PREVALENCE OF PONTIC DESIGN IN POSTERIOR FPD- A RETROSPECTIVE STUDY

Abinaya[1], Dr. Harini. K*[2]

[1]Saveetha Saveetha Dental College and Hospital, Saveetha Institute of medical and technical Sciences, Saveetha University, 162, Poonamalle high road, Velapanchavadi, Chennai- 600077

[2]Senior Lecturer, Department of Prosthodontics, Saveetha Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162, Poonamalle high road, Velapanchavadi, Chennai- 600077

Corresponding Author:

Dr. Harini K, Senior Lecturer, Department of Prosthodontics, Saveetha Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162, Poonamalle high road, Velapanchavadi, Chennai- 600077

Abstract:

The selection of an appropriate pontic design is a crucial factor in the success and longevity of posterior fixed partial dentures (FPDs), which are widely used to replace missing teeth in the premolar and molar regions. The posterior area requires pontic designs that can withstand occlusal forces, provide comfort, facilitate hygiene maintenance, and, to a lesser extent, meet aesthetic demands. The prevalence of these designs reflects a combination of clinical considerations, patient preferences, and advances in dental technology and materials. Sanitary or hygienic pontics are frequently chosen for posterior regions because of their ease of cleaning, as they do not contact the edentulous ridge, reducing the risk of plaque accumulation and tissue irritation. The choice of pontic design in posterior FPDs significantly impacts patient satisfaction and clinical outcomes. Research suggests that hygienic pontics, although effective for reducing complications related to oral hygiene, may be less favored by patients desiring a natural appearance in their restorations. This study highlights the need for a patient-centered approach in pontic design selection for posterior FPDs, balancing functionality, esthetics, and ease of maintenance. The aim is to find the prevalence of Pontic design in the posterior region, preference of materials of choice and its longevity of materials aspect.

Keywords: Material selection, Marginal Integrity, Posterior FPD , Pontic design, Prevalence, Patient satisfaction.

Introduction:

Fixed partial dentures (FPDs) are commonly used in prosthetic dentistry to replace missing teeth, particularly in the posterior region of the mouth. The posterior region, comprising premolars and molars, is fundamental for efficient chewing, proper distribution of bite forces, and maintaining overall occlusal harmony. When a tooth is lost in this region, it disrupts these functions, often leading to further dental complications if not restored adequately(1). Patients

with FPD require regular lifelong professional maintenance with repeated interventions and reinstructions regarding maintenance of proper oral hygiene around fixed prosthesis (2).The prosthetic solution in such cases usually involves the placement of an FPD, also known as a bridge, which uses adjacent teeth as supports, or abutments, for an artificial tooth, known as a pontic(3). The design and selection of pontic types for posterior FPDs are critical factors influencing the success and longevity of these restorations. The choice of pontic design is influenced by clinical considerations, patient preferences, esthetic demands, functional requirements, and ease of oral hygiene maintenance(3).

Pontic design is especially challenging in the posterior region due to factors unique to this area. Unlike the anterior teeth, where aesthetics are the primary concern, posterior pontics must fulfill other demanding criteria, such as load-bearing capacity, occlusal stability, and comfort(4). The survival of FPD depends on the state of the marginal adaptation. The longevity of FPD depends on the condition of marginal fit and esthetics is also a major concern during restoration of anterior partial edentulous areas(5). Several types of pontic designs are commonly used in the posterior region, each with specific benefits and limitations. These include the sanitary (or hygienic) pontic, ridge-lap pontic, modified ridge-lap pontic, and conical pontic(6). Each design is uniquely suited to address particular clinical needs, and the selection often depends on factors like residual ridge contour, tissue health, patient oral hygiene practices, and the desired esthetic outcomes(7).

The choice of pontic design in posterior FPDs has been shown to have implications for both patient satisfaction and clinical outcomes. A well-chosen pontic design that aligns with the patient's needs and lifestyle can lead to improved long-term success of the FPD, reducing the risks of complications such as plaque accumulation, tissue inflammation, or failure of the abutment teeth(8).The most important criteria aided in increased success of fixed partial denture in evaluation of abutment health(9). Improper pontic selection, conversely, can result in biological and mechanical complications, such as increased stress on the abutment teeth, food impaction, and difficulty in maintaining good oral hygiene, which may ultimately compromise the FPD's durability(10). The aim is to find the prevalence of Pontic design in the posterior region, preference of materials of choice and its longevity of materials aspect.

MATERIALS AND METHODS:

A retrospective analysis was conducted to investigate the prevalence of various pontic designs in posterior FPDs at Saveetha Dental College & Hospitals using the DIAS application. The database included data from 100 patients (50 males, 50 females) who had undergone treatment with FPDs for missing posterior teeth. The sample consisted of different materials, such as PFM (33), hand-layered (46), and monolithic (21) restorations. Various factors, such as the number of FPD units, material choice, and patient satisfaction, were evaluated through DIAS.

The study sample included:

- FPD material types: PFM, Hand-layered, Monolithic
- Pontic designs: Sanitary Pontic, Bullet Pontic, Ridge Lap, Modified Ridge Lap
- Follow-up durations: 2 weeks, 1 month, 3 months
- **Inclusion criteria:**

- Patients aged 18–70 years who have missing posterior teeth and received a posterior FPD.
- Patients who received FPDs using PFM, monolithic, or hand-layered materials.
- Patients who had their FPDs for at least 2 weeks before inclusion in the study.

- **Exclusion criteria:**
  - Patients with systemic diseases that could affect oral health (e.g., diabetes).
  - Patients who have a history of oral cancer or radiation therapy.
  - Patients with poor oral hygiene (as determined by clinical examination and/or patient history).
  - Patients who had prior pontic designs in the posterior region before the FPD.

Data Collection

The following parameters were evaluated:

- **Material Type**: PFM, hand-layered, or monolithic.
- **Pontic Design**: Hygienic (sanitary), modified ridge-lap, ridge-lap, and conical.
- **Number of FPD Units**: 3, 4, 5, or 6 units.
- **Follow-up Duration**: 2 weeks, 1 month, and 3 months.
- **Marginal Integrity**: Patient satisfaction with the marginal fit of the pontic.

Statistical Analysis

Descriptive statistics were used to summarize the data, and Chi-square tests were employed to examine the relationship between variables such as material type, number of FPD units, and patient satisfaction with marginal Integrity.

Results:

The study evaluated the association between various factors, including gender, material type, number of FPD units, and pontic design, with patient satisfaction and marginal rigidity.

Demographics and Material Distribution

A total of 100 patients (50 males, 50 females) were included in the study. The distribution of materials used was as follows:

- **PFM**: 33 cases
- **Hand-layered**: 46 cases
- **Monolithic**: 21 cases

The distribution of FPD units was:

- **3 Units**: 75 cases
- **4 Units**: 9 cases
- **5 Units**: 5 cases
- **6 Units**: 13 cases

Pontic Design Prevalence

The study found the following distribution of pontic designs used in the posterior FPDs:

- **Sanitary (Hygienic)**: 19 cases
- **Modified Ridge-Lap**: 59 cases
- **Ridge-Lap**: 13 cases
- **Bullet Pontic**: 9 cases

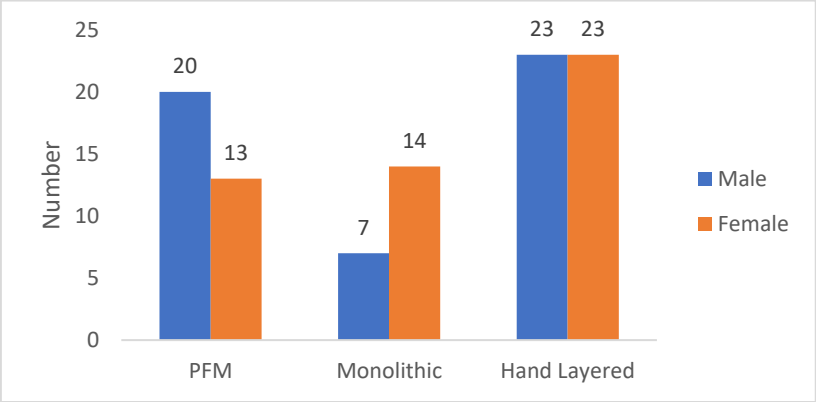
Tables:

- **Table 1**: Gender and Material Used
- **Table 2**: Number of Units and Material Used
- **Table 3**: Number of Units and Marginal Integrity
- **Table 4**: Materials Used and Marginal Integrity
- **Table 5**: Pontic Design and Marginal Integrity

Table 1: Association between Gender and Material Used

Gender	Materials used			p
	PFM	Monolithic	Hand Layered	
Male	20	7	23	
Female	13	14	23	0.148

Chi-Square Test P<0.05 is statistically significant

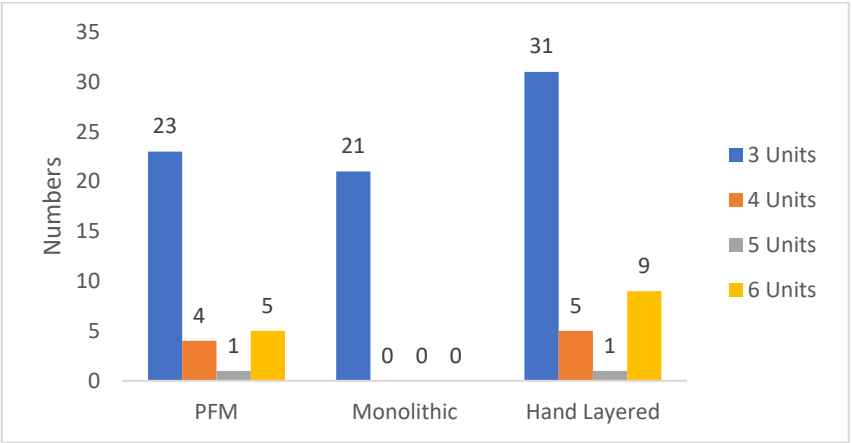


Graph 1: Bar chart represents ; Compares male and female preferences for three materials: PFM, Monolithic, and Hand Layered. Males prefer PFM (20) more than females (13), while females favor Monolithic (14) over males (7). Both genders equally prefer Hand Layered (23). The legend differentiates males (blue) and females (orange).

Table 2: Association between Number of Units and Material Used

Number of Units	Materials used			p
	PFM	Monolithic	Hand Layered	
3 Units	23	21	31	
4 Units	4	0	5	0.160
5 Units	1	0	1	
6 Units	5	0	9	

Chi-Square Test P<0.05 is statistically significant

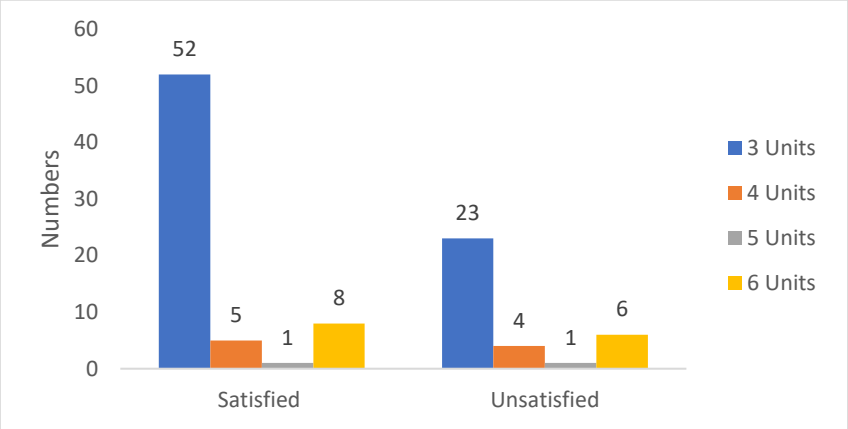


Graph 2: Bar chart represents ; illustrates the association between the number of units and the material used. It compares PFM, Monolithic, and Hand Layered across four unit categories: 3, 4, 5, and 6 units. The majority of cases involve 3 units, while fewer cases involve 4, 5, and 6 units.

Table 3: Association between Number of Units and Marginal Integrity

Number of Units	Marginal Integrity		p
	Satisfied	Unsatisfied	
3 Units	52	23	0.676
4 Units	5	4	
5 Units	1	1	
6 Units	8	6	

Chi-Square Test P<0.05 is statistically significant

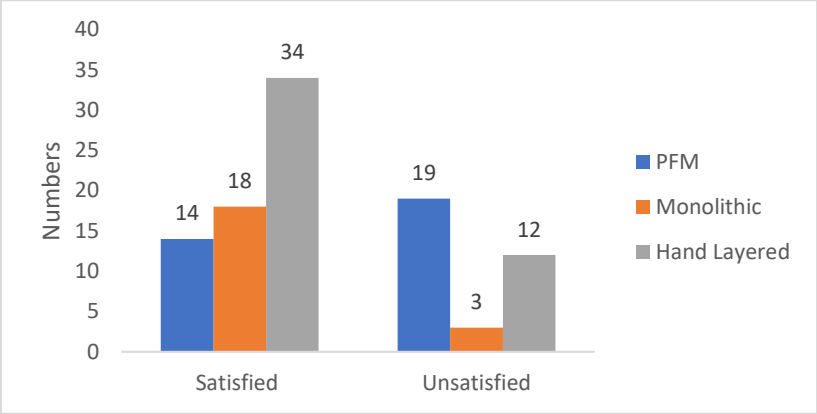


Graph 3: Bar chart represents; shows the association between the number of units and marginal integrity. It compares satisfied and unsatisfied cases across 3, 4, 5, and 6-unit categories. The majority of satisfied cases involve 3 units (52), while unsatisfied cases are also highest for 3 units (23), with fewer cases in other categories.

Table 4: Association between Materials Used and Marginal Integrity

Materials used	Marginal Integrity		p
	Satisfied	Unsatisfied	
PFM	14	19	**0.001***
Monolithic	18	3	
Hand Layered	34	12	

Chi-Square Test P<0.05 is statistically significant

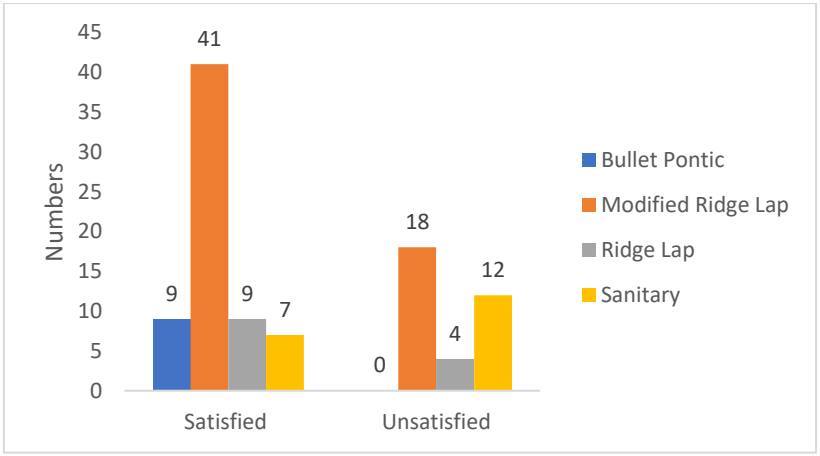


Graph 4: Bar chart represents; compares satisfaction and dissatisfaction levels among PFM, monolithic, and hand-layered restorations. Hand-layered restorations have the highest satisfaction (34), followed by monolithic (18) and PFM (14). However, PFM has the most dissatisfaction (19), while hand-layered (12) and monolithic (3) show lower dissatisfaction rates, indicating varying performance across materials.

Table 5: Association between Pontic Design and Marginal Integrity

Pontic Design	Marginal Integrity		p
	Satisfied	Unsatisfied	
Bullet Pontic	9	0	**0.007***
Modified Ridge Lap	41	18	
Ridge Lap	9	4	
Sanitary	7	12	

Chi-Square Test P<0.05 is statistically significant



Graph 5: Bar chart represent ; the association between pontic design and marginal integrity. The modified ridge lap design has the highest satisfaction (41) but also the most unsatisfied cases (18). Bullet pontic and ridge lap show equal satisfaction (9), while the sanitary design has fewer satisfied (7) and more unsatisfied cases (12).

Chi-square tests were conducted to assess statistical significance, with a significance level of $p < 0.05$.

Chi-Square Test Results

1. **Association between Gender and Material Used**
    - P-value: 0.148 (Not statistically significant)
2. **Association between Number of Units and Material Used**
    - P-value: 0.160 (Not statistically significant)
3. **Association between Number of Units and Marginal Rigidity**
    - P-value: 0.676 (Not statistically significant)
4. **Association between Materials Used and Marginal Rigidity**
    - P-value: 0.001 (Statistically significant)
5. **Association between Pontic Design and Marginal Rigidity**
    - P-value: 0.007 (Statistically significant)

Discussion:

The prevalence of various pontic designs in posterior FPDs reflects both clinical and practical considerations. Sanitary or hygienic pontics, for instance, are typically preferred in posterior regions where esthetics are less critical, as they allow easy access for oral hygiene and minimal contact with the underlying ridge(11,12). This design, however, may lack the natural appearance that patients might prefer even in posterior areas. On the other hand, modified ridge-lap and ridge-lap pontics, which mimic the contours of natural teeth more closely, offer improved aesthetics and better support for occlusal forces but may pose challenges for oral hygiene maintenance if not properly designed and contoured(13). Conical pontics are another option, often used in cases where the ridge is narrow, as they provide a localized contact with the ridge, which can be beneficial for patients with limited interarch space(14,15).

Evaluating the prevalence of different pontic designs in posterior FPDs can provide valuable insights into trends in dental practice and patient preferences. It can also shed light on how advancements in dental materials, techniques, and understanding of biomechanics have influenced pontic design choices over time(16). For instance, the increased use of CAD/CAM technology in dental restorations has enabled clinicians to design pontics with more precise contours, potentially impacting the prevalence of certain designs that were previously challenging to fabricate accurately(17).

In recent years, there has been a growing emphasis on evidence-based dentistry, where clinical decisions are informed by empirical data and patient-centered outcomes. This approach has led to a reevaluation of traditional practices in pontic design for posterior FPDs(18). Studies have examined how various pontic designs impact oral health-related quality of life, patient satisfaction, and clinical longevity. For instance, research suggests that patients with modified ridge-lap pontics may experience better satisfaction in terms of appearance and comfort compared to those with sanitary pontics, although they might need to invest more effort in maintaining oral hygiene. Conical pontics, while suitable for certain ridge anatomies, may not be ideal in cases with wide or irregular residual ridges due to their limited contact area. These findings help dentists to make more informed decisions and to customize FPD treatments to better meet individual patient needs(19).

Additionally, factors such as socioeconomic status, access to dental care, and regional preferences may influence the prevalence of specific pontic designs in posterior FPDs. In some regions, cost-effective solutions like the sanitary pontic are more common, especially when

esthetics are secondary to function(20). In contrast, areas with higher patient demands for aesthetic dentistry may see a greater prevalence of modified ridge-lap and ridge-lap pontics, even in posterior restorations. Understanding these trends is important for dental practitioners and researchers alike, as it allows them to adapt to shifting demands and emerging practices within the field of prosthodontics(21).

Another aspect to consider is the influence of patient education on pontic design selection. Patients who are well-informed about the pros and cons of each pontic type are more likely to participate actively in the decision-making process, leading to higher satisfaction with the chosen FPD. Educating patients on the importance of oral hygiene maintenance, especially with designs that have more tissue contact, is essential to ensure the long-term success of posterior FPDs(22). Proper patient education can help mitigate potential challenges associated with designs like the modified ridge-lap pontic, which may accumulate plaque if not cleaned properly.

Despite advancements in dental technology and materials, the selection of pontic design remains a critical and nuanced decision in posterior FPD treatments(23). It requires balancing multiple factors, including functional efficiency, aesthetic value, ease of maintenance, and patient preferences. The prevalence of different pontic designs in posterior FPDs reflects not only the clinical needs of patients but also the evolving standards in dental practice and the adoption of new technologies that facilitate the design and fabrication of durable, patient-centered restorations.

Technological advancements, such as the adoption of CAD/CAM systems, have made it easier to create more precise pontic designs. These systems offer a potential shift in the prevalence of pontic designs, especially as they enable more accurate fabrication of complex shapes, like ridge-lap and modified ridge-lap pontics, which were previously challenging to design and fabricate manually

In conclusion, the prevalence of various pontic designs in posterior FPDs highlights the importance of an individualized approach to dental restorations(24). By selecting the appropriate pontic design based on both clinical evidence and patient-specific factors, dental practitioners can enhance the effectiveness of FPDs, improve patient satisfaction, and minimize potential complications(25). As dentistry continues to evolve, ongoing research and technological advancements will likely further refine pontic designs, offering new possibilities for restoring function and aesthetics in the posterior region with increased precision and success.

Limitations of the Study

This study was limited by its retrospective design, which relies on existing records. The sample size was relatively small, and the follow-up period was short. Future prospective studies with a larger sample size and longer follow-up would provide a more comprehensive understanding of the long-term outcomes associated with different pontic designs.

Conclusion:

The selection of pontic design in posterior FPDs plays a crucial role in both the functionality and esthetics of the restoration. While modified ridge-lap pontics offer a balance of natural appearance and functional stability, hygienic pontics are preferred when hygiene maintenance is prioritized. The advent of CAD/CAM technology has revolutionized pontic design, making complex designs more accessible and enhancing the overall quality of restorations. Clinicians should consider both functional and esthetic needs, along with material properties, when choosing pontic designs to ensure the long-term success of posterior FPDs. Ongoing patient education on the maintenance of these restorations is also critical to achieving optimal results.

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