

# The Potential of Digital Dental Radiography in Recording the Adductor Sesamoid and the MP3 Stages

HUSSAM M. ABDEL-KADER, B.D.S., B.M.M.SC., H.D.D., H.D.D., PH.D.

Orthodontic Department, Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt

**Abstract:** *The current study was undertaken to evaluate the reliability of using a recent advance in clinical radiographic technique, digital dental radiography, in recording two growth indicators: the adductor sesamoid and MP3 stages. With an exposure time five times less than that used in the conventional approach, this method shows greatest flexibility in providing a high quality digitized radiographic images of the two growth indicators under investigation.*

*Index words:* Digital Dental Radiography, Growth Indicators, Adductor Sesamoid, MP3 Stages.

Refereed Paper

## Introduction

Computer technology and digital dental radiography are in common use in dentistry. They offer high quality digital radiographic images producing instant and correctable images, long-term storage of digital images on recordable CDs and computer-archived patient records. Moreover, with no film developing, no dark room, and no wasted time, they should satisfy all dental clinical needs.

The clinical flexibility of using dental X-ray film and machine in recording the adductor sesamoid (Chapman, 1972) and MP3 stage (Abdel-Kader, 1998), encourage us to use the new technology of digital dental radiography in an area of clinical interest to orthodontists.

This study implemented the new computer technology of digital dental radiography to record the different stages of ossification of two growth indicators used for the assessments of a patient's pubertal growth spurt. The first is the adductor sesamoid of the metacarpophalangeal joint of the first finger. In 1972, Chapman reported that the ossification of adductor sesamoid is of significance in recording the adolescent growth spurt. The second indicator is the middle phalanx of the third finger (MP3). Hagg and Tranager (1982, 1988) introduced the MP3 stages, of which there are five, to follow-up the different stages of pubertal growth spurt. The first stage is the MP3-F stage, in which the epiphysis is as wide as the metaphysis and which is considered a preceding event to the onset of the spurt. Next, there is the MP3-FG stage, the acceleration phase of the spurt, in which there is a distinct medial and/or lateral border of the epiphysis forming a line of demarcation at right angle to the distal border. Following this is the MP3-G stage, peak of the spurt, in which the sides of the epiphysis have thickened and also cap its metaphysis, forming a sharp edge distally at one or both sides. Next is the MP3-H stage, the deceleration phase of the spurt, is attained when fusion

of epiphysis and metaphysis has begun. The last stage the MP3-I stage, the end of pubertal growth spurt, is attained with complete fusion of epiphysis and metaphysis.

The aim of this paper is to demonstrate the scope of the digital dental radiographic technique to record the adductor sesamoid and MP3 stages, and the possibilities of the image manipulation to enhance their usefulness.

## Materials and Methods

To show the scope of this new technology, the adductor sesamoid and the MP3 stages of two male patients; 12 and 15 years old, and a 19-year-old female patient, were examined using the technique of digital dental radiography. The Sensor Dental Lynx II of ARDET (Dental Lynx from ARDET, Italy) was used. It is compatible with all existing dental X-ray units on the market. The sensor is connected to computer with the following minimum configuration:

1. Compatible 486 DX2 66 or advanced.
2. 8Mb RAM.
3. HD 500 MB.
4. Video board SVGA.
5. SVGA screen.

The patient is instructed to place her/his hand with the palm downward on a flat table. The finger concerned is aligned with the long axis of the intra-oral dental sensor (global surface area of 20 × 30 mm), in such a way that the area to be radiographed will be located in the centre of the sensor. The cone of the dental X-ray machine should be positioned in light contact with the finger and perpendicular to the sensor (Fig. 1). The exposure time was 0.05 second.

## Results

Immediately after exposure, a high contrast radiographic image without any distortion of the adductor sesamoid and the third finger middle phalanx (MP3 stages) appeared on the screen of the computer monitor (Fig. 2 a and b). Once

Correspondence: Professor Dr H. M. Abdel-Kader, 5 Gamaat Al-Dowal Al-Arabia Street, Al-Mohandessen 12411, Dokki, Cairo, Egypt (e-mail: hussamkader@hotmail.com; web site: <http://www.geocities.com/ResearchTriangle/Thinktank/2718/>)



FIG. 1 The position of the dental sensor, finger, and the cone of dental X-ray machine.



FIG. 2 The adductor sesamoid and the MP3-I stage of the 15-year-old male patient (A) and 19-year-old female patient (B).

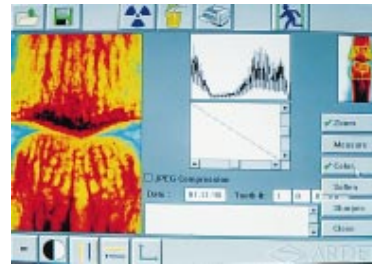


FIG. 3 Zooming of the MP3-I stage of the 15-year-old male patient (A) and measurement which can be taken (B).



FIG. 4 Comparing the MP3 stages of the 12-year-old male patient, MP3-F stage (A), 15-year-old male patient, MP3-I stage (B), and 19-year-old female patient, MP3-I stage (C) using the colour option of the programme.

the instant radiographic image is obtained, numerous image treatments can be obtained:

1. Zooming and measurements (Fig. 3 a and b)
2. Comparison with previous radiographic images of the same patient or with other patients (Fig. 4 a-c).

A finding of the current study is shown by the different computer layout of the MP3-I stage of the 15-year-old male patient (A) and the 19-year-old female patient (B) (Figs 5-8). Images with average densities (Fig. 5 a and b) showed no line of demarcation between the epiphysis and metaphysis for the two patients. This gave a picture of complete fusion of epiphysis and metaphysis for both. On the other hand, with the use of the darker densities and different colors option of the program (Figs 6-8), the epiphysis of the 15-year-old male patient (A) appear elliptical-shaped, and of much darker density and of different colours than the metaphysis. This may be due to incomplete replacement of the cartilaginous epiphysis by mature bone. While the epiphysis and metaphysis of the 19-year-old female patient (B) appeared with more or less the same homogenous density and colours, and the elliptical shape of the epiphysis completely disappeared, which mean that the cartilaginous epiphysis has been replaced by mature bone.

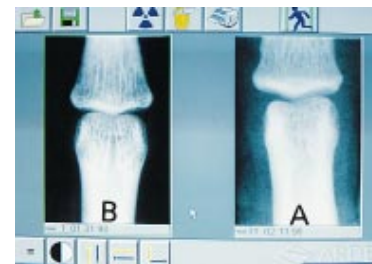


FIG. 5 A and B show the MP3-I stage of the 15-year-old male patient and 19-year-old female patient, respectively, using the average density option.



FIG. 6 A and B showed the MP3-I stage of the 15-year-old male patient and the 19-year-old female patient, respectively, using the dark density option.

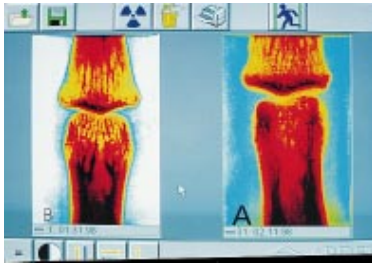


FIG. 7 A and B showed the MP3-I stage of the 15-year-old male patient and the 19-year-old female patient, respectively, using the colour option.

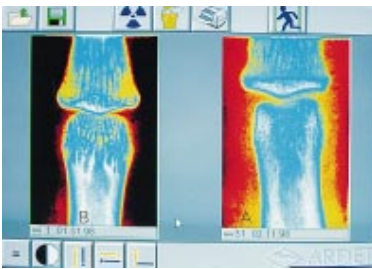


FIG. 8 A and B showed the MP3-I stage of the 15-year-old male patient and the 19-year-old female patient, respectively, using the colour option.

## Discussion

The manipulation of the images suggest there is scope for cross-sectional and longitudinal studies of the transitions between the different stages of pubertal growth spurt curve (MP3 stages) from MP3-F stage to MP3-I stage, using this new technology of digital dental radiography. The proposed study would give rise to additional information to

give a more precise detection of the different stages of pubertal growth spurt period and the late mandibular growth stage.

## Conclusions

The method described potentially has the following advantages:

1. It provides the highest quality and greatest flexibility for producing digitized radiographic images of the adductor sesamoid and MP3 stages, with an exposure time five times lower than usual.
2. Subsequently, there is less X-rays exposure.
3. There is much faster and easier orthodontist–patient–parent communication.
4. An archive may be easily generated.

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