

Co-relation of condylar shapes and mandibular dimensions in partially edentulous condition- a retrospective case control cross sectional study

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Abstract

Loss of missing posterior teeth could disrupt the occlusal stability and increase the masticatory load affecting the function of TMJ leading to an imbalance in the distributary load and could be a risk factor in the development of TMDs. The objectives were to assess the condylar shape, morphology and mandibular dimensions in partially edentulous patients and to compare and correlate the variations of condylar shape, morphological changes and mandibular dimensions of partially edentulous to that of the dentulous patients. There was statistically significant difference in Condylar length, mandibular width, antegonial notch depth, anterior ramus notch depth, posterior ramus notch depth in partial edentulism. Angled shape was more common in partially edentulous state and round shape in dentulous state. It is, thus, necessary to maintain a balanced occlusal harmony to prevent the occurrence of temporomandibular joint disorders.

Keywords: Condylar shape, mandibular dimension, partially edentulous

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1. Introduction

Temporomandibular disorders (TMD) are a group of conditions characterized by pain or dysfunction in the temporomandibular joint. It is a complex illness with a number of etiological factors. Condyle is a component of the mandible that is considered as the integral part of the temporomandibular joint (TMJ). At some point in their lives, 65–85% of people suffer some temporomandibular joint dysfunction (TMD) symptoms, although only one in four people are aware of these symptoms and report them to a professional. In this situation, 57% of the general population needs treatment to lessen TMD symptoms [1,2]. Occlusal anomalies, orthodontic therapy, bruxism, orthopaedic instability, macro and micro trauma, joint laxity, and exogenous oestrogen are a few of the etiological causes. TMD may be triggered by psychological elements including stress, tension in the mind, worry, or sadness. Clinically, it presents with discomfort during opening and closing the mouth, may or may not be associated with clicking and pain [3,4]. According to some investigators, osteoarthritis was more prevalent and was more severe in people who were losing their molar support [5,6]. It is still debatable if tooth loss and temporomandibular disorders (TMD) are related. The loss of posterior teeth could cause occlusal instability and increase masticatory load, which would alter the temporomandibular joint's ability to function and result in an

imbalanced distribution of masticatory burden. This may increase the chance of developing TMDs [7,8]. Partial edentulism refers to the loss of one or more teeth but not all teeth. In India the prevalence of partial edentulism without rehabilitation is around 75%. Some authors have stated that losing molar support was associated with the presence and severity of osteoarthritis. Loss of teeth might result in the tilting of the adjacent teeth toward the edentulous area, resulting in premature contacts, finally giving rise to changes in the position of the condyle in the fossa eventually leading to TMJ disorders [9]. Yet, the association between dentition status and temporomandibular disorders (TMD) remains controversial. Literature review shows a paucity of research in the assessment of condylar shape in partially edentulous patients. In dentistry, panoramic radiographs have a variety of complementary clinical radiological applications. It is appropriate for detecting obvious bony changes in the condyle and has been suggested as a screening technique for patients with TMJ joint symptoms [10].

Hence, the study was undertaken to assess the correlation of condylar morphology, dentition status and condylar dimensions in partially edentulous patients using panoramic radiographs.

2. Materials and methods

Ethical Clearance was obtained from the Institutional Review Board (SRMU/M&HS/SRMDC/2021/PG/019). In this study, 200 orthopantomographs (100 partially edentulous and 100 control) were included which were taken using Acteon X Mind Trium Digital OPG Machine. The patient's clinical details and duration of edentulism were collected from the dental records. Two groups were present where Group 1 included Partially edentulous radiographs and Group 2 included completely dentate radiographs. We included patients in Group 1 with Kennedy's Class I and II, age 30-50 years, attrition status with a score of 0 and 1 with a duration of edentulism for more than 5 years. Group II had completely dentate radiographs and were age matched. Exclusion criteria comprised of radiographs that had evidence of orthodontic treatment, radiographical evidence of orthognathic surgery, radiographical evidence of facial trauma, completely edentulous patients, duration of edentulism less than 5 years, history of temporomandibular joint Disorders, impacted tooth, Cysts, tumours and attrition status beyond a score of 2 based on the criteria of Smith and Knight,.

All the OPG's taken were exported to Image J software where eleven linear measurements such as condyle length, coronoid length, ramus height, total ramus height, ramal width, mandibular body length, mandibular width, sigmoid notch depth, posterior ramus notch depth, anterior ramus notch depth, retromolar space measurement were evaluated for each OPG and the condylar outline were marked. (Figure 1) Radiographic morphological changes of the condyle were recorded based on definitions by Muir and Goss et al. by two observers. A normal condyle was given a score of 0. An abnormal condyle was given a score of 1 based on the following criteria:

- (1) Flattening: loss of an even convexity or concavity of the joint out lines,
- (2) Osteophyte: local outgrowth of bone arising from a mineralized joint surface,
- (3) Erosion: local area of rarefaction in the cortical plate of a joint surface,
- (4) Sclerosis: thickening of the cortical bone on a joint surface,
- (5) Ely's cyst (sub cortical cyst): Rounded radiolucent area that may be just below the cortical plate or deep in trabecular bone.

The condylar shapes were of four types such as round, pointed, flat and angled. (Figure 2)

For the assessment of the intraobserver and interobserver reliability 20 OPGs were randomly selected and re-examined after a duration of 2 weeks by the same observer.

Statistical analysis

Statistical analysis was done by using SPSS (IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp. Released 2019). Descriptive statistics was done to assess the mean and unpaired t test was done to assess the difference among the study variables. P-value <0.05 was considered to be statistically significant.

3. Results and Discussions

In the comparison of mean differences of the measurements, we found statistically significant differences in Condylar length, mandibular width, antegonial notch depth, anterior ramus notch depth, posterior ramus notch depth (Table 1). We found that majority of the partial edentulism of the unilateral site 38.8% was on the right side which had angled shape, 11.8% had flat shape, 22.4% had pointed shape and 27.1% had round shape. In the control group, maximum patients showed round shape with 81.2%, 7.1% had angled shape, 2.4% had flat and 9.4% showed pointed shape (Graph 1). About 11.07% had dissimilar shapes of right and left condyle in the same patient. 13.22% had abnormal condyle in partially edentulous group.

One of the major health problems associated with ageing is tooth loss. If edentulism is not appropriately addressed in terms of prosthetics, it may lead to the loss of the morphological and functional harmony of the stomatognathic system in addition to problems with phonation, cosmetics, and digestion. The patient's quality of life will likely be significantly impacted by this. In addition to poor dental hygiene, tooth loss can also be brought on by damaging addictions and systemic diseases. Long-term tooth loss may impair the tension between the muscles and nerves, the mandibular dynamic pattern, and the TMJ's ability to move in its normal alignment [11]. A retrospective study explores outcomes that are specified at the beginning of a study by looking backward at data obtained from previous patients. It is used to evaluate a hypothetical theory including purported risk factors and an outcome. Thus, the research was carried out using this retrospective study method [12]. One of the most often used imaging techniques for standard assessment in clinical practise is orthopantomography. It has a number of advantages, including panoramic radiography, is affordable, needs little technical know-how, is simple to conduct, and is educational. The technique's major benefit is that it may be used repeatedly to give a basic overview of the jaws and the structures that go with them. OPG was therefore employed in the investigation [10]. The study was carried out in patients with a duration of edentulism of more than 5 years. RGK Shet et al., showed significantly high prevalence of Temporomandibular joint dysfunction signs in subjects with edentulous span of more than 5 years [13].

Ikebe et al. found that bite force decreased with age and this decrease was more related to the deterioration of occlusal surface than to aging itself. Tooth loss produced an overload on the TMJs and favouring the development of alterations in joint structures, becoming more evident as age increases, mainly in patients with arthritis [14].

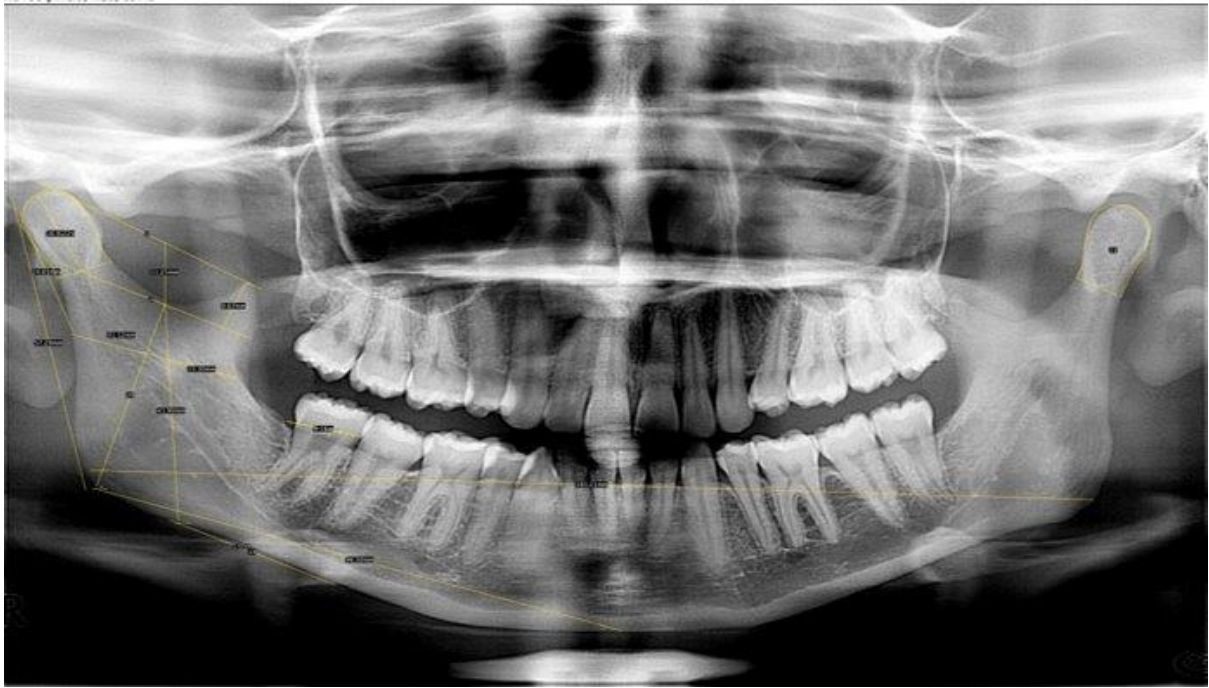


Figure 1. OPG in Image J software with measurement markings

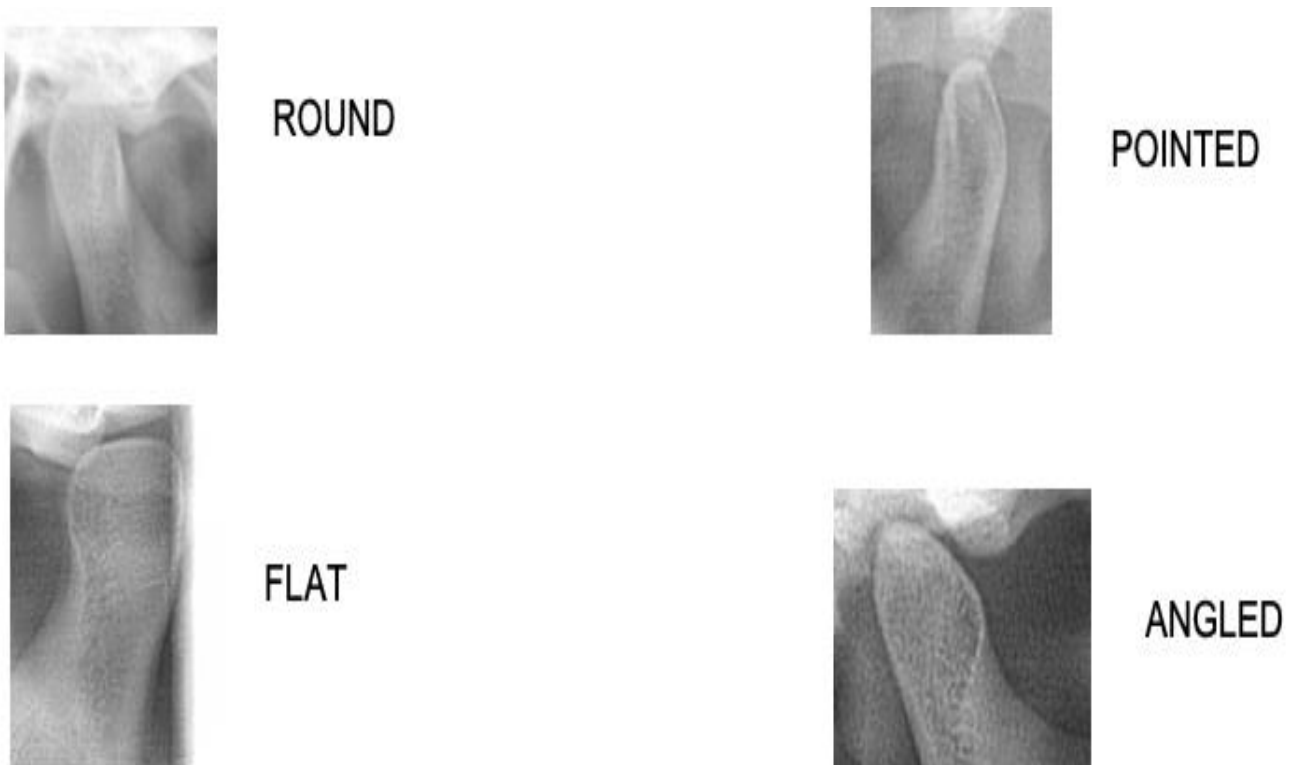
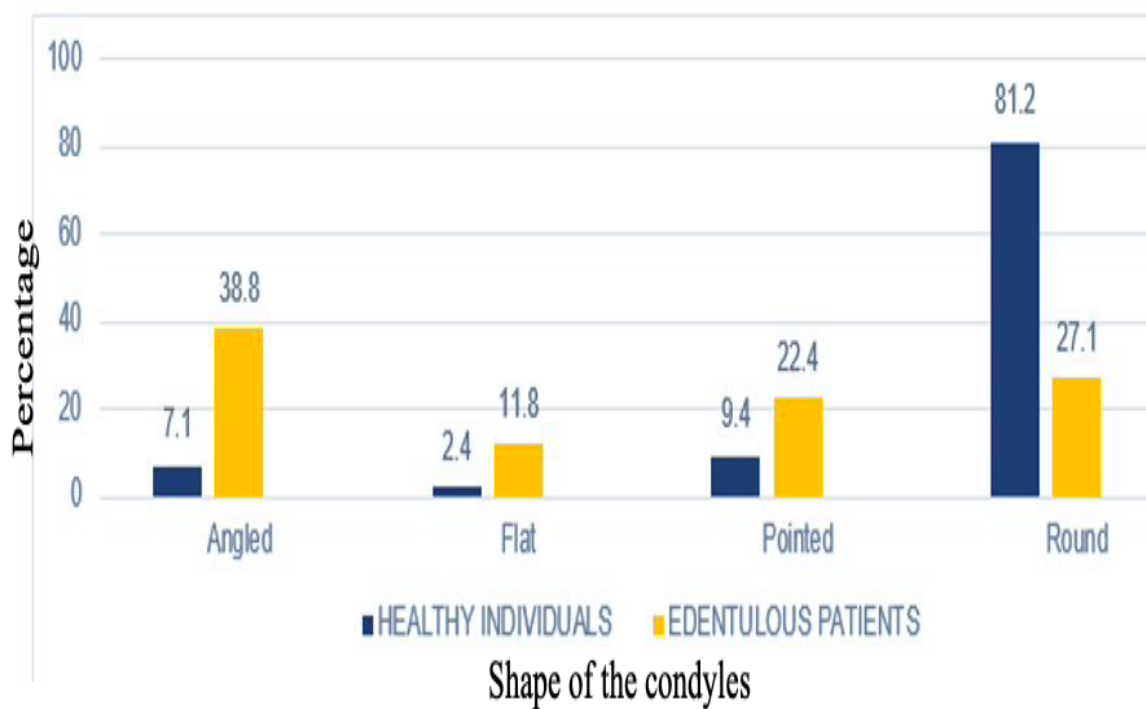


Figure 2. Types of condylar shapes

Table 1. Linear measurements

Measurement	Study Group	Control Group	P value
Condylar length	16.9836	16.2056	0.01*
Coronoid length	11.4551	11.3513	0.028
Mandibular width	192.7985	191.8925	0.01*
Mandibular body length	109.4991	109.4989	0.446
Sigmoid notch depth	12.4221	12.4220	0.446
Antegonial notch depth	2.0548	1.8988	0.01*
Anterior ramus notch depth	14.5489	13.8789	0.01*
Posterior ramus notch depth	23.4095	22.7628	0.01*
Ramus height	49.4038	49.4037	0.465
Total ramus height	101.2244	101.2241	0.446



Graph 1. Shape of the condyle in percentages

By means of histological studies of temporomandibular joints in young adults Pullinger et al. also found that the thickness of the joint tissue in the condyles ranged from 0.21 to 0.41 mm, and the smallest thickness was found in individuals lacking molar support. The authors concluded that the loss of molars produced an increase in compressive load in the anterosuperior condylar region [15]. Hamid Reza Fallahi et al., evaluated the relationship between partial edentulism and temporomandibular joint disorders and found that partial edentulism is an important etiological factor in promoting temporomandibular joint disorders. Our results are in line with this study [6]. Bhupender Singh et al., assessed the normal morphology of condyles in healthy population and found that round shape was the most common among the individuals which is in accordance with our study. The present study also showed similar results where the shape was rounded on the sides which were dentate when compared to angled condyles on the sides which had edentulous states [16].

Basheer et al, concluded that gonial angle and ramal notch depth in partial edentulism had significant difference when compared to fully dentate patients [17]. In our study, both anterior and posterior ramal notch depth had statistically significant difference and us in line with the study. In partial or total edentulism the functions of the muscles of mastication such as masseter and temporal muscles reduces and this could affect the mandibular dimensions, Oksayan et al [18]. Corelating the results with the standardised three-dimensional imaging modality such as CBCT was not done. As this was a pilot study, only two-dimensional radiographic retrospective research was performed. Based on these results, using studies using larger population and advanced imaging modalities can be performed to validate the results of this study. The results of this study could be further validated using three-dimensional imaging modalities.

4. Conclusions

The present study showed that loss of occlusal stability can affect the morphology of condyles in partially edentulous patients. This suggests that it is imperative to maintain a balanced occlusal harmony to prevent the occurrence of temporomandibular joint disorders.

Conflict of Interest

There are no conflicts of interest among authors.

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