

# BARIUM SULFATE STENT FOR PREOPERATIVE ASSESSMENT FOR PLANNING OF OPTIMAL CLINICAL OUTCOME.

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## ABSTRACT:

Implant restorations need detailed presurgical planning before implant placement for successful clinical outcome. Now a day CBCT are used extensively in clinical practice to evaluate the underlying bone substrate.

Radiopaque markers are used to identify specific areas. Radiopaque template allow imaging of the restoration contour in related to bone substrate. In this article we added barium sulfate in acrylic resin to make diagnostic template.

## INTRODUCTION:

On the examination of the reconstructed cross section images of cbct, the radiographic markers can be identified in the specific areas for preoperative assessment purpose before implant placement. In this way using radiographic template the desired implant axis can be correlated to the existing bone substrate and the contour of the planned restoration that may contribute significantly to the treatment planning and provide the clinician with valuable information.

Implant restorations need detailed presurgical planning before implant placement for successful clinical outcome. CT-Dental scan and Cone Beam Computer Tomography (CBCT) are used extensively nowadays in the clinical practice, in order to investigate the bone substrate, bone anatomy before implant surgery.

The most common types of diagnostic templates are constructed from autopolymerizing resin with radio-opaque materials used as markers to

determine specific anatomical areas. As radio-opaque markers various materials have been used, including **metal rods, titanium rods, guttapercha, barium sulfate etc.** <sup>(1)</sup>

## Need for presurgical implant planning:

Computer-Aided Examinations (CBCT or CT Dental Scan) offer great help in presurgical planning for successfully implant treatment. Detailed imaging is necessary in order to determine the desired implant axis related to the bone substrate.

The representation of the restoration contour offers also valuable information as the implant axis can be determined (or modified) according to the contour of the planned restorations. The insertion of implants in prosthetically favorable position may prevent later problems and complications during the clinical function of the implants. <sup>(1)</sup>

## Various material used as radiopaque markers:

Various materials have been proposed as radiopaque markers in the drill holes as guttapercha, titanium rods and silicone. Other materials have also been used as radiopaque coverage for the outer surface of the template as zinc foil or guttapercha diluted in chloroform. <sup>(2-4)</sup> Barium sulfate has also been proposed as radiopaque material added in the mass of acrylic resin. Amalgam powder is also used for sharpening the CT-Scan image. <sup>(5,6)</sup>

## Advantages of radiopaque template

-The presented technique is simple, cost- and time effective and requires no additional equipment.

-It is dimensionally stable and rigid. <sup>(7)</sup>

-Barium sulfate is nontoxic, tasteless, white in color and odourless material. <sup>(7)</sup>

## Case report

### Screening of the patient:

**Clinical examination:** A 18 year old male with a chief complaint of partial edentulism in the upper region. On clinical examination hypodontia with two rudimentary teeth was noticed in the maxillary region. Mandibular region had full complement of teeth. Patient medical history did not reveal any syndromes neither was it suggestive of any family inheritance.

On **radiographic examination** impacted teeth were evidenced with poor radiographic densities. The bone height and bone width were compromised. Before planning the treatment modality, a comprehensive outlook of the architecture of the bone is imperative.

A tentative maxillomandibular relationship was recorded. Trial was done with the existing dentition. A single maxillary tooth supported overdenture was fabricated. This denture was then duplicated for a radiographic stent which was planned in order to demarcate the precise locations of Implant placements.

### Methodology:

Barium sulfate was incorporated in different proportions in the denture base and acrylic teeth for easy differentiation of densities during pre-surgical implant planning. A recommended mixing ratio of 22.5 gm polymer: 10 ml monomer for heat cure for conventional heat polymerization process. <sup>(8)</sup>

Barium sulfate is used to identify the teeth from the diagnostic wax-up in a 20% BaSO<sub>4</sub> solution. If a soft tissue (flapless surgery) template is to be made, teeth are ideally identified with a 20% BaSO<sub>4</sub> solution, and the base (soft tissue) uses a 10% mix. This allows for differentiation of the teeth from the soft tissue. Poor mixing will result in a nonhomogeneous mixture that exhibits areas of high radiolucency. <sup>(9)</sup>

A choice was made for the use liquid barium sulphate.

Proportion for acrylic teeth- 2ml of Barium sulfate, 22.5 gm of powder and 8ml of monomer  
Proportion for denture base-1ml of barium sulfate, 22.5 gm of powder and 9 ml of monomer.

### Discussion:

In this case, Radiographic stent made with liquid barium sulfate so that it should mix easily without any clumps of powder left in mixture otherwise it results into nonhomogeneous mixture that exhibits areas of high radiolucency.

After curing and processing, in the radiopaque stent minimal distortion was seen. It fits in patient mouth with minimal occlusal adjustment.

Retention was good with the template. Patient was comfortable.

But color stability was compromised because barium sulfate was little pinkish whitish in color, after incorporating it in acrylic powder, its color got changed, looks like a porous denture but its texture was smooth.

Proportion of barium sulfate added in acrylic resin powder is different for different authors. According to Fondriest JF et al The Ratio for acrylic teeth is 1 part of Barium sulfate and 10 parts of acrylic resin powder. <sup>(10)</sup> But according to Basten CH et al 1 part of barium sulfate and 2 parts of acrylic resin

Barium sulfate is used in medical field specially in radiology as contrasting medium in fluoroscopic examinations of the gastrointestinal tract and intestinal radiology

It is biocompatible, non toxic and tasteless material. If it incorporated in acrylic resin powder in proper proportion it will give us excellent detailing of tooth contour, underlying mucosa and bone substitute. It can be used as a blueprint of planned restoration. The full-contour radiopaque template enables the clinician to visualize the outline of the planned restoration in relation to the bone structures.

So this method can be used for regular radiographic presurgical assessment purpose in full mouth implant rehabilitation cases.

### CONCLUSION:

The digital technology has made tremendous progress allowing not only a precise pre-surgical evaluation of the bone substrate but also offering the possibility of a completely digital planning and guided surgery. On the other side it is not

always affordable for the patient to undertake the cost of guided implant placement and an accurate presurgical examination using CBCT with a radiographic template may offer valuable information for the further treatment.<sup>(1)</sup>

Using Full contour radiopaque template to relate the planned implant position to the bone substrate of the patient and also it enables the clinician to visualize the outline of the planned restoration in relation to the bone structures to minimize the complication during implant placement.

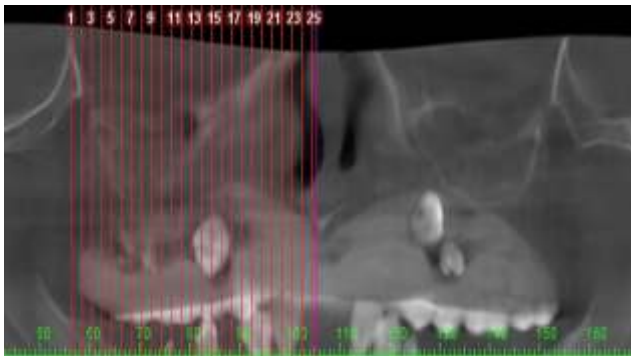


Fig1 : Panoramic view- Radiopaque template made of barium sulfate

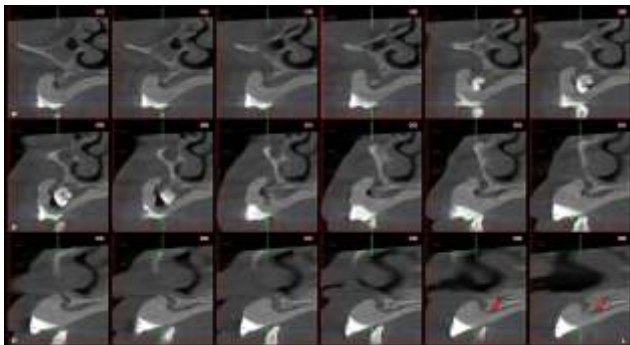


Fig 2: Cross section images of patient's 1<sup>st</sup> quadrant using Radiopaque template

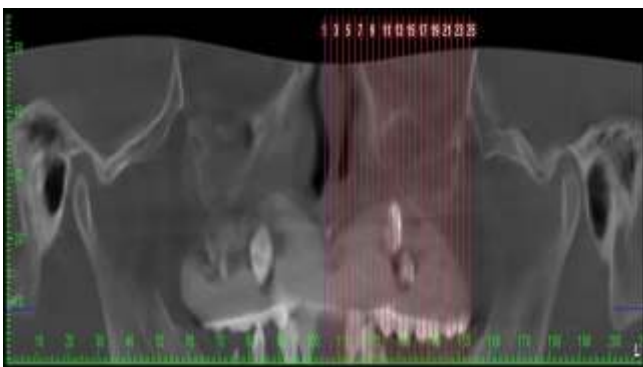


Fig 3: Panoramic view of patient wearing barium sulfate stent.

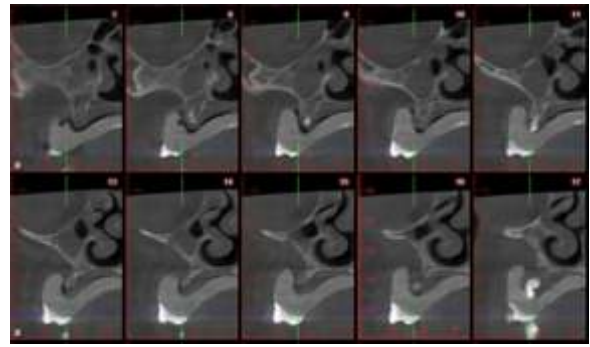


Fig 4 : In these cross section images ,We can appreciate teeth contours, denture base, underlying mucosa and bone substitute and anatomical landmark

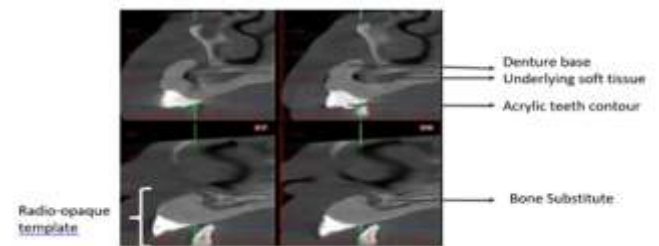


Fig 5: Cross section view, where we can appreciate all specific areas before implant placement

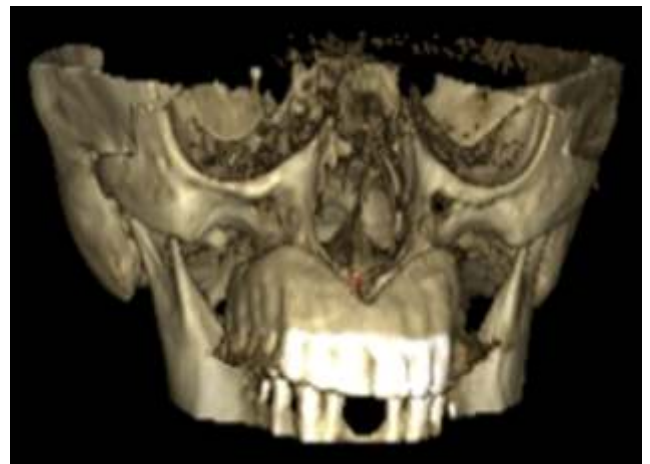


Fig 6 & 7 : 3-D views of patient wearing Radiopaque template





Photographs of Radiopaque template made of acrylic resin in which barium sulfate was added in proper ratio

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