, measuring the distance from the shoulder of both shoulders to the wall.

3) Prone push-ups. Measuring tool: Tape measure. Measurement method: prone position, upper limb flexion does not provide support, keep the pelvis close to the ground, and measure the distance between the upper sternal angle and the ground.

2.2.2. Mathematical Statistics and Analysis

Microsoft office excel 2016 software and IBM SPSS Statistics Subscription statistical software were used to process and analyze the obtained data. Static postural assessment, cervical range of motion, and shoulder and neck function test results are expressed as mean ± standard deviation (M±SD). The test method was independent samples T-test and one-way ANOVA, and the α value was set to 0.05.

3. Results

3.1. Comparison of results for students of different ages

Table 2: Comparison of test results for students of different ages (M±SD)

	Angle (°)	7-9y (n=18)	10-12y (n=12)	13-15y (n=10)	F value	P value	Partial η2
Static posture assessment	Angle of lateral tilt of the spine	5.10±3.81	4.88±2.03	4.86±5.23	0.018	0.982	0.001
	Head forward tilt angle	27.06±7.42	30.37±8.00	29.01±9.28	0.628	0.539	0.033
ROM	Cervical spine flexion	63.17±18.67	55.50±21.68	70.00±17.17	1.558	0.224	0.078
	Cervical spine extension	54.67±13.11	59.92±13.63	53.40±13.86	0.783	0.464	0.041
	Cervical scoliosis - left	26.83±11.46	32.17±12.15	27.50±13.29	0.751	0.479	0.039
	Cervical scoliosis - right	31.78±13.43	36.75±11.31	31.00±18.41	0.579	0.566	0.030
	Cervical rotation - left	54.72±19.71	64.33±12.79	58.10±14.68	1.193	0.315	0.061
	Cervical rotation - right	66.33±8.31	62.00±11.34	57.90±17.14	1.669	0.202	0.083
Shoulder and neck functional testing	Thoracic spine flexibility (°)	55.36±15.86	60.54±16.71	64.70±18.46	1.047	0.361	0.054
	Acromial wall distance (cm)	8.43±1.78	11.10±1.59	11.43±2.00	12.462	0.000**	0.402
					7-9y-10-12y	p<0.001	
					7-9y-13-15y	p<0.001	
	Prone (cm)	15.00±5.84	11.58±5.48	12.50±5.56	1.457	0.246	0.073

* p<0.05 ** p<0.01

There was a significant difference in the distance between the acromion and the wall in 7-9-year-old students and those aged 10-12 and 13-15 years (Table 2).

3.2. Comparison of results for students of different genders

Table 3: Comparison of test results for students of different genders (M±SD)

	Angle (°)	Female(n=9)	Male(n=31)	t value	P value	Cohen's d
Static posture assessment	Angle of lateral tilt of the spine	3.93±2.31	5.28±4.01	-0.954	0.346	0.361
	Head forward tilt angle	23.17±4.45	30.10±8.17	-2.427	0.020*	0.919
ROM	Cervical spine flexion	66.11±16.17	61.55±20.55	0.611	0.545	0.231
	Cervical spine extension	60.89±17.87	54.48±11.74	1.275	0.210	0.483
	Cervical scoliosis - left	28.44±14.98	28.65±11.36	-0.043	0.966	0.016
	Cervical scoliosis - right	34.22±9.81	32.74±15.25	0.274	0.786	0.104
	Cervical rotation - left	61.11±20.35	57.68±15.93	0.535	0.596	0.203
	Cervical rotation - right	63.78±11.03	62.68±12.54	0.237	0.814	0.090
Shoulder and neck functional testing	Thoracic spine flexibility (°)	64.39±16.24	57.76±16.92	1.044	0.303	0.395
	Acromial wall distance (cm)	9.00±2.57	10.27±2.11	-1.512	0.139	0.573
	Prone (cm)	13.89±5.38	13.19±5.91	0.316	0.753	0.120

* $p<0.05$ ** $p<0.01$

Gender showed a significance of 0.05 for Head forward tilt angle (t=-2.427, p=0.020) (Table 3.)

3.3. Comparison of results for students of different disability

Table 4: Comparison of test results for students of different disability (M±SD)

	Angle (°)	autism (n=15)	Intellectual disability (n=18)	Multiple Disability (n=7)	F value	P value	Partial η2
Static posture assessment	Angle of lateral tilt of the spine	5.72±3.27	4.85±3.45	3.70±5.26	0.713	0.497	5.72±3.27
	Head forward tilt angle	27.99±8.48	28.88±8.15	28.83±7.66	0.053	0.949	27.99±8.48
ROM	Cervical spine flexion	55.87±22.60	65.28±17.78	70.00±14.09	1.608	0.214	55.87±22.60
	Cervical spine extension	53.67±9.55	57.89±13.79	55.71±19.66	0.396	0.676	53.67±9.55
	Cervical scoliosis - left	28.07±9.83	30.50±13.21	24.86±14.02	0.563	0.574	28.07±9.83
	Cervical scoliosis - right	34.07±13.57	35.67±11.83	24.29±18.82	1.766	0.185	34.07±13.57
	Cervical rotation - left	62.27±11.82	57.28±17.15	53.29±24.56	0.752	0.479	62.27±11.82
	Cervical rotation - right	64.13±9.26	65.44±11.26	53.86±16.51	2.638	0.085	64.13±9.26
Shoulder and neck functional testing	Thoracic spine flexibility (°)	61.63±16.79	59.58±18.27	53.29±13.20	0.583	0.563	61.63±16.79
	Acromial wall distance (cm)	10.30±2.24	9.97±2.34	9.32±2.21	0.440	0.647	10.30±2.24
	Prone (cm)	12.67±6.26	14.56±5.94	11.71±3.70	0.779	0.466	12.67±6.26

* $p<0.05$ ** $p<0.01$

Static posture, ROM, and functional tests for different impairments did not show significance (p>0.05) (Table 4.)

4. Discussion

In 2018, a survey was conducted on a total of 800 individuals selected from four primary schools and four high schools in Beijing to statistically analyze postural abnormalities. It was found that the proportion of head bias reached 10% in primary schools and 12.5% in high schools[9][10]. Students in special education schools, compared to regular students, do not have a heavy academic workload, but their head protraction angles are much larger than those of regular students. The physical fitness of special students, such as muscle flexibility and strength, is relatively poor compared to that of regular children[11], which may result in weaker development and control of body posture, leading to this outcome. Further assessment of the strength and flexibility of the shoulder and neck muscle groups in special students with UCS can be conducted to determine the specific causes.

The cervical spine joint motion in special students is generally greater than the normal average in the sagittal plane, suggesting that this group may have excessive flexibility in the anterior-posterior direction, potentially leading to insufficient cervical stability; whereas the lateral flexion is less than the normal value, indicating insufficient flexibility in the coronal plane[12]. The cervical rotation angles are all less than the normal values, and the left rotation angle is much greater than the right, suggesting that there may be muscle imbalance in the cervical rotator muscle groups of special students[13]. To determine the exact reasons, further measurement of the strength and flexibility of the left and right rotator muscle groups is needed, along with large-sample cross-sectional studies and observation of the daily cervical activity habits of special students[14].

A study on the current state of body posture among children and adolescents in Beijing found differences in body posture among children and adolescents of different ages, and that poor body posture becomes more severe with increasing age[15]. The results of the distance of the acromion from the wall in this study are consistent with those findings. No significant differences were found in the results of several other tests, which may be due to the small sample size and relatively concentrated data that did not create a gap.

Special students, due to various disabilities or diseases, typically have a higher incidence rate in males than in females. In terms of physical fitness, males have greater absolute strength, explosive power, and endurance than females, while females have better flexibility[16]. In terms of body posture, this study conducted an independent sample T-test on the measurement results of males and females, and no significant differences were found. Compared to regular students, research has shown that the incidence rate of abnormal posture in male middle school students is higher than in females[17]. The results of this study found that the average head protraction angle in males was higher than in females, while the average values for cervical spine joint motion in all directions were slightly higher in females than in males.

In this study, the measured population can be divided into students with autism, intellectual disabilities, and multiple disabilities according to the type of disability. The results showed that students with multiple disabilities had the smallest cervical spine motion and the least ideal results in shoulder and neck functional tests, indicating that we should pay more attention to the development of posture and physical fitness in students with multiple disabilities. This study only conducted a preliminary classification of the type of disability in students, and in future research, we can classify students with different types of disabilities according to the level of disability, increase students' basic information, and include the causes of different types of disabilities, growth environment, and family factors in the research to provide a more comprehensive analysis of the causes of Upper Crossed Syndrome.

5. Conclusions

1) The head tilt posture of the students was more serious than that of normal students.

2) As students from different age groups grow older, the prevalence of postural abnormalities such as rounded shoulders and chest retraction tends to increase year by year

3) There is no gender difference observed in the symptoms of Upper Crossed Syndrome among students from Special Schools.

4) The symptoms of forward tilt were the most severe in students with multiple disabilities.

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