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Merging 3D optical measurement system (structured light-based surface topography) and digital radiograms - the technique and preliminary results

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Background

Diagnosing scoliosis requires the ability to visualize curvature of the spine in a 3-dimensional (3D) environment. 2-dimensional X ray remains the primary imaging modality [1]. However, recent progress in 3D-optical imaging may improve diagnostics and increase its safety for scoliosis patients [2].

Purpose

The purpose of this study was to present the potential usefulness of merging data from the 1-directional radiogram with a 3D model obtained with an optical measurement system.

Methods

The images of 11 adolescents (average age 15.05 years) with adolescent idiopathic scoliosis (AIS) were selected for this study. Average Cobb angle 31.7° surface kyphosis angle 10.45° and surface lordosis angle 36.06°. An IRB was approved for this study. The merging algorithms were developed as an operational plug-in for OsiriX Imaging Software used in the facility for viewing medical images from the hospital PACS system. The 3D data from a 4-directional (360°) 3D optical measurement system (structured light-based surface topography) and digital radiograms were merged into one, consistent 3D model. The plug-in allowed loading and adjusting the data collected by these two systems. Finally, the composed 3D image was viewed, processed and saved in DICOM file format.

Results

Merged images showed the data obtained from a 4-directional 3D optical system and X ray for the same patient made the same day. The results of this comparison are presented in graphical form. Additionally, patients appreciated that the merged 3D/X ray images provided a better understanding of the deformity and the ability to see their body surface from a new, unexpected perspective.

Conclusions and discussion

Merging of data obtained with the 4-directional optical measurement system with data taken from another medical system, such as X ray photography, gives physicians a powerful diagnostics tool that, combines the advantages of both examination methods [3]. Moreover, as acquisition time for 4-directional optical measurement is short (a few seconds) and there is no X ray radiation, the examination can be repeated as many times as needed.

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