

## Establishment of Digital Bone Age Criteria for Adolescents Aged 6-12 Years

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**ABSTRACT.** This Article through to the Digital Medical Imaging Technology in the Practical Application of Review on the Research of Bone Age, At Beijing Sports University Experiment Center to Participate in the Development of Low Dose of Bone Age Full Protection of Digital Image Testing System (Shj - 1) and the Traditional X-Ray Photograph of a Test to Do Comparative Research of the Skeletal Age Respectively from Shooting Time, X Ray Radiation Dosage, Interpretation Image Processing, and Interpretation of Report Generation and Interpretation Results of Storage and Transportation, Etc. Comparing Experiments, Establishing Standards for Digital Bone Age 6 to 12 Years Old. the Results Show That the Application of Digital X-Ray Machine Has Significant Advantages in Medical Image Standardization, Radiation Protection of X-Ray Machine, Data Storage and Transportation, Etc. the Newly Established Digital Bone Age Standard for 6-12 Year Olds is More Accurate and Convenient.

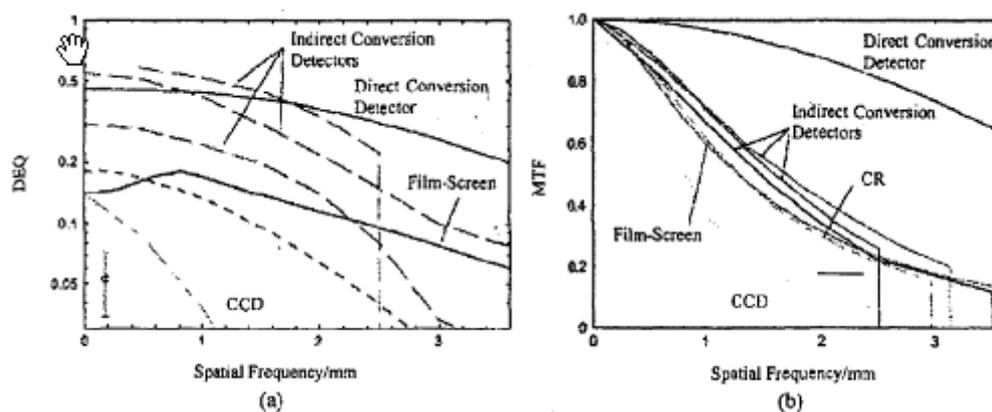
**KEYWORDS:** Adolescent Digital Bone Age Standard Digital Flat Plate Detector Dr Dicom Image Standard

### 1. Introduction

Since the Discovery of X-Ray by German Physicist W.C.Roontgen in 1895, X-Ray Technology Has Become a Specialized Subject of Diagnosis and Treatment, Playing a Very Important Role in Sports Medical and Health Undertakings [1]. in Medical Diagnosis, According to the Penetrating Effect of X-Ray, Differential Absorption, Photosensitive Effect and Fluorescence Effect, a Certain Part of the Human Body Can Be Judged to Be Normal. When X-Rays through the Body, the Absorption of Each Part of the Human Body Structure At Different Levels, Such as Bone Absorption of X-Ray Quantity More Than the Amount of Muscle Absorption, through the Body after the X-Ray Quantity is Different, through the Body's Density Distribution At Different Positions of the X Ray to Carry the Body of Information, in the Detector or Photographic Film Photographic Function or the Strength of the Fluorescent Effect Has the Very Big Difference, in the Detector or Photography on Film (after Developing and Fixing) Will Show Different Density Shadow. According to the Contrast of Shade Shade, Combining Clinical Manifestations,

Laboratory Results and Pathological Diagnosis, the Corresponding Determination Results Can Be Made.

The current X-ray machine mainly includes the traditional screen X-ray machine system (image acquisition through film), CR system, ccd-based DR system, DR system based on indirect plate detector, and DR system based on direct plate detector [2].



*Fig.1 Curve Diagram of Characteristics of X-Ray Machine System Changing with Spatial Resolution*

There are many articles about the introduction and comparative study of several systems at home and abroad. This paper mainly focuses on the bone age interpretation and bone growth and development evaluation, which are very important in the evaluation of adolescent growth and development, and carries out a comparative study between the traditional screen X-ray machine system and the latest DR bone age testing system.

DR (Digital Radiography) is a direct Digital X-ray system. The structure is mainly composed of high frequency X-ray machine, X-ray detector, control system and image workstation. According to X-ray detector, it is divided into CCD and flat detector. Since the size of CCD is smaller than the area of human body irradiated by X-ray, the CCD system needs to reduce the imaging area by optical method, which not only leads to the reduction of quantum detection rate, but also causes geometric distortion, light scattering, etc. [3]. In addition to the influence of thermal noise, the spatial resolution obtained by CCD is generally lower than that obtained by flat plate detector.

PACS (Picture Archiving and Communication System) originally means computer Archiving and transmission of medical images (collection and digitization of medical images, storage and management of images, high-speed transmission of digital medical images, digital processing and reproduction of images, and

integration of image information with other information) [4]. PACS system is the basis of paperless and non-film medical treatment in the future, which can reduce the operating cost of the hospital, improve the quality of clinical diagnosis, promote the overall efficiency of the hospital and realize telemedicine.

Beijing lang Ann video technology co., LTD. And Beijing sports university experiment center Xiong Kaiyu professor and professor Xu Gang, joint research and development of low dose of bone age full protection of digital image testing system (SHJ - 1) as an example, the system adopts the integrated design of a portable, components can be separately removed. Software used in the medical community recognized the PACS system, can be in large quantities, under the condition of continuous work, transillumination, read, print reports, image transmission at the same time, Digital collection part collects indirect digital plate imaging techniques (tablet size is 9 "X 11", pixel size \* 160 microns to 160 microns. Grey price for 14), to generate images for the standard DICOM medical image [5], interpretation software can be directly to generate the image edge enhancement, zoom in, dynamic range from building, multi-frequency equilibrium, and other processing, protective case of using composite metal material technology, X-ray xie leakage is only one over five thousand of the national security requirements [6].

## **2. Methodology**

*2.1 research objects: in the experimental group, 5,650 young normal han children (3,100 males, 6 ~ 12 years old) were randomly selected. There were 2,550 females aged 6 to 12.*

### **2.1 Research Methods:**

Literature review method: widely collect and access to domestic and foreign digital X-ray machine, medical imaging workstations, bone age in application and practice of sports information, grasp the hotspot applications of digital X-ray system, will be fully read the relevant information, and classify and analysis, compare the DR technology and traditional screen film difference of X-ray film method.

Expert interview method: to for many years engaged in the digital X-ray system, bone age test engineers, experts and professors to ask about digital X-ray and medical imaging technology in the application of bone age testing and practice of counseling problems in the process of research, compare the digital X-ray technology and traditional screen piece X film method difference in practical application.

Experiment method: stratified cluster sampling method was adopted, except for those with viscera diseases and endocrine diseases, abnormal body development, body deformity and students who participated in amateur art and sports school training. Among them, males aged 11 to 12 and females aged 9 to 12 were divided into one group every half year, and other age groups were divided into one group at 1 year. Children take posterior and anterior x-rays of their left wrist within 15 days

of their birthday.

Experimental apparatus: experimental group using bone age SHJ - 1 test system for data acquisition, transmission, identification, storage, control group adopts the method of traditional screen piece of X-ray film data acquisition, transmission, identification, storage, respectively, on the acquisition time, radiation dose, report generation time, store the results more indexes such as comparative analysis.

### 3. Results and Discussion

*Table 1 : Comparison Of Digital Bone Age Test System (Shj-1) and Screen X-Ray Machine*

	Screen X-ray machine (X film)	Digital X-ray bone age system
Image acquisition, processing and transmission	There is no	PACS digital image can be enhanced, zoomed in and out, dynamic range from construction, multi-frequency equalization and other processing. Standard DICOM3.0 standard images
Image report generation time	477s	94s*
Results the storage	The film is stored once, taking up space and space	DICOM images 40-50 (MB), can be copied and stored, repeatedly called
Leakage radiation in the loading state	0.89mGy/h	0.17uGy/h**

Note:  $p < 0.05$  \*  $p < 0.01$  \*\*

3.1 digital X-ray machine can stable control, exposure time, exposure intensity detector controller for image preprocessing, image workstation PACS system can need according to the practical interpretation of various image post-processing, such as the window width and window level adjust the zoom in and out of, the whole figure, local amplification, black and white and reverse, for example, area and Angle measurement, image mosaicing, etc. The tablet detector generates standard DICOM3.0 images, and the image determination software supports DICOM3.0Print/Send and Worklist interface: with and output DICOM3.0 image format. It can be fully connected with HIS, RIS and PACS systems, and the images are published to the DICOM network.

***3.1 In the Past, X-Ray Film Was Obtained by Developing and Fixing, and the Time Period Was Very Long. Now, Hospitals Generally Use Medical Film Washer.***

3.3 the storage of X-ray in traditional hospitals depends on a special film warehouse, and with the accumulation of the films over the years, there are great practical problems in the preservation and search of the films. The results of the digital X-ray machine can be transmitted through the network and the hard disk COPY is infinite, which solves the difficulty in the storage and search of massive X-ray films.

3.4 GB 9706.12 1997 is the state food and drug administration of medicine about medical diagnostic X-ray equipment and such equipment parts universal standard, the standard of all kinds of X-ray tube assembly and X-ray source component average air kerma should not exceed 1.0 mGy/h, use MPR200 portable radiation meter choose three test by actual test, zhengzhou teachers college is presently bone age digital bone age system lab test personal average 0.17 uGy air kerma/h, The average individual specific air release kinetic energy of the radiology test site was 0.89mg /h, and the average individual specific air release kinetic energy of the digital bone age system was about 5000 times of that of the radiology department of the hospital. The digital bone age system provided good radiation protection for the staff and subjects who used the system for a long time.

#### **4. Conclusion**

Through the comparison between the shooting work of digital X-ray system and traditional X-ray film and its application in practical work, the following findings are found:

4.1 the shooting speed is fast, and the passing rate can reach 70 person-times per hour. The portable design is suitable for the large-scale physical fitness testing of teenagers and the testing of graded competitions such as youth sports and dance

4.2 digital bone age testing system to obtain high image resolution, image clarity, exquisite, after interpretation personnel according to the need to enter through a series of image post-processing such as edge enhancement, magnification, black and white and reverse, the function such as image smooth, can extract rich reliable clinical diagnostic information, bone growth and development of the actual evaluation for teenagers to have good effect.

4.3 the digital X-ray bone age testing system has changed the traditional film photography method in the past, canceled the original image management mode and eliminated the film warehouse, but can use the computer non-film file management technology, improved the work efficiency, save money and site. At the same time, the application of PACS system provides great convenience for experts to judge the growth and development status of teenagers from a distance.

4.4 the digital image generated by the digital X-ray machine can be used to obtain a lower X-ray dose or a higher resolution image, so that the test workers and subjects can reduce the harm of X-ray radiation.

At present, the system has been applied to the bone age test of youth grading competitions of national football association and badminton association, and the

bone age test of youth grading competitions of table tennis, tennis, taekwondo and judo in henan province. At the same time, the system has been used in the related subjects of the national physical health of adolescents and achieved good results. Medical imaging technology in the application of sports scientific research and teaching is flourishing, many experts and scholars at home and abroad to use X-ray technology, ultrasonic imaging (ultrasound), electroencephalogram (EEG), magnetoencephalography does kinematics research (MEG), believe that with the continuous development of digital medical imaging technology, will be the development of sports scientific research, training and teaching more and more technical support.

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