Research Article

Academia Journal of Medicine
Vol. 9, No. 2, July–December 2026

Clinical Factors Guiding Prosthodontic Treatment Decisions Among Dentists in Maharashtra, India: A Cross-Sectional Survey

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https://doi.org/10.48165/ajm.2026.9.02.19

ARTICLE INFO

Article history:
Published: 2026

Keywords:
clinical decision-making
dental implants
dental luting cements
dentists
prosthodontics
treatment planning

ABSTRACT

Purpose: To rank factors guiding three prosthodontic decisions among dentists in Maharashtra and examine variation by professional background and practice setting. Materials and Methods: This cross-sectional survey included 400 dentists from 11 districts. A 30-item questionnaire assessed glass ionomer versus resin cement, fixed partial denture versus implant, and implant-supported overdenture versus fixed implant-supported prosthesis decisions on a six-point scale. Internal consistency was evaluated using Cronbach's alpha with bootstrap confidence intervals. Friedman tests with Kendall's W and Holm-adjusted post hoc tests evaluated rankings. Nonparametric tests compared domain scores across groups. Results: Overall internal consistency was good (alpha = 0.881; 95% CI: 0.861-0.897). Marginal seal ranked highest for cement selection (mean 4.43), prognosis and risk of failure for fixed partial denture versus implant decisions (mean 4.51), and retention and stability for complete-arch decisions (mean 4.42). Rankings differed within every domain (all $P < 0.001$), although Kendall's W indicated modest separation among generally high ratings. Prosthodontic and other specialty respondents scored all domains higher than general dentists, and dentists in hospital-based educational settings scored them higher than private practitioners (all Holm-adjusted $P < 0.001$). Scores did not differ by gender or correlate with age. Conclusion: Dentists prioritized biological durability, mechanical predictability, and long-term prognosis. Professional training and institutional context were associated with the breadth of factors considered.

INTRODUCTION

Clinical decision-making in prosthodontics requires simultaneous assessment of biological status, mechanical demands, material properties, patient expectations, anticipated maintenance, and affordability. Questionnaire-based research has shown that these judgements can be evaluated systematically and that dentists may assign different importance to the same clinical attributes [1]. Variation has also been demonstrated when clinicians choose between tooth-supported and implant-supported treatment, indicating that prosthodontic planning is rarely governed by a single variable [2].

The decision process must combine clinical feasibility with patient-centred care. A recent cross-sectional survey found that clinical-case, operator-related, and patient-related considerations contribute differently according to the professional background of the decision-maker [3]. In parallel, shared decision-making requires the dentist to explain reasonable alternatives and incorporate informed patient preferences, particularly when choices differ in

surgical involvement, treatment duration, removability, maintenance, cost, or reversibility [4].

Selection of a definitive luting agent illustrates the interaction between material and case factors. Glass ionomer-based and resin cements differ in adhesion, strength, solubility, moisture sensitivity, handling, and clinical indications [5]. Consequently, the restorative material, tooth substrate, preparation geometry, retention requirement, and possibility of adequate isolation should be considered together [6]. A cement that is appropriate for a retentive preparation and conventional restoration may not provide the same predictability in a short preparation or an adhesively retained ceramic restoration.

Treatment of partial and complete edentulism involves a broader balance of anatomy, prognosis, risk, maintenance, and patient preference. When replacing a missing tooth or short span, a fixed partial denture avoids implant surgery but requires suitable abutments, whereas an implant preserves adjacent tooth structure but depends on bone availability and surgical acceptability. Comparative evidence indicates that both approaches can be successful when appropriately selected, although their complications and economic implications differ [7]. For complete-arch rehabilitation, fixed and removable implant prostheses can both provide favourable outcomes, but differ in hygiene access, repair requirements, retention, cost, and patient experience [8]. Digital planning and manufacturing have added further options for diagnosis, communication, and prosthesis delivery [9].

Despite the availability of multiple treatment modalities, limited regional evidence describes how dentists integrate these competing considerations in routine practice. Therefore, this study aimed to rank the factors influencing three prosthodontic decisions among dentists in Maharashtra: glass ionomer cement versus resin cement, fixed partial denture versus dental implant, and implant-supported overdenture versus fixed implant-supported prosthesis. It also evaluated whether decision-domain scores differed according to gender, age, professional group, and practice setting.

MATERIALS AND METHODS

Study design and reporting

A descriptive cross-sectional survey was conducted among dentists practicing in Maharashtra, India. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidance for cross-sectional studies [10]. The online component was designed and reported with reference to the Checklist for Reporting Results of Internet E-Surveys [11].

Ethics and consent

The study protocol was reviewed and approved by the Institutional Ethics Committee of Nair Hospital Dental College, Mumbai. Participation was voluntary. The information sheet explained the study purpose, confidentiality safeguards, and the right to decline participation. Electronic consent preceded the online questionnaire, and written informed consent was obtained for printed questionnaires.

Participants and sampling

Eligible participants were dentists practicing in Maharashtra who were independently involved in prosthodontic treatment planning. General dentists, postgraduate trainees, and specialists were included. Undergraduate dental students, interns, dentists without involvement in prosthodontic procedures, and incomplete or internally inconsistent submissions were excluded. Convenience sampling was used through professional dental associations, academic institutions, hospitals, private clinics, email, and online professional networks. Online responses were collected using Google Forms, and printed questionnaires were distributed in clinical and academic settings.

The minimum sample size was calculated using the single-proportion formula, with an expected proportion of 40%, 95% confidence level, and 5% absolute precision. The calculated minimum was 369 participants; the final analytic sample comprised 400 complete responses.

Questionnaire development

The self-administered questionnaire comprised demographic and professional information followed by 30 decision items. Content was reviewed by five dental experts representing relevant specialties, and wording was revised for clarity and clinical relevance. The revised version was pilot tested with 20 dentists from the target professional population before survey circulation.

The decision items were organized into three 10-item domains. The cement-selection domain assessed the choice between glass ionomer and resin cement. The fixed partial denture versus implant domain assessed replacement of missing teeth with a tooth-supported fixed partial denture or a dental implant. The complete-arch domain assessed the choice between an implant-supported overdenture and a fixed implant-supported prosthesis. Each item was rated from 0 (not at all important) to 5 (extremely important). All included responses contained complete item-level data; observed responses ranged from 1 to 5.

For professional-group analyses, respondents with a BDS qualification were classified as general dentists. MDS-qualified dentists and postgraduate trainees in

Prosthodontics were grouped as prosthodontic specialists or trainees. MDS-qualified dentists and postgraduate trainees in Periodontics, Oral Surgery, Endodontics, or Pedodontics were grouped as other specialty specialists or trainees.

Statistical analysis

Analyses were conducted in Python 3.12.13 using pandas 2.2.3, NumPy 2.3.5, and SciPy 1.17.0. Categorical variables were summarized as frequency and percentage. Age was summarized using mean, standard deviation, median, interquartile range, and range. Individual importance ratings were summarized using mean, standard deviation, median, interquartile range, mean rank, and the proportion assigning a high or extremely high rating (scores 4-5).

Internal consistency was estimated using Cronbach's alpha for the full 30-item instrument and for each 10-item domain. Percentile 95% confidence intervals were obtained from 5,000 bootstrap resamples. A domain score was calculated as the participant-level mean of its 10 constituent items.

Because item ratings were ordinal and repeated within respondents, differences among items in each domain were tested using the Friedman test. Kendall's W quantified concordance in ranking. When the omnibus test was significant, the highest-ranked item was compared with each remaining item using paired Wilcoxon signed-rank tests with Holm correction. Gender comparisons used the Mann-Whitney U test. Professional-group and practice-setting comparisons used Kruskal-Wallis tests followed by Holm-adjusted pairwise Mann-Whitney U tests. Epsilon-squared quantified the effect size for Kruskal-Wallis analyses. Associations between age and domain scores were assessed using Spearman rank correlation. All tests were two-sided, and $P < 0.05$ was considered statistically significant. Multiplicity adjustment was applied within each prespecified family of comparisons.

RESULTS

Participant characteristics

All 400 records had unique identifiers and complete responses for the variables included in the analysis. Participants had a mean age of 42.09 years (SD 14.31), with a median of 41 years (IQR 27-56) and a range of 24-64 years. Women accounted for 215 participants (53.75%). There were 203 prosthodontic specialists or trainees (50.75%), 121 general dentists (30.25%), and 76 specialists or trainees from other dental specialties (19.00%). Private practice was the most common setting (44.75%), followed by government hospital and educational institutions (31.25%) and private hospital and educational institutions (24.00%). Participants represented 11 districts across Maharashtra (Table 1).

Table 1. Demographic and professional characteristics of participants (N = 400)

Characteristic	Category/statistic	Value, n (%)
Age, years	Mean ± SD	42.09 ± 14.31
	Median (IQR)	41 (27-56)
	Range	24-64
Gender	Female	215 (53.75)
	Male	185 (46.25)
Qualification	MDS	163 (40.75)
	BDS	121 (30.25)
	Postgraduate trainee	116 (29.00)
Professional group	Prosthodontic specialist/trainee	203 (50.75)
	General dentist	121 (30.25)
	Other specialty specialist/trainee	76 (19.00)
Practice setting	Private practice	179 (44.75)
	Government hospital and educational institution	125 (31.25)
	Private hospital and educational institution	96 (24.00)
District	Thane	49 (12.25)
	Navi Mumbai	48 (12.00)
	Mumbai	43 (10.75)
	Palghar	36 (9.00)

Nagpur	36 (9.00)
Nashik	35 (8.75)
Solapur	32 (8.00)
Pune	31 (7.75)
Amravati	30 (7.50)
Aurangabad	30 (7.50)
Kolhapur	30 (7.50)

Values are n (%) unless otherwise stated. IQR, interquartile range; SD, standard deviation.

Internal consistency and domain-level distributions

The 30-item instrument demonstrated good internal consistency (Cronbach's alpha = 0.881; 95% CI: 0.861-0.897). Domain-specific alpha values were 0.693 for cement selection, 0.719 for fixed partial denture versus implant, and 0.711 for implant-supported overdenture versus fixed implant-supported prosthesis. Mean domain scores were high across the instrument: 4.221 (SD 0.438) for cement selection, 4.339 (SD 0.430) for fixed partial denture versus implant, and 4.304 (SD 0.431) for the complete-arch domain (Table 2).

Item rankings differed significantly within every domain. The Friedman statistic was 246.126 for cement selection, 120.756 for fixed partial denture versus implant, and 103.836 for the complete-arch domain (all $P < 0.001$). Kendall's W values ranged from 0.029 to 0.068, indicating that the statistically detectable ordering represented modest separation among factors that were generally rated highly.

Table 2. Domain scores, internal consistency, and within-domain item comparisons

Domain	Mean ± SD	Median (IQR)	Alpha (95% CI)	Friedman χ^2	P value	Kendall W
Cement selection	4.221 ± 0.438	4.30 (4.00-4.50)	0.693 (0.640-0.740)	246.126	<0.001	0.068
FPD vs implant	4.339 ± 0.430	4.40 (4.10-4.70)	0.719 (0.670-0.759)	120.756	<0.001	0.034
IOD vs FISP	4.304 ± 0.431	4.40 (4.10-4.60)	0.711 (0.663-0.750)	103.836	<0.001	0.029
Overall instrument	-	-	0.881 (0.861-0.897)	-	-	-

Each domain contained 10 items. Friedman tests had 9 degrees of freedom. CI, confidence interval; FISP, fixed implant-supported prosthesis; FPD, fixed partial denture; IOD, implant-supported overdenture.

Factors influencing cement selection

Marginal seal and microleakage prevention was the highest-ranked cement-selection factor (mean 4.43; 88.00% rating it high or extremely high), followed by retention in short or tapered preparations (mean 4.41), bond strength to tooth structure (mean 4.40), resistance to solubility in oral fluids (mean 4.39), and retention for different crown types (mean 4.37). Ease of excess cement removal ranked lowest, although 68.00% still rated it high or extremely high (Table 3).

Pairwise comparisons showed that marginal seal did not differ significantly from retention in short or tapered preparations, bond strength, solubility resistance, or retention for different crown types after Holm adjustment. It was rated more highly than cost and economic feasibility (adjusted $P = 0.035$), moisture tolerance, post-cementation sensitivity, ease of cementation, and ease of excess removal (all adjusted $P < 0.001$).

Table 3. Importance ranking of factors influencing glass ionomer versus resin cement selection

Rank	Factor	Mean	SD	Median (IQR)	High rating, n (%)	Mean rank
1	Marginal seal and microleakage prevention	4.43	0.77	5 (4-5)	352 (88.00)	6.18
2	Retention in short or tapered preparations	4.41	0.74	5 (4-5)	353 (88.25)	6.06
3	Bond strength to tooth structure	4.39	0.79	5 (4-5)	344 (86.00)	6.06
4	Resistance to solubility in oral fluids	4.39	0.80	5 (4-5)	346 (86.50)	6.05
5	Retention for different crown types	4.37	0.78	5 (4-5)	344 (86.00)	5.96

6	Cost and economic feasibility	4.26	0.83	4 (4-5)	327 (81.75)	5.63
7	Moisture tolerance during cementation	4.15	0.90	4 (4-5)	306 (76.50)	5.30
8	Post-cementation sensitivity	4.00	0.94	4 (3-5)	287 (71.75)	4.80
9	Ease of cementation	3.93	0.95	4 (3-5)	278 (69.50)	4.56
10	Ease of excess cement removal	3.87	0.95	4 (3-5)	272 (68.00)	4.39

High rating denotes a score of 4 or 5 on the six-point importance scale. IQR, interquartile range; SD, standard deviation.

Factors influencing fixed partial denture versus implant decisions

Prognosis and risk of failure ranked first in the fixed partial denture versus implant domain (mean 4.51; 90.00% high or extremely high), closely followed by bone quality and quantity (mean 4.51; 90.00%). Patient age, digital workflow availability, oral hygiene, long-term maintenance, and condition of adjacent teeth also received high mean ratings. Patient preference and aesthetic expectations had the lowest mean scores in this domain, but each was still rated high or extremely high by 77.00% of respondents (Table 4).

The highest-ranked factor, prognosis and risk of failure, did not differ significantly from bone quality, patient age, digital workflow availability, or oral hygiene after Holm correction. It was rated more highly than long-term maintenance (adjusted $P = 0.001$), condition of adjacent teeth (adjusted $P = 0.002$), economic considerations, aesthetic expectations, and patient preference (all adjusted $P < 0.001$).

Table 4. Importance ranking of factors influencing fixed partial denture versus implant selection

Rank	Factor	Mean	SD	Median (IQR)	High rating, n (%)	Mean rank
1	Prognosis and risk of failure	4.51	0.71	5 (4-5)	360 (90.00)	6.11
2	Bone quality and quantity	4.50	0.71	5 (4-5)	360 (90.00)	6.07
3	Patient age	4.44	0.75	5 (4-5)	352 (88.00)	5.80
4	Digital workflow availability	4.39	0.86	5 (4-5)	340 (85.00)	5.74
5	Oral hygiene status	4.38	0.80	5 (4-5)	340 (85.00)	5.65
6	Long-term maintenance and follow-up	4.33	0.81	5 (4-5)	333 (83.25)	5.45
7	Condition of adjacent teeth	4.32	0.79	4.5 (4-5)	337 (84.25)	5.40
8	Economic considerations	4.25	0.82	4 (4-5)	328 (82.00)	5.13
9	Aesthetic expectations	4.15	0.91	4 (4-5)	308 (77.00)	4.84
10	Patient preference	4.12	0.91	4 (4-5)	308 (77.00)	4.80

High rating denotes a score of 4 or 5 on the six-point importance scale. IQR, interquartile range; SD, standard deviation.

Factors influencing implant-supported overdenture versus fixed prosthesis decisions

Retention and stability ranked highest in the complete-arch domain (mean 4.42; 87.75% high or extremely high), followed by bone quality and quantity (mean 4.42), digital workflow availability (mean 4.39), ease of prosthetic repair or modification (mean 4.39), and number of implants and load distribution (mean 4.35). Treatment time ranked lowest (mean 4.05), although 72.00% rated it high or extremely high (Table 5).

After Holm adjustment, retention and stability did not differ significantly from bone quality, ease of repair or modification, digital workflow availability, implant number and load distribution, surgical complexity and risk, aesthetic expectations, or economic feasibility and maintenance cost. It was rated more highly than patient preference for fixed or removable treatment and treatment time (both adjusted $P < 0.001$).

Table 5. Importance ranking of factors influencing implant-supported overdenture versus fixed implant-supported prosthesis selection

Rank	Factor	Mean	SD	Median (IQR)	High rating, n (%)	Mean rank

1	Retention and stability	4.42	0.75	5 (4-5)	351 (87.75)	5.91
2	Bone quality and quantity	4.42	0.76	5 (4-5)	352 (88.00)	5.86
3	Ease of prosthetic repair or modification	4.39	0.80	5 (4-5)	336 (84.00)	5.85
4	Digital workflow availability	4.39	0.85	5 (4-5)	344 (86.00)	5.86
5	Number of implants and load distribution	4.35	0.81	5 (4-5)	338 (84.50)	5.68
6	Surgical complexity and risk	4.32	0.76	4 (4-5)	342 (85.50)	5.48
7	Aesthetic expectations	4.30	0.83	5 (4-5)	330 (82.50)	5.48
8	Economic feasibility and maintenance cost	4.29	0.79	4 (4-5)	334 (83.50)	5.36
9	Patient preference for fixed or removable treatment	4.11	0.88	4 (4-5)	305 (76.25)	4.81
10	Treatment time	4.05	0.94	4 (3-5)	288 (72.00)	4.70

High rating denotes a score of 4 or 5 on the six-point importance scale. IQR, interquartile range; SD, standard deviation.

Associations with participant characteristics

Domain scores did not differ significantly by gender after Holm correction. Age was not significantly correlated with cement selection (rho = -0.072), fixed partial denture versus implant (rho = -0.054), or complete-arch scores (rho = -0.069); the adjusted P value was 0.456 for each correlation.

Professional group was strongly associated with all three domains. Compared with general dentists, prosthodontic specialists or trainees and respondents from other specialties reported higher scores for cement selection, fixed partial denture versus implant, and complete-arch decisions (all pairwise adjusted $P < 0.001$). The two specialist groups did not differ significantly. Effect sizes were substantial, with epsilon-squared values of 0.368, 0.426, and 0.463 across the three domains.

Practice setting was also associated with every domain. Respondents working in government or private hospital-based educational institutions assigned higher scores than private practitioners (all pairwise adjusted $P < 0.001$). Scores did not differ between the two institutional settings. Epsilon-squared values ranged from 0.162 to 0.175 (Table 6).

Table 6. Domain scores according to professional group and practice setting

Comparison	Category	Cement selection	FPD vs implant	IOD vs FISP
Professional group	Prosthodontic specialist/trainee	4.40 (4.20-4.60)	4.60 (4.40-4.70)	4.50 (4.40-4.70)
	Other specialty specialist/trainee	4.40 (4.30-4.60)	4.60 (4.40-4.70)	4.50 (4.30-4.70)
	General dentist	3.80 (3.60-4.20)	3.90 (3.60-4.20)	3.90 (3.60-4.10)
Practice setting	Private hospital and educational institution	4.40 (4.20-4.60)	4.60 (4.40-4.70)	4.50 (4.30-4.60)
	Government hospital and educational institution	4.40 (4.20-4.60)	4.50 (4.40-4.70)	4.50 (4.30-4.60)
	Private practice	4.00 (3.70-4.40)	4.20 (3.70-4.50)	4.10 (3.70-4.50)

Values are median (IQR). Professional group: cement $H = 147.912$, epsilon-squared = 0.368; FPD vs implant $H = 171.194$, epsilon-squared = 0.426; IOD vs FISP $H = 185.813$, epsilon-squared = 0.463. Practice setting: cement $H = 71.321$, epsilon-squared = 0.175; FPD vs implant $H = 66.303$, epsilon-squared = 0.162; IOD vs FISP $H = 66.815$, epsilon-squared = 0.163. All omnibus $P < 0.001$. FISP, fixed implant-supported prosthesis; FPD, fixed partial denture; IOD, implant-supported overdenture; IQR, interquartile range.

DISCUSSION

The present study showed that dentists prioritized biological durability, mechanical predictability, and long-term prognosis. Marginal seal led cement selection, prognosis and bone quality dominated the fixed partial denture versus implant decision, and retention and stability ranked highest for complete-arch rehabilitation. The small Kendall's W values indicate modest separation among factors that were generally regarded as important.

For cement selection, marginal seal clustered with retention in short preparations, bond strength, solubility resistance, and crown retention. These properties collectively determine resistance to microleakage and decementation. Clinical studies have demonstrated satisfactory outcomes for both glass ionomer-based and

self-adhesive resin cements when zirconia restorations are used under favourable conditions [12,13]. Thus, the results support indication-based selection rather than routine preference for one cement. Handling and excess removal remained relevant after biological and mechanical requirements were satisfied. Reported gaps in cement knowledge among dental learners further support preparation-specific teaching [14].

Prognosis and bone quality were the principal factors distinguishing a fixed partial denture from an implant. Implant-supported prostheses demonstrate high survival, although biological and technical complications remain clinically relevant [15]. The condition of adjacent teeth must therefore be considered with bone availability, surgical risk, maintenance, and the likely consequences of failure. When abutment teeth are healthy, implant treatment may preserve tooth structure; when bone or soft tissue is deficient, a tooth-supported option may be more proportionate. This agrees with risk-based frameworks that discourage treating implant placement as the automatic replacement for every missing tooth [16].

Retention, stability, bone quality, repairability, and load distribution led complete-arch decisions. Patient-reported evidence confirms that both fixed and removable implant rehabilitation can improve satisfaction, but each design presents different hygiene and maintenance demands [17,18]. Comparative clinical findings suggest that overdentures may facilitate cleaning, whereas fixed prostheses may better satisfy patients seeking a non-removable solution [19]. The high score for implant number and load distribution was also justified, because implant quantity should be interpreted together with arch anatomy and prosthesis design [20]. Repair planning remains essential owing to the continuing possibility of biological and technical complications [21].

Digital workflow availability ranked highly in both implant-related domains. Nevertheless, full-arch applications require greater verification than single-unit and short-span digital impressions [22]. Professional group produced the largest differences: postgraduate-trained respondents assigned higher importance than general dentists. Educational exposure may broaden risk assessment, while evidence-access barriers can influence routine practice [23]. Earlier survey evidence also indicates that training and experience modify prosthodontic recommendations [24].

Clinically, the findings support structured decision aids incorporating prognosis, anatomy, retention, maintenance, cost, and informed patient preference. Case-based learning tools may improve calibration across practice settings [25]. The study's large complete sample and ordinal-appropriate analysis strengthen the findings; however, convenience sampling, self-reported priorities, and the regional setting should be considered when applying them elsewhere. Future multicentre studies should compare stated priorities with actual treatment choices and evaluate whether structured decision aids improve consistency and patient understanding.

CONCLUSION

Dentists in Maharashtra placed greatest emphasis on biological durability, mechanical stability, and long-term prognosis when making prosthodontic decisions. Marginal seal led cement selection; prognosis and bone quality led fixed partial denture versus implant selection; and retention and stability led the choice between implant-supported overdenture and fixed implant-supported prosthesis. Professional training and hospital-based educational practice were associated with broader attribution of importance across decision domains, whereas gender and age were not. Structured, evidence-informed decision aids may help standardize risk assessment and strengthen communication of reasonable treatment alternatives.

DECLARATIONS

Ethics approval and consent to participate

The protocol was approved by the Institutional Ethics Committee of Nair Hospital Dental College, Mumbai. All participants provided electronic or written informed consent before completing the questionnaire.

Funding

No external funding was received for this study.

Conflicts of interest

The authors declare no conflicts of interest.

Data availability

De-identified data supporting the findings are available on reasonable request, subject to institutional and ethical requirements

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How to Cite this Article: Agarwal H., Kulkarni R., Phansalkar G., Sarode S., Chaugule P., Jadhav A.. (2026). Clinical Factors Guiding Prosthodontic Treatment Decisions Among Dentists in Maharashtra, India: A Cross-Sectional Survey. *AJM*, ***9***(2), 103-111. https://doi.org/10.48165/ajm.2026.9.02.19