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Prosthodontic evaluation of pound concept in determination of mediolateral mandibular posterior teeth position in Moradabad population

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Abstract
Introduction: Ideal arrangement of artificial posterior teeth is an important step for success in complete denture. Pound postulated that the lingual surfaces of mandibular posterior denture teeth should occupy an area bounded by two lines originating from the mesial surface of the mandibular canine and extending posteriorly to the lingual and buccal aspect of the retromolar pad.
Aim and objectives: The aim and objective of this study was to evaluate mediolateral positioning of mandibular posterior teeth in relation to pound theory.
Methodology: Fifty subjects were selected and mandibular impressions were taken and casts were poured. Pound triangles were marked on the cast. Photographs of the casts were taken and transferred to the computer for the further analysis by using Digimizer image analysis software. The Pound triangle was drawn & distance of lingual surfaces of each posterior tooth from the internal line of Pound triangle was measured. Points which were placed within the pound triangle presented as (0) and medial to the internal line of Pound triangle was (>0) and data was subjected to statistical analysis.
Results: In left quadrant about 97.2% first premolar, 94.5% of second premolar, 76.3% of first molar and 89% of second molar and in right quadrant about 96.3% first premolar and second premolar, 75.4% first molar and 89% second molar were located inside pound triangle.
Conclusion: It was concluded that in most of the cases lingual cusps of the mandibular teeth were within pound triangle which helps to stabilize the mandibular denture.

Keywords: Pound triangle, mandibular posterior teeth arrangement

Introduction

Arrangement of artificial posterior teeth for functional harmony depends on a thorough understanding of occlusion in complete denture therapy.[1] It is not simply a mechanical procedure for placing teeth to follow the form of the arch or to satisfy the laws of leverages; it requires dexterity and a knowledge of biology. [2] The position of artificial teeth in complete denture is dependent to a large extent on the state, morphology and position of the denture area. [3] The key objective is to position the posterior teeth so that patients will not bite their tongue and cheek muscles as they chew. [4] The most critical areas affecting denture stability function, and comfort is the posterior occlusion. Various reference points have been proposed for arrangement of artificial mandibular posterior teeth which include pound triangle, [5, 14] retromolar pad, [15, 19] center of the ridge, [20, 23] crest of the ridge [24, 35] and mylohyoid ridge. [2]

Pound triangle is a guide for the mediolateral positioning of the mandibular posterior teeth so that occlusal forces are transmitted to the supporting mandibular residual ridge. In 1951 Pound postulated that the lingual surfaces of mandibular posterior denture teeth should occupy an area bounded by two lines originating from the mesial surface of the mandibular canine and extending posteriorly to the lingual and buccal aspect of the retromolar pad. This area was designated as pound triangle. [13] Misch *et al* [15] suggested that in mandibular over denture prostheses, denture teeth are set medial to the retromolar pad. There by the occlusal forces are generated more vertically over the maxillary bone, thus reducing tipping and enhancing the upper denture stability during function.

In contradiction, certain authors postulated that posterior teeth should be placed on the center of the stress-bearing area as dictated by the nature of ridge resorption and not necessarily over the center of the residual ridge. Various occlusal schemes are advocated for arrangement of mandibular posterior teeth in residual ridge resorption cases in which Matsumaru *et al* [36] recomended that lingualized occlusion assists in greater denture stability in patients with severe residual ridge resorption or arch length discrepancy between the ridges.

Since, there was no consensus related to the location of mandibular posterior teeth, this study was planned to evaluate pound concept in determination of mediolateral mandibular posterior teeth position in Moradabad population.

Materials and Method

All the patients reporting to the outpatient department of the hospital were examined clinically for eligibility criteria decided for the study. Ethical clearance was obtained from the Institutional Ethics & Review Board and an informed consent was taken from the selected patients.

Subjects greater than 18 years of age and having a full complement of permanent dentition (excluding third molar) were included in the study. While subjects having dental caries, attrition of teeth, missing teeth, crowding, tooth size alteration or a fixed posterior dental prosthesis (long span bridges), history of orthodontic treatment, periodontal diseases like periodontal pockets, pathological drifting of teeth, asymmetry of the face were excluded from the study.

Sample size of 220 was decided according to power analysis using the formula $n= (Z1)^2 [P(1-P)/d^2]$. One hundred and ten patients of both the right and left quadrant were evaluated for buccolingual positioning of mandibular posterior teeth in relation to pound triangle. Hence, the total sample size was two hundred twenty.

Mandibular impressions were made using irreversible hydrocolloid (alginate) and casts were obtained by using type III gypsum product. Retromolar pad area, mesial surface of canine, and lingual surfaces of each posterior tooth were marked on the casts. Also metallic rulers were placed alongside of casts for standardization.

Photographs of the mandibular casts were taken with stabilized digital camera (Nikon D3500, Nikon Corporation) at a distance of 25 cm from the cast with the help of tripod at a shutter speed of 2 seconds, the magnifying power of (2/3) and the focal length of 40 mm by maintaining the ISO speed of 250 maximum aperture of 4, f/13 and 1/125 second The obtained images were then transferred to the computer for the further analysis by using Digimizer image analysis software.

The Pound triangle was marked by extending two lines originating from the mesial surface of the mandibular canine to lingual and buccal aspects of the retromolar pad for right and left of each mandibular cast. Distance of lingual surface of each posterior tooth from the internal line of pound triangle was measured **(**figure 1**)**. Points which fall within the pound triangle were presented as (0) and points medial to the internal line of pound triangle were presented as (>0). Obtained data were analysed with SPSS version 16.0 (Microsoft Inc., IL, USA) and subjected to statistical analysis.

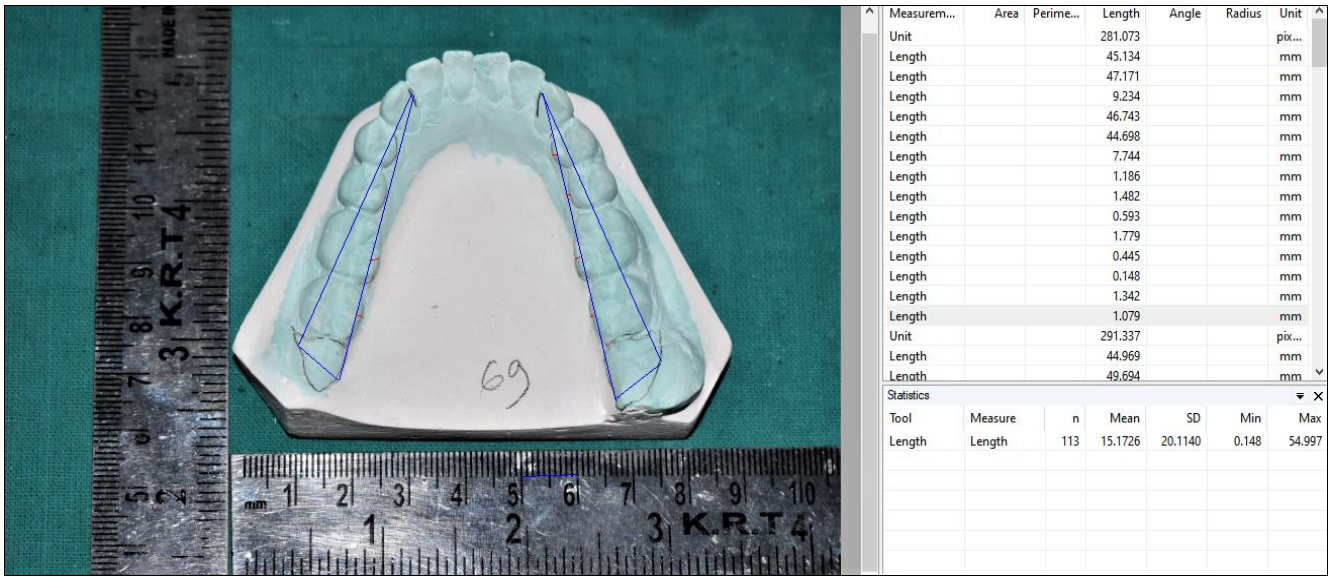

Fig 1: Analysing cast using Digimizer image analysis software

Results

Figure 2

Describes the relative frequency of mediolateral positioning of all posterior teeth in relation to Pound triangle. All the teeth falling within Pound triangle were labelled as "0". Teeth falling outside the Pound triangle were labelled as ">0". The chi square test revealed that about 95.9% of first premolars, 94.5% of second premolar, 75.9% of first molar and 90% of second molars were located inside pound triangle. Only about 4% left first premolars, 5.4% second premolar, 24% first molar and 10.9% second molar was outside the pound triangle.

Figure 3

describes the relative frequency of mediolateral positioning of left quadrant teeth in relation to Pound triangle. The chi square test revealed that in left quadrant about 97.2% first premolar, 94.5% of second premolar, 76.3% of first molar and 89% of second molar were located inside pound triangle. Only about 2.7% left first premolar, 5.4% second premolar, 23.6% first molar and 10.9% second molar were outside the pound triangle.

Figure 4

describes the relative frequency of mediolateral positioning of right quadrant teeth in relation to Pound triangle. The chi square test revealed that about 96.3% first premolar and second premolar, 75.4% first molar and 89% second molar were located inside pound triangle. Only about 5.4% first premolar, 5.4% second premolar, 24.5% first molar and 10.9% second molar were outside the pound triangle.

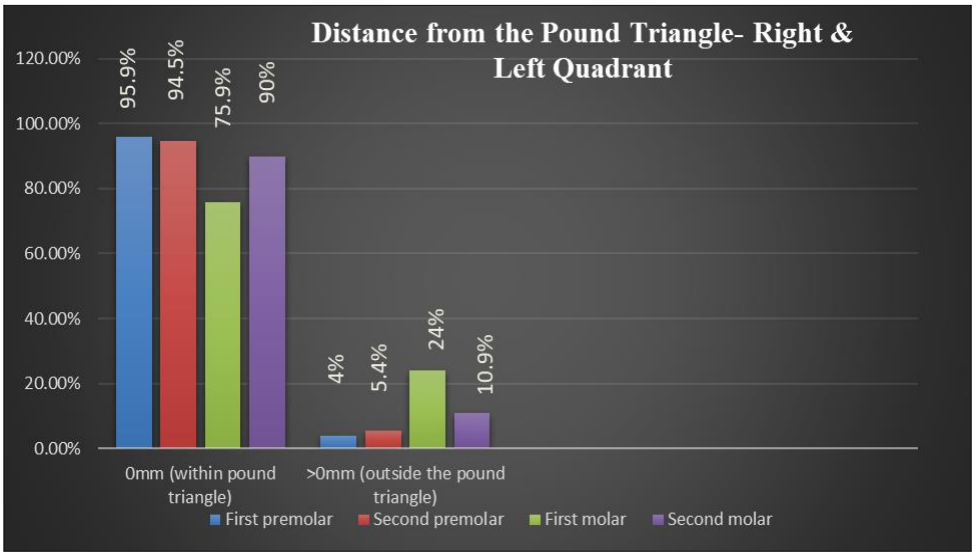

Fig 2: Relative frequency of mediolateral positioning of all posterior teeth in relation to Pound triangle

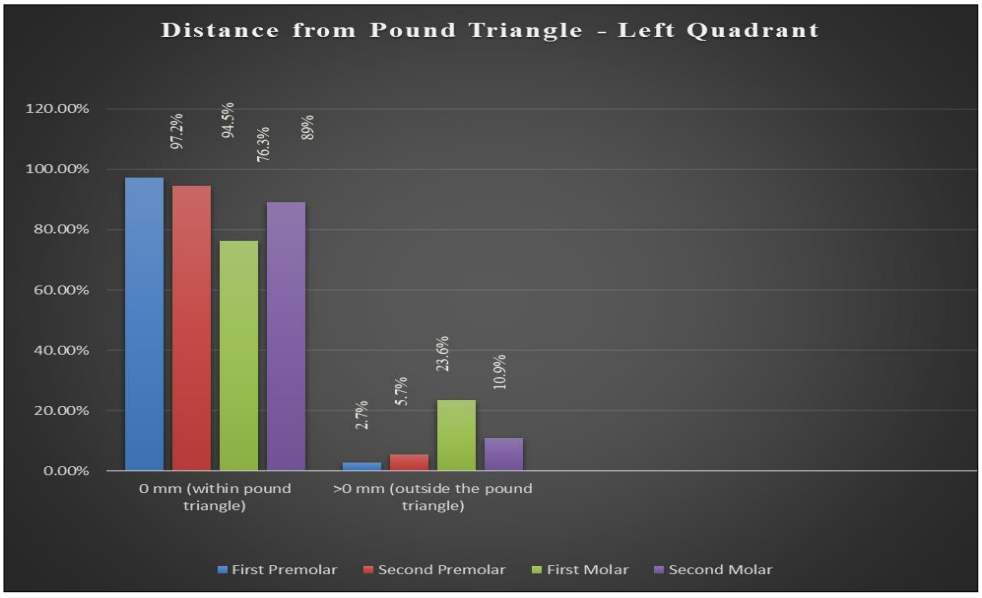

Fig 3: Relative frequency of mediolateral positioning of left quadrant teeth in relation to Pound triangle

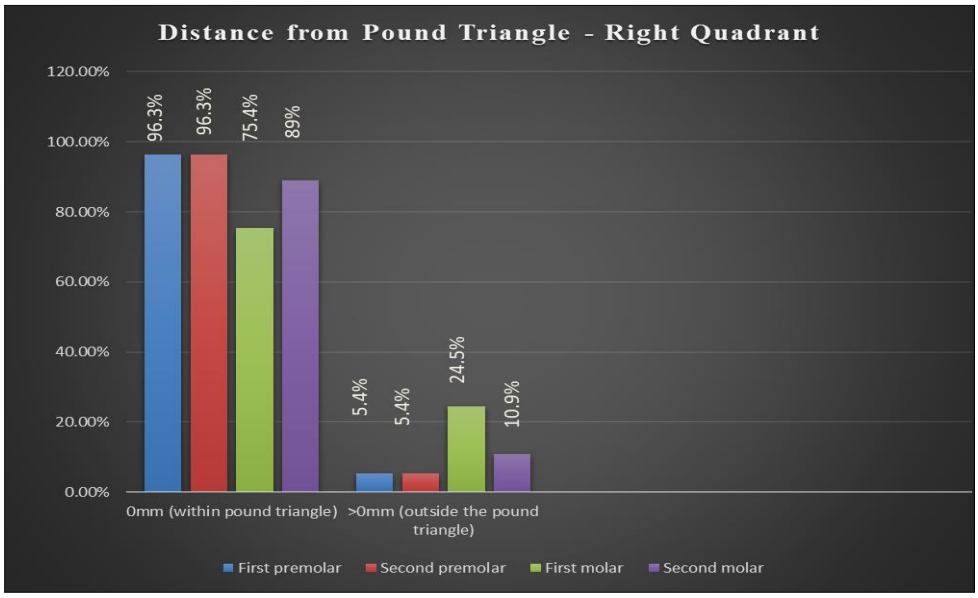

Fig 4: Relative frequency of mediolateral positioning of right quadrant teeth in relation to Pound triangle**.**

Discussion

The buccolingual positioning of artificial posterior teeth is an important factor for denture stability and pressure distribution on the supporting tissue under a denture. In the present study photographic method was chosen for assessing the relationship between pound concept and buccolingual position to overcome the drawback of manual method such as inaccuracy of markings, inter-operative variations and time economy.

The results of the present study is in accordance with the study conducted by Khaki *et al*[13] who concluded that the most frequent position of lingual cusps of posterior teeth were in 1mm distance buccal to the pound triangle. Similarly, other studies[5-14] supported the pound concept which documented that lingual surface of the lower teeth should be placed slightly buccal to the line from the mesial side of the cuspid to the lingual side of the retromolar pad, instead of tooth over the ridge concept.

This is also supported by Ortman *et al* [16] who advocated that the mandibular posterior teeth are set on a reference line from the tip of the cuspid to the apex of the retromolar pad. The central fossa of all the teeth coincides with this line which is very close to the buccolingual position of the natural teeth. In case of broad arches this line falls very slightly lingual to the first molar. The same reference line is also mentioned by Smith *et al* [18] and Jones *et al*. [25]

In contradiction, certain authors [20, 24] postulated that mandibular posterior teeth should be placed on the center of the stress-bearing area. Whereas other authors [25, 35] advocated that teeth should be positioned over the crest of the residual ridge to ensure stability and guide against any tipping or dislodgement of dentures. While Martone *et al* [35] proposed that the buccal cusps of the mandibular first molars are placed over the crest of the ridge, but the lingual cusps should lie directly on a line which extending from the mesial of the cuspids to the buccal side of the retromolar pad.

However, this study presents few limitations. As it was conducted only in one demographic location, the result may vary in morphological changes of tooth in geographically distributed people.

Conclusion

- Most of the mandibular posterior teeth were located inside pound triangle. The incidence of first molar was highest and first premolar was lowest of being outside the pound triangle.
- In left quadrant the incidence of first molar (76.3%) was highest and first premolar (97.2%) was lowest of being outside the pound triangle.
- In right quadrant the incidence of first molar (75.4%) was highest and first and second premolar (96.3%) was lowest of being outside the pound triangle.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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