A quick and simple method to obtain a radiographic evaluation of remaining alveolar bone height before implant placement

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Abstract
This article describes a method for making a diagnostic radiographic evaluation of remaining alveolar bone height in the bounded-saddle patient without the previous fabrication of a study model and radiographic ball-bearing template. The method presented is simple, enabling the busy practitioner to perform immediate radiographic diagnosis and inform the patient at the first visit about the available alveolar bone height at the site of planned implant insertion. This method is therefore time saving for both the dentist and the patient.

Key words: Diagnostic, radiograph, metal ball, alveolar bone height.

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INTRODUCTION
Over the past two decades many articles have evaluated the success rates of fixed prostheses supported by osseointegrated implants, with the work of Makkonen et al.,1 Arvidson et al.,2 and Lekholm et al.3 indicating high rates of success for prostheses five to 10 years in function.

Taking radiographs to help with the evaluation of the remaining bone height available for implant insertion is a generally recognized procedure.

A diagnostic radiograph of the posterior regions of the jaws is mandatory if implant placement is considered at these sites in order to avoid possible damage to the inferior alveolar nerve or antral penetration.

Taking panoramic radiographs such as an orthopantomogram (OPG) is common practice nowadays because of the adequate information it conveys, and its relatively low radiation exposure and cost. However, in those cases where an OPG machine is not readily available, periapical radiographs can also be used for assessing the vertical bone height. The familiar procedure of having metal ball(s) (measuring balls) of known diameter incorporated into an acrylic template4 necessitates the previous making of a study model of the patient (Fig 1). In addition to the relatively tedious procedure and expenditure (impression, making of study model and metal ball-bearing acrylic template) a further disadvantage for the patient is that a diagnostic radiograph can only be taken at the next appointment.

This paper describes a procedure that enables the immediate taking of a diagnostic radiograph as a result of a controlled, secured and thereafter easily removed intra-oral fixation of a metal ball of known diameter.

MATERIALS AND METHOD
A thixotropic material which is slightly radiopaque and has a high dimensional stability and sufficient working time is required. This requirement is fulfilled by PRESIDENT JET Bite® (Coltène/Whaledent Inc, New York, USA) which is a yellow addition-cured silicon bite registration material that has a high final hardness. For every planned site of implant placement one metal ball of known diameter is required (Friadent AG, Mannheim, Germany). A metal ball of 5mm diameter is easy to handle and gives reliable measuring results.

After the patient is appropriately positioned the mucosa and teeth in the saddle area of interest (Fig 2) are dried and the material is directly applied with the help of the dispenser and mixing cartridge to the area of planned implant insertion. It is important that the material completely fills the space of the bounded saddle and is in contact with the neighbour teeth. While the material is still soft (working time is approximately 50
seconds) the patient bites together in order to prevent occlusal disturbances. After the silicon has set (setting time is approximately 2 minutes and 30 seconds) the measuring block is secured in position by the undercuts of the neighbouring teeth and dislodgement of it is thus prevented (Fig 4). The hardness of the material and its correct positioning should be confirmed by clinical checking.

In order to make further measuring blocks at other sites in the oral cavity it is possible to remove the already set measuring block which can be re-inserted later. While the radiograph is taken the patient does not experience any foreign body sensations relating to the measuring block in the mouth. The technique of panoramic radiography is unaffected by the presence of the measuring block. If periapical radiography is used, distortion is minimized by using the long cone paralleling technique, as magnification decreases with increasing focal spot-to-film distance. This technique also increases image clarity (sharpness).

After radiographic exposure it is easy to remove the measuring block from the mouth because of its elasticity. Owing to the minor radiopacity of the silicone material, the contrast of the metal ball is clearly visible on the radiograph (Fig 5).

From the radiograph taken (OPG or periapical) measurement is performed with a ruler from the crest of the alveolar ridge to the opposing landmark, such as the planned apical position for implant placement (the superior cortex of the mandibular canal or inferior border of the maxillary sinus in the posterior regions). The evaluation of the height of alveolar bone available for implantation can then be determined by the application of the following mathematical formula:

\[ \frac{\text{ADB} \times \text{RBH}}{\text{RDB}} = \text{ABH} \]

whereby ADB=Actual diameter of metal ball (which is known to be 5mm). RDB=Diameter of metal ball on radiograph (OPG or periapical). ABH=Actual bone height available for implantation (vertical distance between alveolar crest and opposing landmark). RBH=Bone height available for implantation as measured from the radiograph.

Thus:

\[ \frac{\text{ADB} \times \text{RBH}}{\text{RDB}} = \text{ABH} \]

**DISCUSSION**

The quality of the radiograph of the evaluated alveolar bone height by employing the familiar method

![Fig 1. Metal ball-bearing acrylic template with study cast.](image1)

![Fig 2. Lateral view of bounded saddle.](image2)

![Fig 3. Fully inserted metal ball in thixotropic PRESIDENT JET Bite® material.](image3)

![Fig 4. The patient bites together in order to prevent occlusal disturbances and dislodgement of the measuring block.](image4)
of taking radiographs using a radiographic ball-bearing template and that of the intra-oral technique described here is the same. The described method is applicable in the case of bounded saddles. The thixotropic property of the material prevents it from flowing away from the proposed site of implant placement, and furthermore, additional retention may also be obtained by undercuts, if present, of the teeth bordering the saddle on either side. For the dentist, it is of great advantage that a diagnostic measuring radiograph can be taken without any delay. The metal ball also provides information on radiographic distortion (as the diameter of the ball is known to be 5mm). Any distortion can be calculated by measuring the diameter of the ball on the radiograph and dividing it by the true diameter. Only in this way can an accurate measure of bone height be determined from the conventional OPG or periapical radiograph.

The implant consultation can be satisfactorily performed at the very first visit so that the patient can leave the surgery being well informed. The consultation cost can be reduced because of the absence of any laboratory stages. This may also make it easier for the patient to attend for a consultation visit.

**CONCLUSION**

A simple method of obtaining quick and accurate measurements of bone height is presented. By using these means the real bone height can be arithmetically evaluated. This method should be considered as an aid in treatment planning for implant restorations in bounded saddle areas and should be associated with all other factors of the decision-making process.

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**REFERENCES**


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