

**Cephalometry: Rationale for Management of Recurrent Fracture of Maxillary Prosthesis**

Dr. Ritu Saneja, Junior Resident, Department of Prosthodontics, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi

Dr. Rajesh Seturaman, Professor and head, Department of Prosthodontics, K.M SHAH Dental College, Sumandeep University, Vadodara, Gujrat

Dr Pavan Dubey, Assistant Professor, Department of Prosthodontics, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi

**Corresponding Author:** Dr Pavan Dubey, Assistant Professor, Department of Prosthodontics, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India-221005

**Type of Publication:** Case Report

**Conflicts of Interest:** Nil

**Abstract**

A 65-year-old male patient reported to the Department of Prosthodontics with the chief complaint of broken maxillary complete denture and wanted a new set of dentures for the same. On clinical examination, the maxillary arch was completely edentulous while the mandibular arch was partially edentulous with few teeth remaining in the posterior region. The patient had a history of prosthetic rehabilitation with complete denture and removable partial denture in both maxillary and mandibular arches respectively. The patient also reported that the maxillary dentures fractured very frequently since the inception of rehabilitation. However, the surfaces and contours of the dentures appeared quite satisfactory in compliance with the intraoral examination. The high magnitude of masticatory forces may be held responsible for frequent fracture of the maxillary denture in such cases. To check the patient's biting force, lateral cephalogram was used as a diagnostics aid. This hypothesis is based on the literature where Frankfurt mandibular plane angle (FMA) has been described as a major determinant of variation in musculature and

masticatory forces associated with muscles and occlusion. The FMA may be either high or low which clinically manifests in the patient in terms of a high angle or low angle patients where the optimum value is considered to be somewhere around 25 degrees. Frankfurt mandibular plane angle was determined after tracing the lateral cephalogram. The lateral cephalogram was further correlated with the clinical condition of the patient and it was found that FMA in the present case was less than 20 degree which implies that the FMA was on the lower side and therefore the magnitude of biting force in this patient was very high. It was therefore decided to make a prosthesis which may encounter these forces. To remedy the situation it was decided to reinforce maxillary denture base with metal in the maxillary complete denture.

**Keywords:** Mid-palatal denture fracture , FMA , metal occlusals

**Introduction**

The significance of cephalometry is very well understood as a diagnostic aid in dentistry. In complete denture Prosthodontics, cephalometric radiographs help to assess the underlying structure as they are oriented planar

radiographs of the skull.[1] The lateral cephalogram plays a very important role because it demonstrates the geometry of the alveolus in the anterior region and the relationship of the lingual plate to the patient's skeletal anatomy. Additionally, the lateral cephalometric view can help us to evaluate the loss of vertical dimension, skeletal arch inter-relationship, anterior tooth position in the prosthesis and resultant moment of forces.[2] The type of occlusion can also be possibly determined by means of cephalometry which helps in knowing the pattern of occlusion in cases requiring full mouth rehabilitation. Cephalometry has been a very reliable tool in the prediction of the growth in children but has not received the attention as it deserves as an aid in treatment planning for adult occlusal problems.

This case judiciously demonstrates the high diagnostic value of cephalometry in the treatment planning, prosthesis designing, and rehabilitation of completely edentulous arch. Hence, determining the probability of high masticatory force at the time of diagnosis might help the dentists to eliminate further complication such as mid-palatal fractures of the maxillary prosthesis.

### Case Presentation

A male patient aged 65 years reported to the postgraduate section of Department of Prosthodontics at dental faculty of the Banaras Hindu University with the chief complaint of repeated fracture of maxillary complete denture. On clinical examination, the maxillary arch was completely edentulous while the mandibular arch was partially edentulous with missing 31, 32, 33, 41, 42, 43, 47. teeth

### Investigations

As the patient was referred from another institute, the patient had already his orthopantomogram. Interpretation of orthopantomogram (OPG) was done to evaluate the general picture of bone and rule out any underlying pathology relevant to the area of interest. Subsequently

lateral cephalogram [figure 1] was also analyzed to evaluate the maxillomandibular relationship and the cephalogram was subjected to tracing, it was found that the FMA formed was less than 20 degrees designating the subject under low angle category, therefore the outcome of anticipated magnitude of biting force was high.

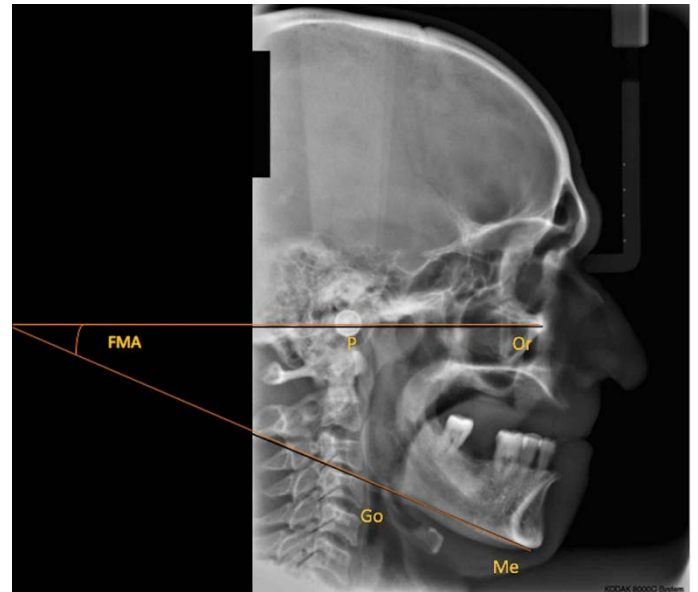


Figure 1: Frankfort Mandibular Plane Angle tracing formed by Frankfort plane and mandibular plane by locating anatomical landmark gonion and menton on lateral cephalogram- 16degree which implies low FMA angle, therefore high biting force

### Diagnosis

As there were no teeth in maxillary arch patient had completely edentulous maxillary arch and Kennedy's Class III Modification 1 edentulous space in mandibular arch and is low angle patient with FMA angle of 16 degrees correlating with clinical condition as having close bite skeletal pattern and hence high bite force

### Materials And Method

After discussion, the treatment plan was made to rehabilitate the maxillary arch with metal denture bases which may tolerate the masticatory forces and eventual mid-palatal fracture may be avoided. The intent to modify the occlusal surfaces of acrylic posterior teeth was the

presence of natural antagonist teeth which may abrade and wear the acrylic teeth of maxillary denture at a faster rate. To overcome this limitation of acrylic teeth incorporation of metal castings (metal occlusals) were cast and embedded after the try-in.

#### **Fabrication of metal denture base**

Master casts were made, blocked out, duplicated and the refractory cast was made. Wax pattern was made for the casting of metal denture base,[figure2] investment was done and casting was done. [figure3] Metal denture base was incorporated into heat cured acrylic denture base. Maxillo-mandibular relation was made, teeth arrangement was done and try-in was performed.[Figure3]



Figure 2: refractory cast with wax pattern for metal base



Figure 3: Trial of metal denture base

#### **Fabrication of metal occlusal teeth**

Putty index of posterior teeth of the previous denture was made, Wax pattern was made up to the occlusal third portion of the putty index, loops were added to gain retention in acrylic resin. Wax pattern was invested, the casting was done, finishing and polishing were done of the metal occlusals. The proportion of metal occlusal teeth were re-oriented on the putty index, remaining two-thirds of the index was filled up with wax and a pattern of the tooth with metal occlusal castings was made, this was flaked, dewaxed and packed using heat cure tooth-f

Metal occlusal teeth were replaced in the posterior teeth region in the trial dentures, [figure 4a]the trial was performed, Some lateral interferences were observed which were removed by trimming the metal. Flasking, dewaxing, and packing were done in a conventional manner and dentures were delivered.[Figure5b].



Figure 4a: Metal Occlusal teeth being flaked , Figure 4-b :Trial with Metal occlusal teeth intraoral view

#### **Outcome and follow up**

A follow-up visit was made at 24hours, 1 week, 3 months, 6-month time interval. At the recall visit after 6 months, there were no pathologic changes in the TMJ and associated structures were observed. There was no history of fracture of the maxillary denture base. [figure 5][figure5a]



Figure 5: intraoral view, Figure 5a : Extraoral picture of patient with prosthesis

### Discussion

A basic rule in treatment planning is to preserve what is right and change what is wrong without changing the present harmony. Cephalometric analysis is an aid in making the decision but it is never the sole determinant of treatment; rather it is one part of the diagnostic triad that includes;[3]

1. Clinical examination and evaluation
2. Mounted diagnostic casts
3. Cephalometric analysis

If all three parts of the analysis are in agreement the diagnosis can be made with assurance. Based on these observations the patients can be categorized into two types: [1]

- 1) High angle patients having the values more than  $30^\circ$  characterized by clinical open bite.
- 2) Low angle patients having values less than  $20^\circ$  characterized by Clinical closed bite

In Normal relations, Tweed found out that values for FMA lie within the range of  $16^\circ$ -  $35^\circ$ , the average being  $25^\circ$  however the general population has the deviation of 5degrees. The extensive research and literature confers that

Individuals with high FMA have a lower magnitude of biting force whereas individuals with low FMA have a higher magnitude of biting force. Low FMA individuals

are predisposed to have a deep bite,[4] as primarily elevators (masseter, temporalis, and internal pterygoid) are in a vertical chain, directly in line with the molars. On the account of the same, they also show hypertrophied muscles as well as more osseous mass to accommodate larger muscular patterns and broader facial patterns. The individuals having a High FMA are more prone to have an open bite. They have an arcuate pattern of muscle arrangement which makes them less powerful muscles. In the same context as the underlying bone has less osseous mass, underdeveloped mandible and small temporal fossae are quite evident.

### Removable Prosthodontics

In complete denture Prosthodontics, the condition of Low FMA patients is more crucial as stress is imposed on residual ridges with the forces of higher magnitude. Therefore the possibility of fracture of denture bases is higher. Hence Overdenture is the preferred modality of treatment, The clinical precision again becomes questionable as the determination of correct VD is critical.[5][7] However different treatment modalities can be considered at this stage for preventing any damage to the denture and also denture related psychological damage to the patient.

### Fixed Partial Dentures

From Prosthodontics perspective in natural dentition patients with low FMA have a predisposition to the decreased vertical dimension of occlusion due to smaller teeth size or also may be due to infra erupted or intruded teeth.[6] Therefore in cases of fixed partial dentures tendency to return to former occlusion is higher if VDO is raised during treatment. At the same time, patients with low FMA have a poor prognosis for a long span and cantilever bridges as the clinical crowns are shorter and hence may compromise with the mechanical form of tooth preparation. Furthermore, lack of occlusal-gingival space



causes difficulty in deciding the pontic form as well as solder rigidity which in turn causes increased abrasion of the prosthesis.

### **Learning Point**

1. Determination of biting force is not clinically possible therefore it becomes mandatory for a clinician to determine whether to which group the patients belong.
2. Low FMA should be always considered for high strength denture bases.
3. Cephalometry is, therefore, a very significant aid in determining the propensity of underlying pathology which can be met with more accuracy.

### **References**

1. Chaconas SJ, Gonidis D. A cephalometric technique for prosthodontic diagnosis and treatment planning. J Prosthet Dent. 1986 Nov;56(5):567-74.
2. Ricketts RM. Role of cephalometrics in prosthetic diagnosis. J Prosthet Dent 1956;6:488-503.
3. Dawson. PE.(1988) Evaluation, diagnosis and treatment of occlusal problems St.Louis, MO : Mosby.
4. DiPietro GJ, Moergeli JR. Significance of the Frankfort-mandibular plane angle to prosthodontics. J Prosthet Dent. 1976 Dec;36(6):624-35.
5. Monteith BD. Evaluation of a cephalometric method of occlusal plane orientation for complete dentures. J Prosthet Dent. 1986 Jan;55(1):64-9.
6. Tallgren A, Lang BR, Walker GF, Ash MM. Roentgen cephalometric analysis of ridge resorption and changes in jaw and occlusal relationships in immediate complete denture wearers. J Oral Rehabil. 1980 Jan;7(1):77-94.
7. DiPietro GJ, Moergeli JR. Significance of the Frankfort-mandibular plane angle to prosthodontics. J Prosthet Dent. 1976 Dec;36(6):624-35.