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LETTER TO THE EDITOR

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# EPIDEMIOLOGICAL STUDY OF ADOLESCENT IDIOPATHIC SCOLIOSIS USING LOW/NON-RADIATION SCREENING METHODOLOGY

We read with great interest the article by Zheng and colleagues (1) addressing the epidemiology of adolescent idiopathic scoliosis (AIS) in Eastern China. Using 2-stage screening, they demonstrated several lines of epidemiological evidence on AIS in Wuxi, a city in Zhejiang Province in eastern China, with a population of approximately 6.5 million. In general, AIS in the city is characterized by a higher prevalence and lower body mass index with high progressive risks. We would like to make some comments that aim to elucidate the truth to the spinal community and the public regarding AIS.

First, there is increasing evidence that exposure to ionizing radiation is harmful for adolescents undergoing frequent full-spine radiographs during the watchful diagnostic and treatment period (2). Moreover, posterior-anterior (PA) projection radiographs, focusing on the spine, should be used to greatly reduce exposure to radiation (2). Notably, Zheng and colleagues took ionizing radiation into consideration by using standing PA whole-spine X-rays during the hospital stage (1). In addition to using PA projection, accurate and tight collimation can greatly reduce the radiation dose and risk of cancer (3). Powys et al. (4) performed 3 levels of collimation of a lateral projection of the facial bones, and determined the comparative doses to the thyroid and the lens of the eye. They found considerable reduction in dose to the thyroid and lenses with tighter collimation. Lee et al. (5) examined the effects of "stepwise collimation" in scoliosis with mathematically simulated dose estimations, using tissue-weighting factors and a Monte Carlo method. They found that, in general, there were large decreases in effective dose, but less so to organs in the target site of the examination. Therefore, we suggest that PA projection radiographs with tight collimation can reduce ionizing radiation more effectively than pure PA projection.

Secondly, radiation-free and efficient methods could be considered in future for monitoring the evolution of AIS; for example, 3D-ultrasound (6, 7) and rasterstereography (8) (Table I). Rasterstereography detects the 3D spine deformity using the topography of the surface of the patient's back. The shape of a patient's back is recorded in a standing position by projecting parallel light lines onto the skin surface. Distortions of the raster lines are detected with a digital camera. A mathematical algorithm enables the 3D reconstruction of the spine and calculation of parameters defining the frontal and sagittal profiles. Tabard-Fougere et al. (8) found the rasterstereographic system enables the evaluation of AIS patients with a good validity compared with radiography with overall excellent intra- and inter-rater reliability.

The US Preventive Services Task Force (USPSTF) (9) reported inadequate evidence on the linkage of reduction in spinal curvature in adolescents with long-term health outcomes in adulthood. False-positive rates ranged from 0.8% for the forward bend test combined with scoliometer measurement and Moiré topography to 21.5% for hump assessment alone. Potential harms associated with false-positive results include psychological harms, ionizing radiation, and other harms of unnecessary treatment. Hence, the USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for AIS.

Thirdly, the natural history of AIS should be stressed, which is optimistic rather than pessimistic. In 2003, Weinstein and colleagues noted that untreated adults with AIS were equally productive and functional at a high level at 50-year follow-up with matched controls (10). Agabegi and colleagues (11) concluded that the existing literature is elusive in supporting the practice of performing surgery on patients with AIS. Due to the importance of such scientific information, we have published popular scientific articles for the public via new mass media in China, which has been published as an Editorial (12).

Thus, screening of AIS, which has an optimistic natural history, may not benefit the patients. It is recommended that, in order to benefit more patients, generalized PA projection radiographs with tight collimation or radiation-free and efficient methods should be used to monitor the evolution of AIS.

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**Table I.** Hallmarks of available screening methods for adolescent idiopathic scoliosis (AIS)

| Method | Merits and demerits |
|---|---|
| AP projection radiographs | High utilization rate<br>High-dose of ionizing radiation (2, 3) |
| PA projection radiographs with tight collimation | Lower dose of ionizing radiation (2, 3)<br>Recommended for screening (2, 3) |
| 3D ultrasound | No ionizing radiation (6, 7)<br>Green method for screening (7)<br>Lower utilization rate |
| Rasterstereography | No ionizing radiation (8)<br>Substitution of radiographs to be determined (8)<br>Need further study (8) |

AP: anterior-posterior; PA: posterior-anterior; 3D: three-dimensional.

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*Fu-Jun Luan, MD[1], Jun Zhang, MD[2] and Hai-Qiang Wang, MD, PhD[3]**

From the [1]Department of Orthopedic, Yongchuan Hospital of Chongqing Medical University, Chongqing, [2]Department of Orthopaedics, Baoji Municipal Central Hospital, Baoji, and [3]Department of Orthopaedics, Centre for Translational Medicine, First Affiliated Hospital, Xi'an Jiaotong University, Xi'an, Shanxi Province, China. E-mail: drwanghq@163.com

## RESPONSE TO LETTER TO THE EDITOR FROM LUAN ET AL.

We appreciate the suggestions proposed by Dr Luan and his colleagues.

For the selection of posterior-anterior (PA) or anterior-posterior (AP) whole-spine X-ray examination, the most important factor to consider is that the latter may increase the risk of breast cancer and thyroid carcinoma in girls; therefore, PA whole-spine X-ray examination was used in our study.

Regarding the second point, we completely agree with Luan et al. that radiation-free and efficient methods should be developed and applied in the AIS screening programmes. Three-dimensional ultrasound may be one of the options, and its reliability and validity have been tested by our colleagues (1). Recently, we have tried to investigate the feasibility of 3D-ultrasound in screening AIS and the pilot study has just been finished. We would be pleased to share the results with colleagues in the near future.

Currently, it may not be possible simply to state whether a school scoliosis screening programme is beneficial. A longitudinal study is suggested to pursue the clinical effectiveness and cost-effectiveness of scoliosis screening programme by comparing 2 equivalent communities; one with scoliosis screening vs one without scoliosis screening.


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*Yu Zheng, PhD, Yini Dang, MD, PhD, Xiaojun Wu, MA, Yan Yang, MA, Jan D. Reinhardt, PhD, Chengqi He, MD and Mansang Wong, PhD*

From the Interdisciplinary Division of Biomedical Engineering, The Hong Kong Polytechnic University, 999077 Hong Kong, China. E-mail: 15902305r@connect.polyu.hk.