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The 3D Posture Telediagnosics: Preliminary Efficiency Study

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Abstract: The study was designed to determine the efficiency of posture evaluation performed utilizing the 3 dimensional telediagnostic measurement system. Telediagnostic posture assessment is the unique approach that allows assessing the posture remotely in surface 3D mode. Evaluation phase consists of acquisition at school (approx. 100 children /day). Images are saved as clouds of dots and uploaded on diagnostic server. The data acquisition utilizes unidirectional system based on structured light illumination method. Cloud are retrieved the Telediagnostic Center and finally analyzed and reported. The aim of this study was to evaluate the efficiency of 3D posture assessment. Data of 68 subjects were analyzed. The transmission, analysis, storage and reporting time were measured. Reports contain back images and calculated values indices describing postural deformities. Data retrieval time was (mm:ss,0) - 00:10,0; anatomical landmarking time was - 01:54,7; saving results was - 00:04,4 and report generation - 00:58,8. Average evaluation time for one subject was 5 minutes and 07 sec. (04:01,7 - 06:57,4). Overall time for assessment of 68 subjects has taken 5 hours and 48 minutes. Telediagnostic 3D evaluation seems to be longer than simple Adam's test and scoliometer measurement but during simple examination only 2 subjective parameters are noted and no image is stored for further evaluation/monitoring. However, it is rather not longer than other surface topography examinations. The telediagnostic platform for postural assessment can be operated by trained medical professional efficiently in accurately predicted time. The new telediagnostic approach allows remotely assessing the posture, keeping data for further study and meets the criteria of medical assessment that diminishes radiation exposure.

Introduction

The study was designed to determine the efficiency of posture evaluation performed utilizing the 3 dimensional telediagnostic measurement system. Traditional spine deformities assessment is carried out by a physician during physical examination. Adams test (forward bending test) and rib hump quantification are widely used examination techniques, because it is cheap and easy. However, it has been postulated that those techniques are not objective and many authors have found them inaccurate [1].

Measurement System

The 3-dimensional telediagnostic measurement system consists of Digital Light Projector, matrix detector (industrial CCD camera) and a laptop. During the assessment a set of patterns such as sinusoidal fringes and modified binary Gray codes are projected onto patient's trunk surface. The 3-dimensional images of patient's trunk as clouds of dots are stored in dedicated database (Telediagnostic Centre) for archiving of data and safety purposes. Only authorized investigator can access the data over the Internet. There is no radiation exposure during the examination, so it can be carried out repeatedly without any risk for the patient. More frequent testing allows better monitoring the development of posture deformities. Telediagnostic posture assessment is unique because allows assessing the posture remotely in surface 3D mode based on the cloud of points [2-5].

Material and Methods

Preliminary efficiency study was performed on 68 patients selected from Telediagnostic Centre. Clouds of points for each patient were retrieved, analyzed and reported. Reports consist of back images and calculated curvatures of the spine. Data were retrieved in clinical facility in Warsaw directly from Telediagnostic Centre via high-speed broadband connection (estimated speed – 100 Mb/s). The transmission, analysis, storage and reporting time were measured.

Results

Entire time for evaluation of 68 patients has taken 5 hours and 48 minutes. Average time for one patient was 5 minutes and 7 seconds. Table 1 presents average times and time intervals for each study element.

Table 1. Average time and time intervals for study elements

Element	Average time (mm:ss,0)	Time interval (mm:ss,0)
Data retrieval	00:10,0	00:07,2 – 00:12,5

Anatomical landmarking	01:54,7	01:27,1 – 02:49,2
Saving results	00:04,4	00:02,8 – 00:12,9
Report generation	00:58,8	00:33,7 – 01:55,7

Discussion

Previous studies have proved that raster stereography is reliable method for precise 3-dimensional back shape measurement. False-positive results of Adams test rib hump quantification can be avoided. Reliability of the 3-dimensional posture diagnostic has been proved. This method also allows storing data for further monitoring/evaluation [2-5].

Conclusion

Telediagnostic 3D assessment of 68 patients seems to take longer than Adams test and rib hump quantification, but those common methods do not allow storing objective results or an image for further assessment monitoring. Presented assessment methodology is rather not longer than other surface topography examinations. The telediagnostic platform for postural assessment can be operated by trained medical professional efficiently in accurately predicted time. The new telediagnostic approach allows remotely assessing the posture, keeping data for further study and meets the criteria of medical assessment that diminishes radiation exposure.

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