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A TIME STUDY OF RADIOGRAPHIC TECHNICS

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Fundamental to the planning of any public health program in which clinical dentistry is involved is the need to know the length of time required to complete an operation. With time study information available, the number of prospective patients known and the yearly chair time of the dentist determined, it would be possible to calculate the personnel and equipment requirements and the approximate cost to achieve a certain goal within a given time. The purpose of this study is to supply statistically significant time study data concerning various radiographic technics.

The data for this study were accumulated over a period of a few months and were determined by timing myself with a stopwatch while executing the various radiographic technics. The average operating speed at which a technician works is influenced by his experience and the relative positions of the chair, machine, shield and lavatory. The plan of the x-ray operating room used in this study is shown in Figure 1. The plan was designed to attain two goals: first, to provide adequate x-ray protection for the operator and other x-ray department personnel and, secondly, to minimize the time and effort that the operator must expend with each patient.

Operator protection is obtained automatically by placing the timer of the x-ray machine behind a three-sided lead-lined shield. The shield is six feet high and is provided with a lead-glass window through which the patient and the meters of the x-ray machine can be observed during the exposure. Protection for the other x-ray personnel from the primary radiation is accomplished by using radiopaque barriers. The location and dimensions of the lead shield and the walls of the room prevent the primary x-ray beam from reaching workers behind the bench and at the lavatory. The walls contain a minimum of four inches of brick which affords as much protection from the radiation produced by a dental x-ray machine as would one millimeter of sheet lead. Distance alone is used to provide secondary radiation protection.

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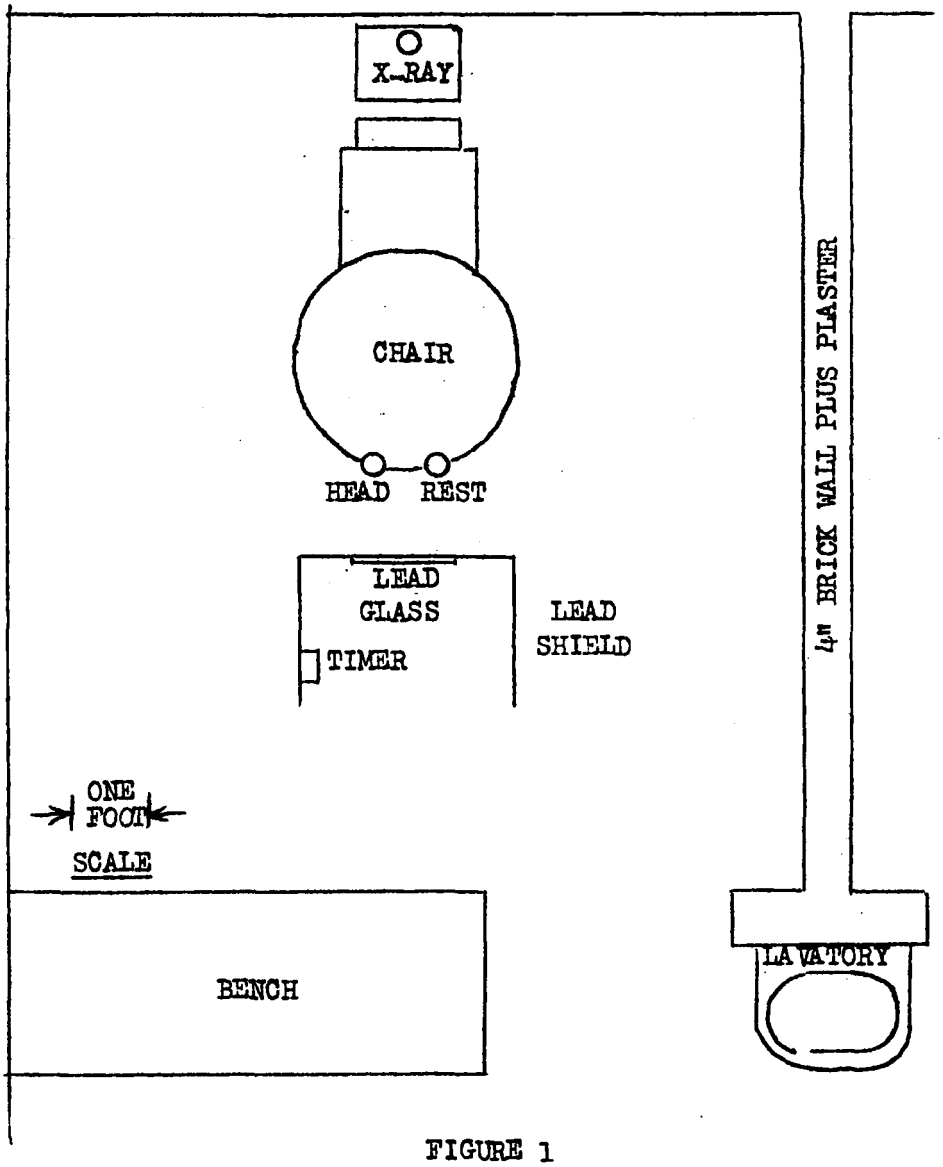

FIGURE 1

The time and effort that the technicians must spend on each patient is kept to a minimum by the several considerations which follow. Equal access to both sides of the patient is possible by placing the base of the x-ray unit at the foot end of the dental chair and by eliminating the usual dental unit with its engine, bracket table and cuspidor. The lead shield is placed just behind the headrest so very few steps are necessary for the technician to move from the patient's side to the timer and to the protection of the shield. Necessary films and equipment are readily available and protected from radiation when kept behind the lead shield. The close proximity of the lavatory to the operating area also saves steps. When the patient is dismissed, the saliva is wiped from the exposed film packets and they are placed in properly identified envelopes on the bench behind the lead shield. A waste paper container for the soiled paper headrest covers is located near the lavatory.

The average operating times listed in Table I were measured from the moment the operator starts to wash his hands until he dismisses the patient, dries and disposes of the exposed film packets and is ready to wash for the next patient. Persons other than the x-ray technician summon the patients from the reception room, provide the necessary identification for the exposed

film packets, and process the films.

An explanatory example of how Table I was compiled is necessary. The average time required to produce one periapical radiograph on each of seventeen adult patients was two minutes and fifteen seconds (2:15). After calculating the standard error of the seventeen individual measurements and the standard error of the average operating time, values of plus or minus eight seconds were determined as the limits for a ninety-five per cent confidence level of the average operating time. This calculation indicates that if the series of measurements for one periapical film were repeated one hundred times, in ninety-five instances the average value would be 2:15 ± 8 seconds or between two minutes seven seconds and two minutes twenty-three seconds.

TABLE I

Technic	Average Time	Sample Size	Limits for 95% Confidence Level
Periapical - Adult			
1 film	2:15	17	± 8 seconds
2 films	3:06	11	± 12 "
4 films	5:06	8	± 19 "
14 films (8" technic)	12:08	16	± 30 "
14 films (16" technic)	15:00	20	± 30 "
Posterior Bite-wings			
Adult - 4 films	4:40	19	± 8 seconds
Child - 2 films			
3 - 8 years	3:10	26	± 15 "
9 - 11 years	2:31	10	± 9 "
Lateral Jaws - 2 - 5"x7" films			
3 - 4 years	3:52	12	± 14 seconds
5 years through adulthood	2:33	15	± 10 "
Elementary School Technic - 8 films			
3 - 8 years	5:40	25	± 11 seconds
9 - 12 years	5:02	18	± 8 "

For the fourteen-film periapical survey of the entire adult mouth it was found that almost twenty-four per cent more time is required with the long-tube (16") technic than with the short-tube (8") technic.

The child-size posterior bite-wing survey (Figure 2) consists of two number zero or number two size bite-wing film packets. A rather excellent straight line correlation exists between operating time and patient age from three through eight years of age. For the ninth, tenth and eleventh years the operating time remains at a constant value. The proximal surfaces of the maxillary first and second molars are usually orientated in a direction running more from the mesio-buccal to the disto-lingual than the proximal surfaces of the other teeth thereby necessitating an additional number two size bite-wing film on each side of the mouth. Since four bite-wing films (two number three and two number two size packets) are used when the maxillary second molar is present, the operating time quite logically is longer than for a two film bite-wing technic and is constant from the twelfth year on through adulthood.

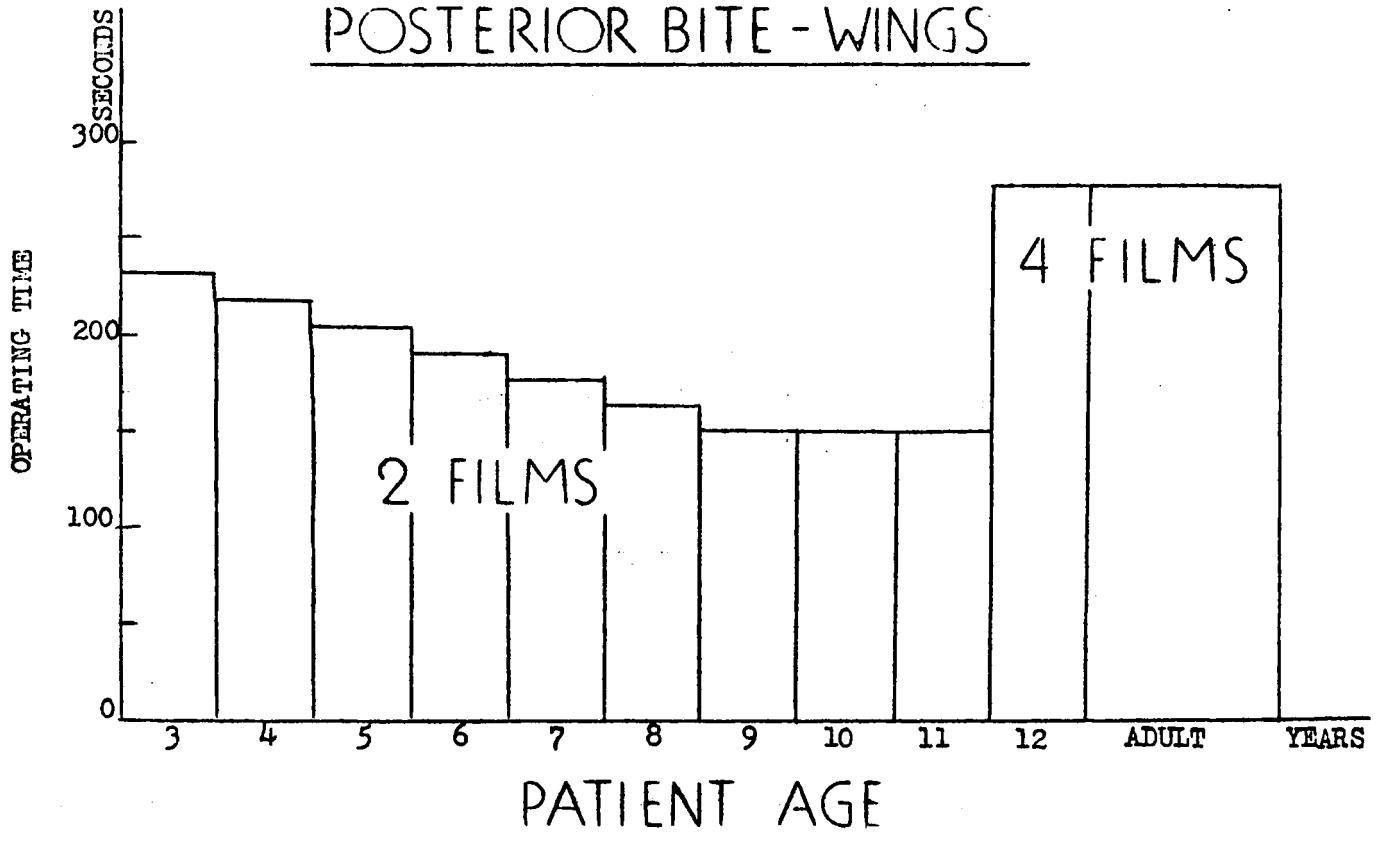

FIGURE 2

To produce satisfactory extra-oral lateral jaw radiographs of three and four year old children, the "fake take"* technic is used. This additional procedure adds to the length of time necessary to expose the two 5"x7" films (Figure 3). Starting with the fifth year the fake take technic no longer is needed. No variation in operating time is noted after the fifth year. This lack of dependence upon age may possibly be explained by the older patient's greater ability to cooperate being equivalent to the younger patient's greater flexibility of head movement.

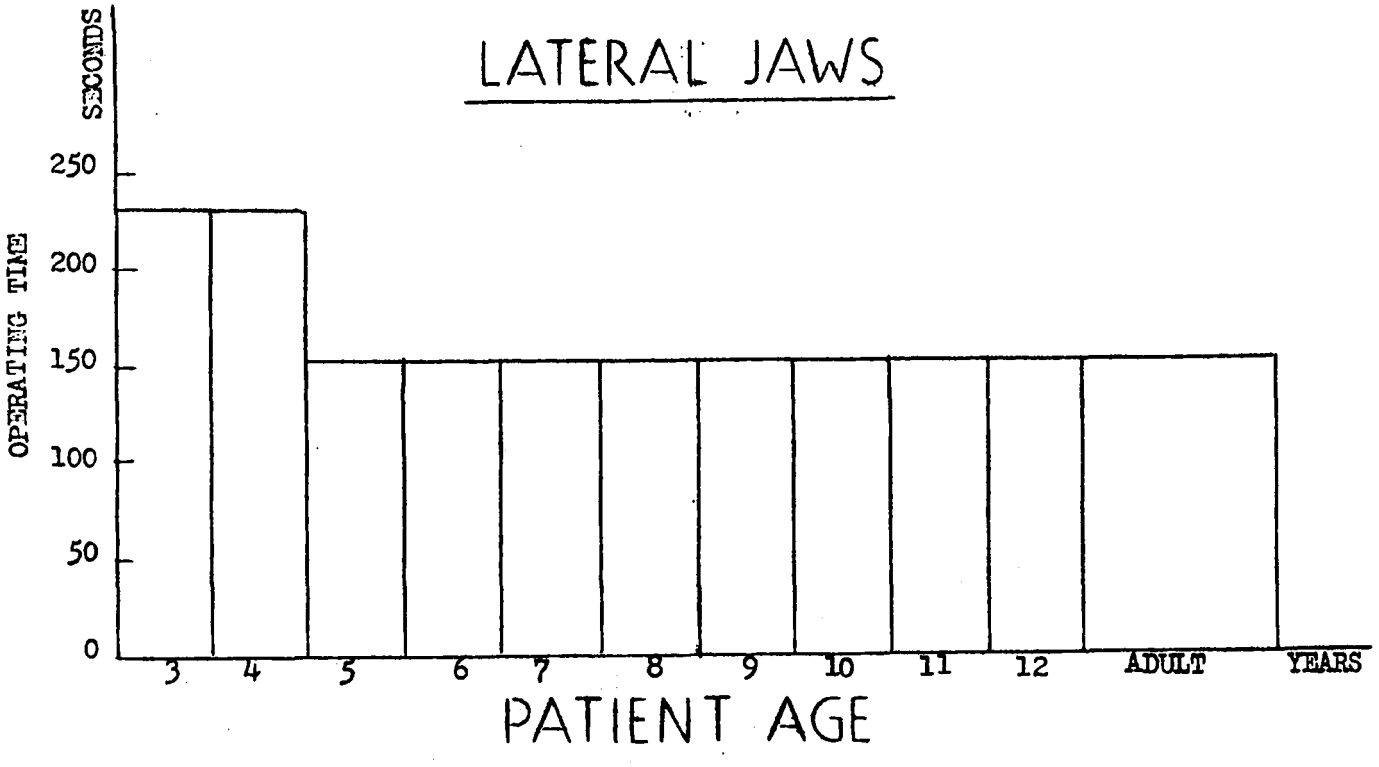

FIGURE 3

The elementary school technic consists of a series of the following eight radiographs; one radiograph of each the right carpal and elbow regions to determine the physiological age of the patient, left and right lateral jaw radiographs, left and right maxillary posterior occlusal radiographs, and maxillary and mandibular anterior occlusal radiographs.

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*The fake take technic is a practice procedure used with very young children. With this technic the x-ray machine is turned off while all of the various steps of the radiographic technic are approximated roughly.

A straight line relationship exists between operating time and age for three through eight years of age (Figure 4), followed by a constant operating time value for nine through twelve years of age. No explanation is given for the change in operating time that manifests itself in the ninth year.

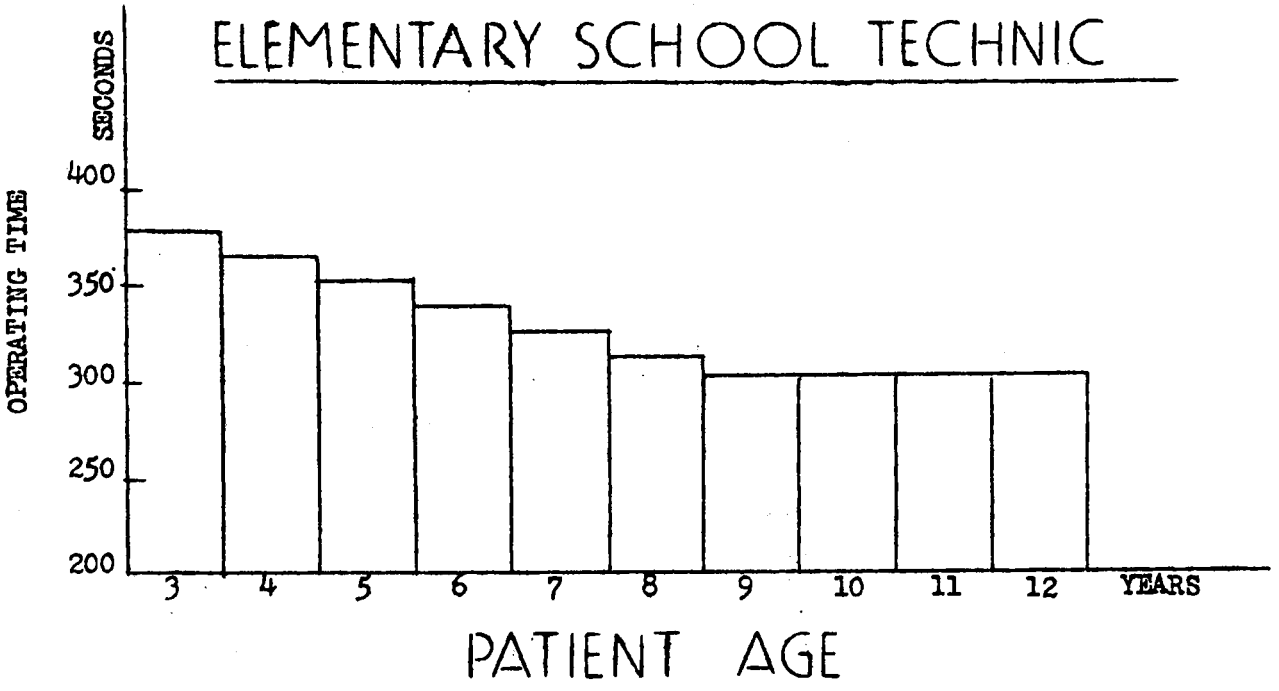

FIGURE 4

SUMMARY

A plan for a dental radiography room is discussed which is designed for efficiency of operation and safety from radiation hazards. Time study data are presented relating to various radiographic technics.