The Reliability of Lateral Cephalometric Projections in Evaluation of the Mandibular Edentulous Ridge Height

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Abstract

The aim of this study was to investigate the efficiency of the lateral cephalometric technique in evaluation of the vertical high of the residual alveolar ridge on each side of the mandible. **Material and Methods:** 5 edentulous dry human mandibles were used. The crest of the alveolar ridge of the left side of each mandible was reduced using a hand file to simulate crestal alveolar bone loss while the alveolar ridge of the right side of the mandibles was left unaltered then the mandibles were sectioned at the symphysis and lateral cephalometric projections were made of both sides then for the right side only then for the left side only. The radiographic height of the mandible was measured making use of specific reference points and lines. **Results:** t-test indicated that the mean dimension obtained from both the radiograph of both sides and that of the right side differed significantly ($P<0.01$) from that of the left side while there was no significant difference between the mean dimension of both sides and that of the right side. **Conclusion:** The results of this work indicated that the height of the residual ridge shown in the lateral cephalogram usually represented the side of the jaw that possessed the higher level of the residual alveolar ridge. The side that possessed the lower level was not represented. In this way it is very difficult to evaluate each side of the jaw alone using this technique.

Introduction:

Though several methods were used to measure the resorption of the residual alveolar ridge (1-3), yet the radiographic evaluation is the most commonly used method (4-6). Many conventional radiographic techniques are recommended to evaluate patients desiring dental implants to measure the

residual alveolar ridge resorption such as panoramic, intraoral, cephalometric radiographs, or a combination of these methods (7-9).

Lateral cephalometric radiography is a widely used technique (4). It gives an image of known magnification (usually ranging from 7% to 12%) and it can be easily reproduced. The soft tissue profile of the face is apparent on this film and can be used to evaluate profile alterations after prosthodontic rehabilitation. It has been mentioned that this technique has its own shortcomings of superimposition of both sides of the mandible as well as the geometric errors encountered (10,11). The present investigation was conducted to investigate the efficiency of the lateral cephalometric technique in evaluation of the vertical high of the residual alveolar ridge on each side of the mandible.

Material and Methods:

Sample Selection:

The samples consisted of five completely edentulous dry human mandibles that were free of any bony pathology.

Preparation of the Samples:

The alveolar ridge of the left side of each dry mandible was shaped starting from the midline backwards to form a curved alveolar ridge concave downwards just anterior to the external oblique ridge using a hand file to simulate crestal alveolar bone loss. The alveolar ridge of the right side of the mandibles was left unaltered (fig. 1).

Fig. (1): The prepared mandible.

The mandibles were sectioned at the symphysis for ease of mounting and assembling. Both halves of each sample were partially embedded in a large platform base of acrylic resin.

In the platform base, the mandibles were placed in the standard horizontal plane as indicated by Friedman (12) so that contact was achieved between the splenium and the horizontal plane at three points. (Fig. 2).

Fig. (2): The mandible positioned in the platform base.

Radiographic Technique:

Positioning the Mandible:

A horizontally positioned plastic plate supported on a vertical stand was used to support the plateform in which the mandible was set. The ear rods of the cephalostat were positioned touching the most posterior and superior points on the mandibular condyles in a standard position.

The mid sagittal plane was set parallel to the plane of the film cassette. The x-ray beam was directed perpendicular to both of them in order to ensure an identical positioning to that of a patient.

Radiographic Projections:

The lateral cephalometric projections were made in three conditions as follows:

a. for the left side only in position while the right side removed. (Fig. 3).

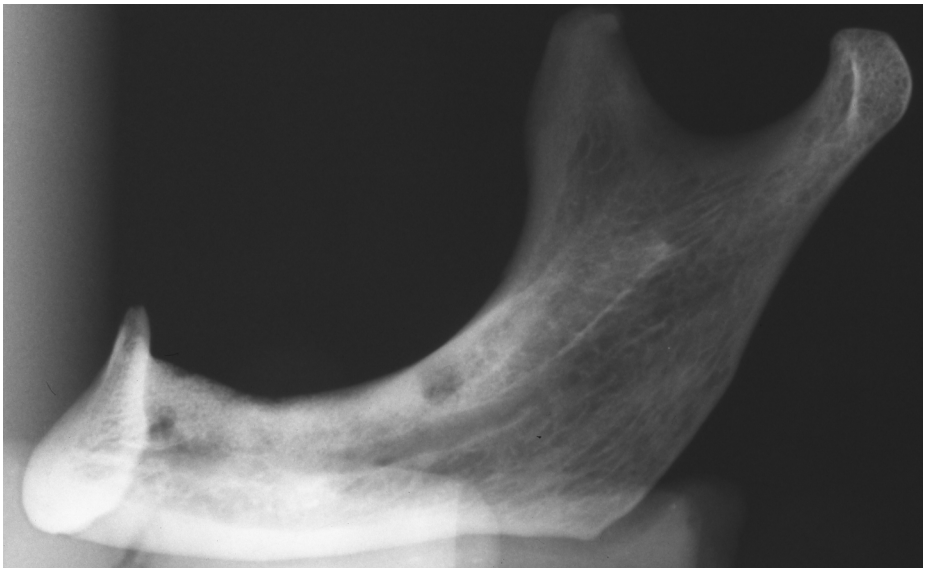


Fig. (3): Lateral cephalogram for the left side.

b. For the right side only in position while the left side removed. (Fig. 4).

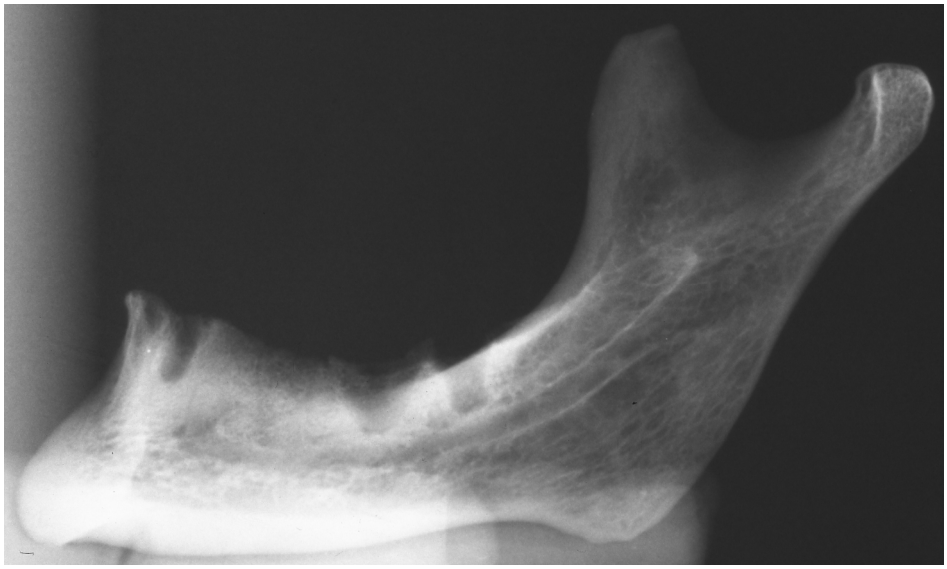


Fig. (4): Lateral cephalogram for the right side.

b. For both sides of the mandible in position. (Fig. 5).

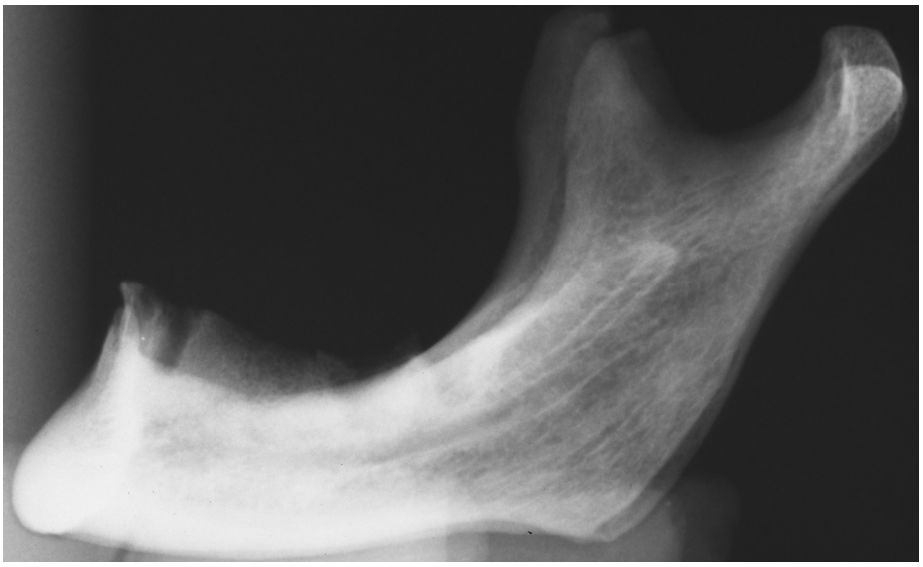


Fig. (5): Lateral cephalogram for both sides of the mandible in position.

Technical Data:

The Planmeca PM 2002 CC Proline (Planmeca, Helsinki, Finland) cephalometric x-ray unit was used and a Kodak Lanex regular 8 x 10" screens and T-Mat G films (Eastman Kodak Co, Rochester, NY) were utilized. The machine was adjusted with a tube voltage of 60 kilovolts peak (kVp) and a tube current of ٤ mA. The exposure time was 0.2 seconds with a fixed focus to film distance of 5 ft (152.4cm).

Processing Conditions:

The three films taken for each sample were processed together – in the same tanks- using a fixed time and temperature technique to ensure standardized processing conditions.

Determination of the Vertical Height of the Mandible:

The three cephalograms for each mandible were traced on calc papers. Magnifying glass and a tracing box with variable diaphragm and light intensity were used to facilitate identification of the landmarks. The height of the mandible was evaluated making use of the points and lines shown in Fig. 6 and Table 1.

Table (1): The points and lines used for determination of the vertical height of the mandible

Point Or Line	Significance
Go	Gonion
M	Menton
ML	Mandibular plane (line)
MLP	Mandibular line perpendicular starting from the gonion upwards
A1, A2, A3	Are points on the splenium at the lower ends of the lines A1 B1, A2 B2, A3 B3, A4 B4, A5 B5, and A6 B6.
B1, B2, B3,	are points on the alveolar ridge at the upper ends of the lines A1B1, A2B2, A3 B3, A4 B4, A5 B5 and A6 B6.
A1B1	A line parallel to MLP and 2 cm anterior to it.
A2B2	A line parallel to A1B1 and 1 cm anterior to it.
A3B3 to A6B6	Are lines parallel and anterior to A2 B2 and at 1 cm distance from each other.

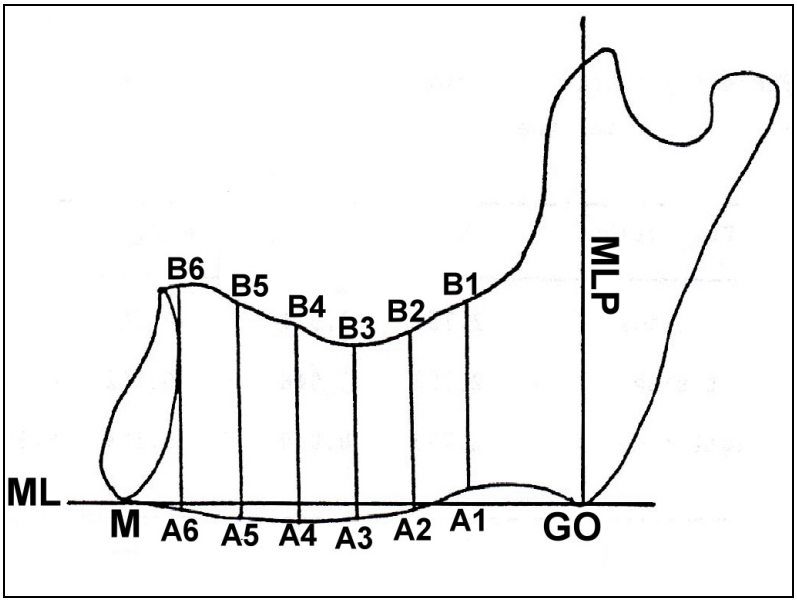


Fig. (6): Tracing of a cephalogram showing the points and lines used for determination of the vertical height of the mandible.

The dimensions A1 B1, A2 B2, A3 B3, A4 B4, A5, B5, and A6 B6 were measured on the three cephalograms of each mandible. Each measurement was recorded 5 times up to 0.01 mm using a dial caliper and a mean value was obtained. The mean value of the four dimensions was then obtained. All the radiographic measurements were done by one examiner. The intra-observer reliability of the measurements was done before proceeding with the study sample measurements. The measurements were done twice in two weeks interval to make sure that the examiner was consistent in his measurements. Pearson correlation coefficient was +0.9 indicating good intra-observer reliability.

Results

Table (2): Mean dimension values and their variability in the three projections.

Projection	Mean	S.E.	S.D.	C.V.%
Both sides	2.762	0.074	0.166	6.001
Left side	2.352	0.046	0.102	4.329
Right side	2.758	0.069	0.154	5.567

Table (3): Student- t test between the mean values of the three projections

Projection	Mean dif. +	Common S.E. ++	t test
Both – left	0.410	0.087	4.713**
Both – right	0.004	0.101	0.040
Left – right	-0.406	0.082	-4.928**

\+ mean difference.

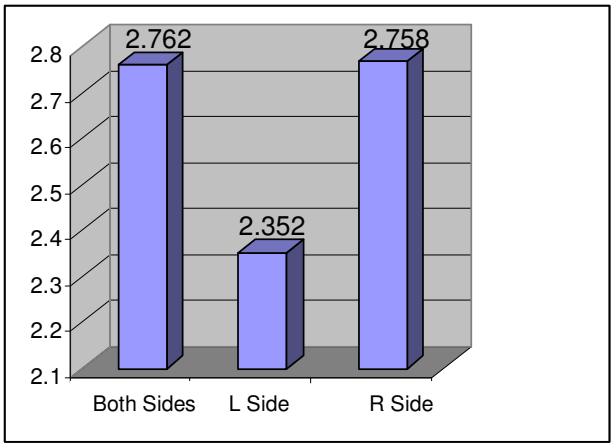
++ Common standard error.

** Significant at P 0.01

\- The second mean is higher than the first one.

The results of this book were presented in tables 2 and 3 and in graph 1. The t - test indicated that the mean dimension obtained from both the radiograph of both sides and that of the right side differed significantly (P<0.01) from that of the left side while there was no significant difference between the mean dimension of

both sides and that of the right side.



Graph. (1): The mean dimension values in the three projections

Discussion

Contrary to the popular and frequently expressed opinion that the lateral cephalometric projection is a reliable (13) and widely used radiographic techniques for evaluating the residual alveolar ridge resorption (4), the results of this study indicated that this technique has many disadvantages. First, the super-imposition of the right and left sides with the resultant difficulty in registration of either side of the jaw alone renders this technique suitable only for studies of the residual ridge in the median plane.

Second, the varying degrees of distortion and magnification encountered in this technique (10). It has been estimated that the magnification percentage 7% to 12% depending on the focus to film distance (11,14). The side away from the film will be more magnified than the side toward the film (in most cephalometric x ray units the patient is positioned with the left side toward the film and the right side toward the x ray source).

The results of this work indicated that the height of the residual ridge shown in the lateral cephalogram usually represented the side of the jaw that possessed the higher level of the residual alveolar ridge. The side that possessed the lower level was not represented. In this way it is very difficult to evaluate each side of the jaw alone using this technique, as it is known that the

amount of resorption on both sides of the residual alveolar ridge is not always the same. Moreover, in a given follow-up, the rate of residual alveolar ridge resorption is not necessarily equal on both sides as this rate of resorption could be influenced by many factors as the duration of teeth extraction on each side and the presence of opposing natural teeth on one side (15, 16). This view is in contrast with that presented by Tyndall at al and Harris et al (7, 8) who recommended the use lateral ceplometiric radiographs for the evaluation of the dimensions of the residual alveolar ridge.

It could be concluded that although lateral cephalometric projection may provide a cross sectional evaluation of the ridges, this dimension is seen only at the midline. The images of structures not in the midline are superimposed on the contralateral side, complicating the evaluation of the other implant sites. Occasionally lateral-oblique cephalometric radiography is used with one side of the body of the mandible positioned parallel to the film cassette (17, 18). Image magnification on these views is not predictable, because the body of the mandible is not at the same distance from the cassette as is the rotation center of the cephalostat. Thus measurements made from cephalometric radiographs are not reliable and in general, they are of limited use in the selection and evaluation of implant sites.

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