ORIGINAL ARTICLE

Frequency of Inadequate Dimensions of Rest Seat Prepared on Molar Abutment Teeth For Cast Removable Partial Denture

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Abstract

Background: Properly prepared occlusal rest seats are essential for the stability, support, and longevity of cobalt-chromium removable partial dentures. Inadequate rest seat dimensions can compromise load distribution, leading to prosthesis failure. However, deficiencies in clinical preparation remain common in dental practice.

Objectives: To evaluate the frequency and pattern of inadequate occlusal rest seat preparations on principal molar abutments in patients receiving cobalt-chromium removable partial dentures at the Department of Prosthodontics, Rehman College of Dentistry, Peshawar.

Materials and Methods: A descriptive cross-sectional study was conducted on 96 patients aged 18–74 years. Rest seats were assessed for adequacy based on outline form, mesio-distal width, bucco-lingual width, depth, and overall preparation. Data were analyzed using SPSS version 23.0. Frequencies and percentages were calculated, and the Chi-square test was applied to determine associations with age and gender.

Result: The highest frequency of inadequacy was observed in the mesio-distal dimension (66.7%), followed by the outline form (56.3%). Statistically significant associations were found between age group and inadequacies in outline form (p = 0.038) and mesio-distal width (p = 0.041). No significant association was noted with gender.

Conclusions: A substantial proportion of occlusal rest seats were inadequately prepared, particularly in mesio-distal width and outline form, with greater deficiencies noted among middle-aged patients. These findings underscore the need for enhanced clinical supervision, improved training, and stricter adherence to biomechanical design principles in prosthodontic education.

Keywords: *Cast removable partial denture, Occlusal rest seat, Molar abutment, Rest seat adequacy, Prosthodontic training*

Introduction

Despite advancements in curative and preventive dental care, edentulism remains a significant challenge for healthcare providers.[1,2] Begum *et al*. stated in their study that the overall prevalence of missing teeth was 50.39%, of which the highest prevalence of tooth loss (96.18%) was seen in the 65–74 years age group.[3,4] While in Brazilian study Kennedy class I was the most prevalent mandibular edentulism, while Kennedy class III was the most frequent maxillary one.[5] The declining prevalence of complete edentulism, coupled with rising life expectancy, has led to a growing demand for partial prosthetic rehabilitation.[6]

A removable partial denture (RPD) offers a cost-effective, biologically compatible, and relatively straightforward approach to the rehabilitation of partially edentulous patients.[6,7,8] Removable partial denture prevents extensive damage to adjacent teeth during the preparation of abutments and are relatively inexpensive to fabricate, easy to modify following provision.[9] A properly designed and precisely fabricated removable partial denture (RPD) effectively restores form and function following the loss of natural teeth. Its primary objective is to enhance masticatory efficiency, esthetics, and speech, while maintaining the integrity of the dental arches by preventing tooth migration and supra-eruption into edentulous spaces. Conversely, poorly designed RPDs reduce patient acceptability and tolerance of the prosthesis while raising the risk of caries and periodontal disease in abutment teeth**.**[10]

A metal-based removable partial denture comprises a precision-cast metal framework that provides essential support, retention, and stability, onto which acrylic resin flanges are affixed to restore the form and functionality within the edentulous areas. An oc-

clusal rest in a framework provides positive vertical support and transmits occlusal forces from artificial teeth to natural abutment teeth. Removable partial dentures (RPDs) fabricated without occlusal rests are colloquially termed "gum strippers" due to their detrimental impact on gingival margins, potentially causing soft tissue trauma and periodontal compromise.[11] Acrylic partial dentures lacks occlusal rests therefore prevented from apical movement mainly by the resistance of the underlying mucosa against the denture base.[12]
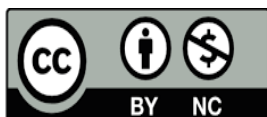
Molar abutments due to their location and function in the oral cavity bear a substantial load during mastication. According to available literature rest seats should have spoon-shaped or rounded triangle, with the apex pointing towards the center of the occlusal surface. They need to be wide bucco-lingually (at least 2–2.5 mm) and extend one-third of the crown's BL width and mesiodistal crown length. Regarding the depth of preparing the occlusal rest seat, literature reviews suggest reducing 1.5mm at the marginal ridge.[13, 14]

Placing the cast occlusal rest seats over inadequately prepared surfaces can result in poor adaptation to tooth natural topography leading to plaque accumulation, caries, gingival recession, decreased masticatory efficiency as well as compromised stability, thus weakening the cast rest and making it more susceptible to fracture.[11] Moreover, an inaccurately positioned rest within a properly prepared rest seat a rest may transmit non-axial forces to an abutment tooth due to the slippage effect along inclined planes leading to displacement of an abutment tooth from the cast rest under functional loading, compromising prosthesis stability and tooth integrity.[11]

Lynch conducted a study in 2010 in UK aiming to examine tooth preparations made by General dental practioniers for occlusal and cingulum rest seats for cobalt–chromium RPD.[15] A Similar study was conducted in Khyber College of Dentistry, Peshawar in 2016 reported that most frequently observed inadequacy was depth of rest seat (46%, n=58), followed by deficiency in general outline form and mesio-distal width (40%, n= 51). Inadequate bucco-lingual dimensions were noted in 37% (n=47) of the cases.[16]

The rationale of the present study is to evaluate the current quality of occlusal rest seat preparations for RPDs and to compare these findings with previous studies to determine whether clinical practices have improved over time. The results will be disseminated locally to enhance practitioner awareness, guide training interventions, and develop standardized clinical protocols for RPD design and preparation. Ultimately, this will contribute to improved prosthesis quality, greater patient satisfaction, and better long-term oral health outcomes..

Material and Methods

This descriptive, cross-sectional study was conducted in the Department of Prosthodontics, Rehman College of Dentistry (RCD), Peshawar, Pakistan, over a period of six months from January 2024 to June 2024, following approval of the research synopsis. The sample size for this study was calculated using the WHO sample size calculator for a single proportion. The calculation was based on a 95% confidence interval, an absolute precision of 0.10, and an anticipated population proportion derived from previous literature. The standard formula used for the estimation was

$$n = \frac{Z^2 \times P \times (1-P)}{d^2}$$

, where n represents the required sample size, Z is the standard normal deviate corresponding to the desired confidence level (1.96 for 95% confidence), P is the estimated population proportion, and d is the margin of error. Using an expected proportion of 0.60 for inadequate rest seat design from prior studies, the calculated sample size was approximately 93. To account for potential data loss or non-responses, the final sample size was adjusted to 96 participants, ensuring adequate precision and reliability of the study results. A non-probability consecutive sampling technique was used. Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Rehman College of Dentistry (Reference No. RCD/ETH/2024/017, dated December 15, 2023), and authorization was also granted by the College of Physicians and Surgeons Pakistan (CPSP) prior to data collection. All participants provided written informed consent, and confidentiality was maintained throughout the study in accordance with the Declaration of Helsinki (2013 revision).

Patients were recruited from the Outpatient Department (OPD) of Prosthodontics. Inclusion criteria consisted of partially dentate patients advised for cast partial dentures with molar abutments; permanent molar teeth with normal occlusal surface morphology, free from caries, restorations, or wear facets on clinical examination; mesio-occlusal rest seats prepared on molars; individuals of either gender; and patients aged 18 to 74 years. Exclusion criteria included patients with principal abutments other than molars, faulty dental casts that were difficult to assess for rest seat dimensions, and rest seats other than mesio-occlusal types such as double embrasure or ring clasp rest seats.

Eligible patients were assigned to clinicians with a minimum of five years of clinical experience who performed mouth preparation, including rest seat formation. Final impressions were taken using putty and light body condensation silicone, and master casts were poured for further evaluation. At the metal try-in stage, each master cast was evaluated for the shape, depth, bucco-lingual width, and mesio-distal length of the occlusal rest seat. The general outline form was visually assessed, while the bucco-lingual and mesio-distal dimensions were measured using a divider and millimeter scale by comparing the prepared area with the total respective dimensions. The depth of the rest seat was assessed by placing a piece of warm modeling wax between occluded casts, and the thickness of the wax was measured using an

Iwanson gauge.

Rest seats were classified as inadequate in shape if they were not spoon-shaped or rounded triangular. Inadequate bucco-lingual dimension referred to less than or greater than one-third of the tooth width in the bucco-lingual plane (ideal value: one-third or approximately 2–2.5 mm). Inadequate mesio-distal dimension referred to less than one-third or greater than one-half of the total bucco-lingual width (ideal range: between one-third and one-half). Inadequate depth was defined as less than 0.5 mm or greater than 1.5 mm. All findings were recorded on a structured proforma.

Data were analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). The Shapiro–Wilk test was applied to assess normality of numerical data. Quantitative variables such as age were presented as mean ± standard deviation, while qualitative variables such as gender and rest seat inadequacies (outline form, mesio-distal dimension, bucco-lingual dimension, and depth) were presented as frequencies and percentages. Associations between categorical variables were analyzed using the Chi-square test or Fisher's Exact Test, where applicable. A p-value of less than 0.05 was considered statistically significant

Results

A total of 96 patients were included in the study, comprising 52 males (54.2%) and 44 females (45.8%), with ages ranging from 18 to 74 years. The findings regarding the inadequacies in occlusal rest seat dimensions were stratified by **age group** and **gender** to assess possible associations.

Stratification with Age Group

When analyzed across age categories, a statistically significant association was observed between **general outline form** and age (p = 0.038), with inadequacy most frequent in the **56–74 years** group (60.6%), followed by the **37–55 years** group (57.7%) and **18–36 years** group (36.4%). For **mesio-distal dimension**, inadequacy was also significantly associated with age (p = 0.041), with the highest frequency noted among participants aged **37–55 years (69.2%)**, compared to **66.7%** in those aged **56–74 years** and **54.5%** among younger participants (18–36 years). In contrast, the **bucco-lingual dimension** and **depth** inadequacies were more common in older groups but did not reach statistical significance (p = 0.129 and p = 0.198, respectively). Overall, **rest seat inadequacy as a whole** was found in **41.7%** of the total sample, showing a higher proportion in the middle and older age groups but without a significant difference (p = 0.172).

Stratification with Gender

Gender-wise comparison revealed no statistically significant association between **rest seat inadequacies** and gender across all dimensions. Inadequate **general outline form** was observed in **57.7% of males** and **54.5% of females** (p = 0.918). Similarly, inadequate **mesio-distal dimension** was found in **69.2% of**
males and **63.6% of females** (p = 0.717). For the **bucco-lingual dimension**, inadequacy was slightly more prevalent among females (**52.3%**) compared to males (**42.3%**), though this difference was not statistically significant (p = 0.119). The inadequacy in **rest seat depth** was almost equal between males (**46.2%**) and females (**45.5%**) (p = 1.000). When assessed **as a whole**, rest seat inadequacy was present in **42.3% of males** and **40.9% of females**, again showing no significant gender-based variation (p = 1.000).

Discussion

The purpose of this study was to evaluate the frequency of inadequate rest seat preparations on molar abutments for cobalt-chromium removable partial dentures (RPDs). The results demonstrate a high occurrence of dimensional inaccuracies, particularly in the mesio-distal and outline form parameters. These findings reaffirm the importance of standardized training and evaluation in achieving clinically acceptable rest seat preparations.

In the current study, the mesio-distal dimension was the most frequently inadequate parameter, in age group of 37-55 years, seen in 66.7% of the cases. This was followed by inadequate outline form (56.3%), bucco-lingual dimension (46.9%), and depth (45.8%), with 41.7% of rest seats being inadequate overall. These results are comparable to those reported by Ali et al. (2020), who found inadequacies in depth (46%), mesio-distal and outline form (40% each), and overall rest seat preparation in 52% of cases.[16] The higher inadequacy in mesio-distal width in our study may reflect a lack of awareness or training emphasis on this parameter, possibly influenced by the posterior location of molars, where visibility and access are more challenging.

A comparison with the Brazilian study done in 2010 and referenced by Ali et al., which assessed occlusal rest seats prepared by undergraduate students, further contextualizes these findings.[17] That study reported that only 20% of rest seats met the recommended depth of 1.5 mm, and 44% lacked proper marginal ridge reduction.[17] In contrast to our findings in a clinical setting with qualified practitioners, the Brazilian study highlighted even greater deficiencies, suggesting that clinical experience alone may not fully eliminate errors in rest seat design. However, the fact that our study still observed high inadequacy rates—even among working practitioners—indicates that rest seat quality remains a widespread challenge and is not limited to undergraduate or novice levels.

Additionally, when compared to Lynch and Allen (2010) from the UK, who observed that only 51% of GDPs prepared rest seats at all, and among those, many were inadequately dimensioned (especially in depth), it becomes evident that rest seat preparation is inconsistently taught and practiced globally.[15] Our findings of over 40% inadequacy in every dimension assessed reflect a similar trend, pointing toward systemic issues in both education and clinical reinforce-

Table 1: Stratification of Rest Seat Inadequate Dimensions with Age Group

Rest Seat Dimensions	18–36 yrs (n=11)	37–55 yrs (n=52)	56–74 yrs (n=33)	Total (n=96)	P value	Chi-Square (χ^2)
General Outline Form						
Inadequate	4 (36.4%)	30 (57.7%)	20 (60.6%)	54 (56.3%)	0.038	2.066
Adequate	7 (63.6%)	22 (42.3%)	13 (39.4%)	42 (43.7%)		
Mesio-distal Dimension						
Inadequate	6 (54.5%)	36 (69.2%)	22 (66.7%)	64 (66.7%)	0.041	0.881
Adequate	5 (45.5%)	16 (30.8%)	11 (33.3%)	32 (33.3%)		
Bucco-lingual Dimension						
Inadequate	3 (27.3%)	24 (46.2%)	18 (54.5%)	45 (46.9%)	0.129	2.487
Adequate	8 (72.7%)	28 (53.8%)	15 (45.5%)	51 (53.1%)		
Depth						
Inadequate	2 (18.2%)	25 (48.1%)	17 (51.5%)	44 (45.8%)	0.198	3.922
Adequate	9 (81.8%)	27 (51.9%)	16 (48.5%)	52 (54.2%)		
Rest Seat as a Whole						
Inadequate	3 (27.3%)	22 (42.3%)	15 (45.5%)	40 (41.7%)	0.172	1.141
Adequate	8 (72.7%)	30 (57.7%)	18 (54.5%)	56 (58.3%)		

Table 2: Stratification of Rest Seat Inadequate Dimensions with Gender

Rest Seat Inadequate Dimensions	Male (n=52)	Female (n=44)	Total (n=96)	P value	Chi-Square (χ^2)
General Outline Form					
Inadequate	30 (57.7%)	24 (54.5%)	54 (56.3%)	0.918	0.010
Adequate	22 (42.3%)	20 (45.5%)	42 (43.7%)		
Mesio-distal Dimension					
Inadequate	36 (69.2%)	28 (63.6%)	64 (66.7%)	0.717	0.131
Adequate	16 (30.8%)	16 (36.4%)	32 (33.3%)		
Bucco-lingual Dimension					
Inadequate	22 (42.3%)	23 (52.3%)	45 (46.9%)	0.119	2.420
Adequate	30 (57.7%)	21 (47.7%)	51 (53.1%)		
Depth					
Inadequate	24 (46.2%)	20 (45.5%)	44 (45.8%)	1.000	0.000
Adequate	28 (53.8%)	24 (54.5%)	52 (54.2%)		
Rest Seat as a Whole					
Inadequate	22 (42.3%)	18 (40.9%)	40 (41.7%)	1.000	0.000
Adequate	30 (57.7%)	26 (59.1%)	56 (58.3%)		

ment.

In this study, age-stratified analysis revealed statistically significant associations between rest seat inadequacy and patient age, specifically for outline form (p = 0.038) and mesio-distal width (p = 0.041). The middle-aged group (37–55 years) showed the highest rates of inadequacies, potentially due to more complex occlusal wear patterns or the increased frequency of RPD indications in this demographic. These findings align with the concept that tooth wear and age-related morphological changes may complicate rest seat preparation and require additional clinical caution.

Conversely, gender-based stratification showed no statistically significant association with any parameter, con-

sistent with the findings of Ali et al.[16] This suggests that rest seat adequacy is independent of the patient's gender and more likely tied to operator technique, judgment, and procedural standardization.

Overall, this study shares many similarities with both local (Ali et al.) and international (Brazilian and UK) findings, it also highlights key deficiencies that remain despite clinical experience.[15,16,17] This emphasizes the urgent need for reinforced clinical training, hands-on workshops, and greater focus on design principles during both undergraduate education and continued professional development

Clinical workload, visibility issues in posterior molars, patient cooperation, and limited training all contribute to high inadequacy rates. Enhanced hands-on training, better assessment tools, and continuing education are necessary to address these systemic issues.

Digital dentistry provides a pathway for improvement. CAD/CAM and 3D-printed templates offer improved precision, although access remains limited in low-resource settings.[18]

National guidelines and competency-based assessments for rest seat preparations can standardize training and improve clinical outcomes across institutions.

In conclusion, the findings highlight a critical need for improved education, better training strategies, and clinical accountability to enhance the success of removable prosthodontics.

Conclusion

The results of this study demonstrate that significant proportion of occlusal rest seat preparations on molar abutments for cobalt-chromium removable partial dentures are dimensionally inadequate. The most frequently inadequate parameter was the mesio-distal dimension with respect to age, followed by outline form and bucco-lingual width. Age showed a significant association with certain inadequacies, particularly in the middle-aged group, whereas gender showed no significant effect. These findings highlight persistent shortcomings in clinical practice and emphasize the need for enhanced training, systematic assessment, and the integration of modern digital tools in prosthodontic education and practice. Adherence to established biomechanical principles and clinical protocols must be reinforced to improve the overall quality of removable partial denture support.

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Author Contributions

1. **Sadaf Khan:** Conception, design, data collection, analysis, and manuscript writing
2. **Sajid Ali:** Supervision and critical review
3. **Faisal Hayat:** Data collection and analysis
4. **Afzal Khan:** Critical review and literature review
5. **Shafqat Hussain:** Literature review
6. **Jodat Askari**: Funding and materials support