

# APPROACH OF DENTAL PRACTITIONERS TOWARDS THE SELECTION OF IMPLANT DESIGNS; A CROSS-SECTIONAL STUDY

<sup>1</sup>AQSA SHAUKAT, <sup>2</sup>NIDA ZEHRA, <sup>3</sup>MUHAMMAD KALEEM

## ABSTRACT

*To investigate the choices made by dental practitioners in selection of the implant prosthesis. A twelve-question survey was designed regarding basic choices in dental implant selection. Dentists from institutes of twin cities were asked to record their response. The data obtained formed the basis for assessment. Overall response rate for the survey was 75%. No variable revealed significant association to the designation or the experience of the clinicians statistically ( $p \leq 0.05$ ). The Straumann and Bio Horizon implant systems are the most used implant systems. Within study limitations, most dentists select implants based on cost effectiveness, ease of use, availability, and thread design. To increase surface area, the presence of micro-threads is preferred over thread pitch and thread depth. The glass ionomer and resin cement are mainly used for placement of prosthesis*

**Keywords:** Dental implant; Practices; Selection; Implantology; Survey.

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## INTRODUCTION

Dental implants are widely accepted as primary method of treatment for single missing teeth, multiple adjacent missing teeth or for support of fixed or removable prosthesis for completely edentulous patients.<sup>1</sup> The utilization of implants varies widely with different countries of the world with maximum acceptance in European countries. In Pakistan, many well-educated populations do prefer implants but only if they are aware of this treatment modality whereas many underprivileged people avoid this treatment due to its cost.<sup>2</sup>

Dental implants have the highest survival rate compared with other types of prosthesis.<sup>1</sup> Unlike fixed restorations they won't fail due to decay or require endodontic treatment. They can also be used successfully as drug carriers due to which periodontal diseases can be avoided in implants better than a tooth.<sup>3,4</sup> However, like any other modality there is a flip side to implant restorations as well. Along with all the benefits comes situations that are more unique to implant dentistry. These unique situations include treatment planning, the fabrication of the restoration, the occlusion, the

maintenance, and the treatment complications like screw loosening, crestal bone loss, prosthesis fracture or implant failure.<sup>1</sup>

Treatment planning for implant-supported prosthesis can be compared to the construction of a building as it involves designing a prosthesis using biomechanical principles. According to stress treatment theorem<sup>2</sup> almost all treatment relating implant dentistry should be centered around biomechanical aspect of stress. Biomechanically based implant treatment plan can reduce and even eliminate many complications.<sup>1,2</sup>

The stress treatment theory has evolved into sequence of treatment planning which includes prosthesis designing, analyzing patients force factors and then bone density followed by planning implant numbers and positioning, implant size, available bone, and implant design. The last step in this sequence is selection of implant design.<sup>1</sup>

There is a wide variety of implants available in the market. The selection of an implant can be a tedious task. An implant has multiple micro and macro design features. The implant macro design is the easiest method to increase surface area significantly and decrease overall risk to the implant interface.<sup>1,2</sup> There are eleven different variables identified that affect the overall functional surface area of an implant and each one can be used for increasing anchorage and reduce chances of overloading.<sup>2</sup>

Every dentist gathers their own experience based on years of practice. Each clinician may have their own

<sup>1</sup> Dr Aqsa Shaukat, Corresponding author: MPhil Trainee, Dental Materials, Email: xaatif@gmail.com

<sup>2</sup> Dr Nida Zehra, Assistant Professor, Department of Dental Materials, AM College NUMS, Email: nidaxehra@gmail.com

<sup>3</sup> Dr Muhammad Kaleem, Associate Professor, Department of Dental Materials, AM College NUMS, Email: mkaleem@amc.numspak.edu.pk

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preferences for design features. This study was designed to investigate these choices made in the selection of an implant.

**METHODOLOGY**

A cross sectional study was performed in twin cities (Rawalpindi and Islamabad) including four dental institutes (AFID, MIHS, IIDC and RMDC) and private clinics from 1<sup>st</sup> September 2021 to 10<sup>th</sup> October 2021. Since the response from private clinics was very low i.e., 13 out of 68 responded, and clinics belonged to different populations, the data was excluded from the study. Only the data from above mentioned institutes was included in the study. Every institute usually has 3 or 4 dentists for placing implants according to their patients’ demands. So, the overall population size of these institutes was estimated to be 25.

Non-probability convenience sampling was done in this survey. The sample size of 24 was determined by using Rao soft sample size calculator, keeping the level of confidence at 95%. The study included the clinicians working on implant supported prosthesis. The consultants, the residents and C-implant certified dentists were all included in the study. The clinicians who failed to respond after being repeatedly approached were excluded.

Data was collected using a twelve-question survey questionnaire. Questionnaire addressed questions regarding preferences of dentists regarding implant design. The collected data included clinician’s demographics (age, gender, designation, and clinical experience), choice of implant system, preferred implant coating, implant thread designs, preferred cement, and retention mode. The collected data was analyzed and interpreted using SPSS version 21. Level of association between experience of clinicians and the variables was calculated using Pearson’s chi-square test.

**RESULTS**

The overall response rate for the survey was 75%. The missing data was mainly due to the questionnaire not being returned. The demographic details are shown in figure 1. No variable revealed significant association to the designation or the experience of the clinicians statistically ( $p \leq 0.05$ ). The Bio Horizon (38%) and Straumann (33%) implant systems are being preferred by clinicians with variable experiences. The clinicians with experience of beyond 10 years are choosing Straumann (1), Nobel BioCare systems (1) and Osteo dent system (1). The 55% of respondents mentioned the reason of their preference to be cost effectiveness. The choice of surface treatment for majority clinicians were calcium phosphate/hydroxyapatite coating (27%) and

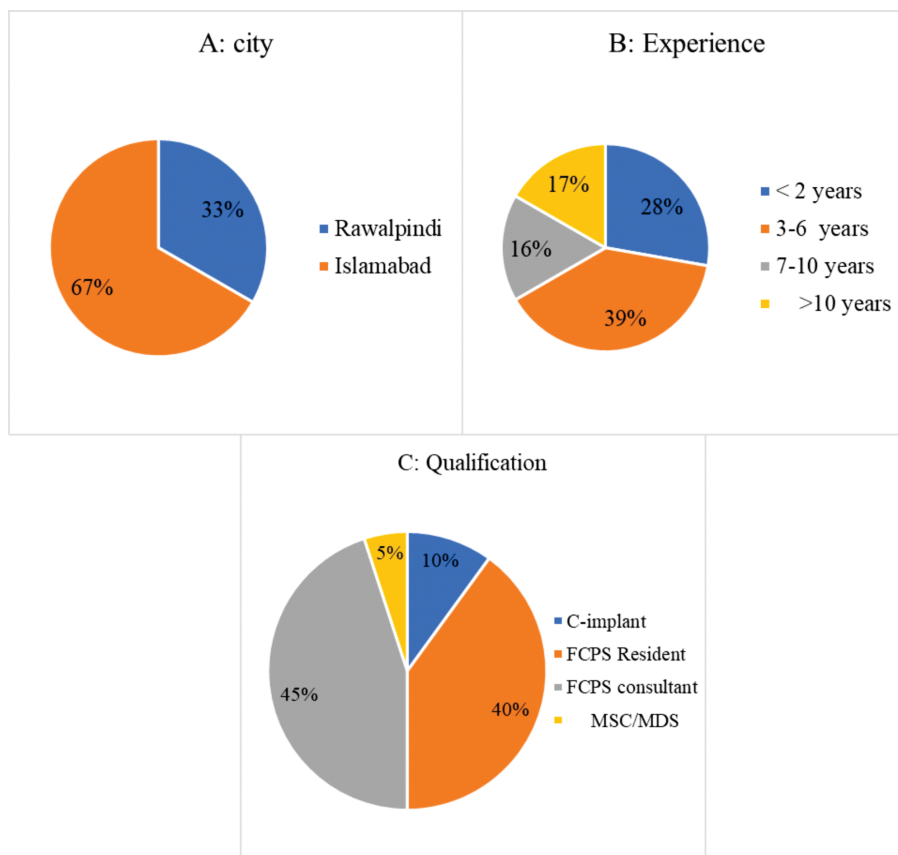


Fig 1: Demographic data: (A) City (B) Experience (C) Qualification

TABLE 1: THE DESCRIPTIVE ANALYSIS OF VARIABLES AND ASSOCIATION BETWEEN EXPERIENCE OF CLINICIANS AND VARIABLES RELATED TO THEIR PREFERENCES REGARDING IMPLANT MATERIAL

S.NO.	VARIABLES	N	%	EXPERIENCE				P-VALUE
				< 2 YRS.	3-6 YRS.	7-10 YRS.	>10 YRS.	
1	Choice of implant system							0.15
	Bio horizon implant system	7	38%	0	6	1	0	
	Nobel bio care implant system	1	5%	0	0	0	1	
	SGS implant system	1	5%	0	1	0	0	
	Straumann	6	33%	1	2	2	1	
	Any other	3	16%	0	2	0	1	
2	Reason for preference							0.39
	Cost friendly	8	44%	1	5	2	2	
	Conveniently available	3	16%	1	1	1	1	
	Implant thread geometry	5	27%	0	3	0	0	
	Implant material	2	11%	0	2	0	0	
	Surface coating	2	11%	0	2	1	1	
	Other	3	16%	0	0	1	1	
3	Choice of surface treatment							0.29
	Bio glass coating	0	0%	0	0	0	0	
	HA/calcium phosphate	5	27%	5	0	0	0	
	Sand blasted larger grit Acid etched (SLA)	5	27%	1	3	0	1	
	Laser Lok	3	16%	1	1	1	0	
	Don't consider	5	10%	0	2	1	2	
4	Preferred design feature							0.017
	Presence of Micro threads	5	27%	0	4	1	0	
	Thread pitch	2	11%	0	0	2	0	
	Thread shape	4	22%	1	2	0	1	
	Thread leads	1	5%	0	1	0	0	
	Thread depth	2	11%	0	1	1	0	
		Do not consider	5	27%	0	3	0	
5	Preferred thread shape w.r.t location							0.58
	Square	3	16%	0	2	1	0	
	Trapezoid	0	0%	0	0	0	0	
	V-shaped	6	33%	1	3	0	2	
	Spiral	4	22%	1	2	0	1	
	Don't consider	15	83%	2	6	3	4	
6	Preferred abutment choice							0.85
	Ceramic	3	10%	0	2	1	0	
	CP Titanium	3	10%	1	2	0	0	
	Titanium alloy	11	61%	0	7	2	2	

7	Choice of cement							0.14
	Glass ionomer cement	11	61%	0	7	2	2	
	Zinc oxide eugenol	0	0%	0	0	0	0	
	Zinc polycarboxylate cement	0	0%	0	0	0	0	
	Any other	7	39%	1	4	1	1	
8	Choice of retention mode							0.51
	Cement retention	5	27%	0	4	1	0	
	Screw retention	6	33%	1	3	1	1	
	Both	7	39%	1	0	1	5	

sandblasted acid etched surface (27%). The preferred thread design feature for increasing surface area is thread shapes (22%) and micro threads (10%). 83% respondents do not favour thread shapes in relation to the location in oral cavity. The preferred abutment was titanium alloy abutment (61%). The glass ionomer cement (61%) and resin cements (39%) are more often selected for cement-retention of prosthesis.

The descriptive analysis of variables is mentioned in table 1.

## DISCUSSION

Implant therapy was introduced by Brane mark in the 1960s and has been successful for decades ever since. It offers a long-term solution to partial and complete loss of teeth so a lot more people are convinced of its use.

A long variety of systems are available in the international market. These systems differ in terms of overall design of implant body, the apex, the number, shape and pitch and depth of threads, and the surface treatments. However, only limited number of systems are available in Pakistan. In order to find out choices made by our clinicians' this survey included questions regarding preferences in implant selection. The clinicians with different designations and experience levels participated in the study.

The initial requirements for clinical acceptance of dental implants are regulated by experts in industry but it is ultimately the dentists' decision on which implant system should be used in clinical practice. The present study results showed Bio Horizon (38%) is mostly used implant system in twin cities followed by Straumann implant systems (33%). However, there is a statistically insignificant association between the preference of clinicians for implant systems based on their experience. Similar results were mentioned in another study.<sup>5</sup> In multiple international studies<sup>6-10</sup>, the systems preferred were Nobel Biocare, Implantium, Osstem, Biohorizon, Straumann and ITI. ITI and Nobel Biocare were used mostly in Europe and in US. However, Branemark, TiUnite, Straumann and AstraTech

are popular implant systems in the Toronto, Ontario, Canada area while ITI, Implantium and densply in Iran and UAE.<sup>8</sup>

The preference for any implant system can be due to multiple reasons. Dentists may consider cost, design features, longevity, amount of bone loss, literature support on success rates, survival rates, incidence of complications, customer service, ease of placement and patient satisfaction.<sup>10</sup> The marketing strategy of companies by conducting implant courses, makes an obvious product bias. Other reasons may be its cost, ease of performing surgical and prosthetic phases, availability of implants. Within limitations of this study, 44% mentioned the reason of preference to be cost effectiveness whereas 16% mentioned ease in availability. It is strongly recommended to use implant systems with thoughtful evaluation and in-depth knowledge of the surgical and prosthetic armamentarium.<sup>11</sup>

Dental implant surface is one of the essential features which determine early success of treatment. Several surface treatments methods are present which improve the rate of osseo-integration and the long-term biomechanical anchorage of the implant.<sup>12</sup> A rough surface increases cellular response. In the presence of excess roughness, especially in the upper threads increases the chances of peri-implantitis. A moderate roughness of 1-2 µm is the most suitable.<sup>12</sup> In the survey, many respondents showed preference for SLA and HA/calcium phosphate treated implants. However, multiple showed preferences for other surface treatments as well.

A conventional threaded implant can increase surface area up to 30% as compared to a smooth cylindrical implant.<sup>1</sup> The 27% of respondents favour thread shape for increasing surface area while 22% respondents preferred the presence of micro threads on implant. Literature search shows many studies<sup>13-15</sup> favouring micro threads. A study by Chowdhary et al., 2015 reports that the presence of micro threads promotes bone formation and give good stress distribution in cancellous bone.<sup>15</sup>



The results have shown that clinicians have no preferences for thread shapes with respect to location. However, the majority chose square or trapezoid thread design. Implant thread shape influences the type of force transferred to the surrounding bone.<sup>16</sup> Presently available thread designs like V-shape, square shape, buttress, reverse buttress, and spiral shape, differ in their face angles. As the thread face angle increases the amount of shear force generated increases.<sup>17</sup> The face angle can modify the direction of occlusal load imposed on the prosthesis and abutment connection to a different direction at the bone interface.<sup>18</sup> A study shows that shear forces in a V-thread and reverse buttress thread is ten times greater than the shear force on a square thread.<sup>19</sup>

Implant abutments can be classified based on their type of material, its retention mode, its fabrication, and connection type. In this study preference for material and retention was included. In this study, 10% clinicians preferred ceramic material whereas 61% mentioned titanium material as first choice. Both materials have shown good results zirconia abutments on one hand have better esthetics along with strength, but titanium implants have always shown excellent biocompatibility.<sup>20</sup>

The preferred retention mode was screw type (33%), but many chose an option for both (27%). The selection basically depends on intra oral conditions more than personal preference. However, the reason for choice of screw retention mode may be because of its retrievability property.<sup>21</sup> This finding is similar to results reported for Pakistan in an international survey of 2009.<sup>22</sup>

According to results, total 61% clinician prefer GIC for cementation. Multiple studies<sup>23-26</sup> report that zinc phosphate has the highest retention property and minimum microleakage as compared to other cements however results obtained in few studies also state that resin cement is superior for the implant prosthesis cementation due to its adhesion property and marginal adaptation.<sup>27,28</sup>

### **Limitations and recommendations**

The study represents data from institutes only, the representation of private clinics could be included as well. The data on preferences, practice decisions, the success and failure reports can help to analyse overall implant practice. The preferences and practices of experts can guide non-experts in decision making benefitting from the knowledge of expert practitioners.

### **CONCLUSION**

1. The Straumann and Bio Horizon implant systems are the most preferred implant systems in Rawalpindi and Islamabad due to their cost effectiveness

and thread geometry.

2. Within study limitations, most dentists select implants based on cost effectiveness, ease of use, availability, and thread design.
3. To increase surface area, the presence of micro-threads is preferred over thread pitch and thread depth.
4. The glass ionomer and resin cement are mainly used for placement of prosthesis.

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**CONTRIBUTIONS BY AUTHORS**

- |                           |  |
|---------------------------|--|
| <b>1 Aqsa Shaukat:</b>    | Wrote article                            |
| <b>2 Nida Zehra:</b>      | Data collection                          |
| <b>3 Muhammad Kaleem:</b> | Supervised research, Final proof reading |