Aims and Scope

Aims

JRCD is an international, open access journal for the dental community. JRCD supports scientific innovations, clinical and experimental research within the whole field of dentistry and its related fields.

Our aim is to provide rigorous peer review, enable rapid publication of cutting-edge research and to create a platform and forum for ideas, opinions, developments and key issues in dentistry for readers to spark debate and discussion.

Manuscript categories: Original scientific research articles, systematic reviews/meta-analyses, comprehensive reviews, communications, case reports, case series, letters, commentaries, editorials. Conference proceedings are also welcomed and other expressions of interest should be directly communicated to the Editors.

Scope

Topics of interest include, without being limited to the following areas:

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    - Oral Physiology
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    - Oral Pathology
    - Inflammation
    - Tumors
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    - Plaque Reduction
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    - Dental Orthopedics
- Dental Biomaterials Science
    - Dental Materials
    - Biocompatibility
    - Biomaterials
- Orthodontics
    - Orthodontic Appliances
    - Dental Orthopedics
    - Orthodontics
    - Dental, Oral and Facial Growth
- Pediatric Dentistry
    - Fissure Sealing
    - Early Dental Care
    - Primary Dentition and Caries

- Early Dental Care
- Primary Dentition and Caries
- Medical Emergencies in Dentistry
- Translational Research

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Bridging Dentistry and Business: Preparing Undergraduates for the Realities of Practice.

Gulmeena Masood

Department of Oral Pathology, Rehman College of Dentistry, Peshawar, Pakistan

With the rapid increase in private dental colleges and the growing number of dental graduates, the profession is experiencing significant saturation across both clinical and academic fields.[1] Despite this expansion, undergraduate training continues to focus primarily on clinical competence and academia, while an equally important dimension—business and practice management—is often overlooked. As a result, many young dentists enter professional life unprepared for the practical realities of running a clinic. Challenges such as purchasing dental materials, negotiating with vendors, managing staff, handling finances, and maintaining budgets frequently contribute to the early downfall of new practices. Clinical excellence alone does not guarantee success; effective financial and managerial skills are equally essential. Even in basic sciences, faculty and laboratories face similar challenges in managing resources and equipment, underscoring the need for business acumen across all domains of dentistry. Therefore, integrating business education into undergraduate dental training is becoming increasingly important for preparing graduates to thrive in the realities of modern practice.[2]

While the need for business education in dentistry is undeniable, its inclusion in undergraduate training comes with both advantages and challenges. On the positive side, such training can better prepare students for future professional endeavors, enabling them to manage time, finances, and resources effectively. Early exposure to business principles can protect young graduates from financial losses, reduce the stress of running a clinical setup or laboratory, and help them cope with the economic pressures that often contribute to anxiety and burnout.[3] Furthermore, in an increasingly saturated job market, business acumen allows dental graduates to explore diverse career pathways beyond traditional academia or clinical practice.[4]

On the other hand, the already demanding curriculum and clinical rotations place significant pressure on students, and the addition of another subject may risk overwhelming them. Implementing a structured business module would also require careful planning, curriculum redesign, and allocation of resources, all of which may initially face resistance from institutions faculty and put pressure on the students. Despite these challenges, the long-term benefits of producing well-rounded dental professionals suggest that a balanced and phased integration of business education is worth pursuing.

In today's evolving dental landscape, success is no longer defined by clinical expertise alone—especially considering the uncertainty witnessed during the COVID-19 pandemic.[5] Hospital jobs were at risk due to reduced patient flow, and private clinics faced sudden financial setbacks that few were prepared for, largely because business and financial management were never part of our formal training. To be better equipped for such challenges in the future, dentists must combine technical skills with sound business judgment. While introducing business education into an already demanding undergraduate curriculum may present challenges, the benefits of providing future dentists with financial literacy, management skills, and entrepreneurial insight far outweigh the drawbacks. A carefully designed and gradually implemented approach can ensure that students are not overburdened, while still preparing them for the multifaceted realities of practice. Ultimately, bridging dentistry and business is not merely an academic addition—it is a crucial step toward empowering graduates to build sustainable careers, deliver better patient care, and adapt confidently to the changing dynamics of the profession.

Corresponding Author:
Gulmeena Masood
Department of Oral Pathology, Rehman College of Dentistry, Peshawar, Pakistan
Email: gulmeena.masood@rmi.edu.pk

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Current Trends in Orthodontics Practices, Regarding the use of Fixed Appliances and its Components Amongst Specialist Orthodontist in Pakistan

Samia Rahman[1], Bushra Amin[2], Asma Javaid[3], Nayab Hassan[4], Muhammad Zaheen[1], Ali Hassan Qureshi[1]

1. Department of Orthodontics, Saidu College of Dentistry, Swat Pakistan
2. Department of Orthodontics, Khyber College of Dentistry, Peshawar Pakistan
3. Dr. Wafaa Tulbah Clinics, Saudi Arabia
4. Khyber Medical University, Institute of Dental Sciences, Kohat, Pakistan

Abstract

Introduction: Orthodontics has come a long way, with remarkable global advancements in appliances and materials that have transformed patient care. From cutting-edge bracket systems to innovative arch wires and bonding techniques, these developments have made treatments more comfortable and effective.

Objective: This study aimed to assess current trends in orthodontic practice in Pakistan by evaluating the usage patterns of fixed appliances and their components among practicing orthodontists.

Material and Methods: A cross-sectional, nationwide survey was conducted from September 2024 to February 2025, targeting orthodontic consultants, residents, and general dentists registered with PMDC. A total of 110 responses were collected via a structured digital questionnaire. Descriptive statistics, chi-square tests, and association analyses were used to evaluate the data.

Results: Conventional metal brackets (75.5%) with MBT prescription (81.8%) and metal material (97.3%) were the most commonly used. The 0.022-inch slot size (82.7%), light-cure composite resin (96.4%), and direct bonding technique (96.4%) were preferred. Bands were favored for molar attachments (70.9%), and continuous mechanics (80%) with elastomeric power chains (70%) were the preferred space closure strategies. Aligners (0.9%) and ceramic brackets (1.8%) had minimal adoption. Significant associations were found between demographic factors and preferences for bracket slot size and molar attachments.

Conclusion: Orthodontic practices in Pakistan align with global standards in many respects but lag in adopting advanced technologies like aligners and self-ligating brackets. Economic limitations, training gaps, and accessibility are major barriers. Future research should explore longitudinal trends, regional comparisons, and strategies to enhance the adoption of modern orthodontic tools and techniques.

Keywords: Orthodontic trends, Bracket systems, Bonding techniques, Aligners, Orthodontic materials

Introduction

Orthodontics has come a long way, with remarkable global advancements in appliances and materials that have transformed patient care. From cutting-edge bracket systems to innovative arch wires and bonding techniques, these developments have made treatments more comfortable and effective.[1,2] As a result, orthodontists worldwide are tailoring their approaches to align with their treatment philosophies, a trend reflected in national surveys that track shifts in orthodontic practices.[3] Studies from developed countries often highlight the adoption of modern techniques, such as advanced bonding methods, diverse bracket types, and new arch wire materials, showcasing how the field is evolving to meet contemporary demands.

In Pakistan, however, the picture is less clear. Despite the global wave of innovation, there's little data on how orthodontic practices are adapting locally. The country's orthodontic scene is rapidly changing, fueled by a growing number of postgraduate programs training a new generation of orthodontists who are embracing different techniques compared to their predecessors.[4] Understanding these emerging trends is critical. It offers a window into how Pakistani orthodontists are integrating modern appliances, materials, and equipment, and whether they're keeping pace with global standards.[5]

Corresponding Author:
Samia Rahman
Department of Orthodontics, Saidu College of Dentistry, Swat Pakistan
Email: samiarahman50@gmail.com

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While research from developed nations has thoroughly explored evolving orthodontic techniques, Pakistan lacks comprehensive insights into the preferences and material choices of its practitioners. Uncovering these trends and the factors driving them is vital for aligning local practices with international benchmarks and overcoming barriers to adopting advanced technologies. This study aims to fill this gap by examining the preferences for orthodontic appliances, bonding techniques, and material usage among a representative sample of Pakistani practitioners.

This study set out to explore current trends in orthodontic practice across Pakistan through a national survey. It focused on the use of fixed appliance materials—such as bracket types, bracket slots, bonding techniques, and arch wires—while considering key factors like cost-effectiveness, treatment efficiency, duration, and finishing quality.

Material and Methods

A cross-sectional study conducted from September 2024 to February 2025.The survey will be conducted across multiple institutions with orthodontic departments, involving orthodontic consultants, orthodontic residents, and clinicians across Pakistan. The sample size estimation was based on an approximate population of 300 orthodontists in Pakistan. A census-based approach was adopted, distributing the questionnaire through professional networks, email, and direct contact. Using Cohen's $w = 0.3$, $\alpha = 0.05$, and 80% power, the minimum required number for chi-square tests was determined to be 88 participants. The study successfully collected 110 responses (36.7% response rate), which was adequate for descriptive analysis, chi-square tests, and multinomial logistic regression. However, potential non-response bias remains a limitation. The survey was distributed among orthodontic consultants having fellowship or membership in the specialty, Resident orthodontists and General

practitioners (Bachelor of Dental Surgery - BDS) registered with PMDC. However Practitioners without PMDC registration and individuals no longer engaged in clinical practice were excluded. This study was approved by the Ethical Review Board under approval number 198-ERB-024.

Descriptive statistics, including frequencies and percentages, were utilized to summarize respondent's demographic characteristics, educational backgrounds, and clinical preferences. Chi-square tests were applied to assess associations between categorical variables, identifying significant relationships between professional factors and orthodontic treatment choices.

A digital questionnaire was designed using Google Forms. It underwent an initial pilot test, followed by revisions based on feedback, and a second pilot test before final distribution. The survey was disseminated via social media platforms to maximize reach. The questionnaire consists of two main sections: **Demographic Information** (e.g., age, gender, institution, and experience) (see Annexure I) and **Fixed Appliances and Components Usage** (see Annexure I) Reminders were sent 2 weeks after the initial distribution to encourage participation. A follow-up reminder was sent to non-responders one month after the first reminder. The survey was thoroughly reviewed by the authors to ensure clarity and precise wording before final distribution.

Results

The gender distribution among respondents is nearly equal, with 51.8% male and 48.2% female. However the educational qualifications vary, with 34.5% enrolled in residency programs, and 52.8% having completed fellowship. A smaller percentage are holding only BDS degree.

Table 1: Sociodemographic, Academic, and Qualification Profile of the Respondents.

Question	Response	Count (n)	Percentage (%)
Gender	Female	53	48.2
	male	57	51.8
Age	30-40	46	41.8
	Above 40	9	8.2
	Below 30	55	50.0
Educational Qualification	General Dentist	14	12.7
	Consultant	58	52.8
	Resident Orthodontics	38	34.5

Table 2 shows most practitioners prefer conventional metal brackets as shown in Figure 1 (75.5%) with MBT prescription (81.8%) and metal bracket material (97.3%). The dominant bracket slot size is 0.022 inches (82.7%). Light-cure composite resin is the adhesive of choice (96.4%), and direct bonding is the most widely used technique (96.4%). Regarding molar attachments, bands (70.9%) are more commonly used than bonded molar tubes.

Table 3 is dedicated to the frequency analysis of treatment strategies in Orthodontics as depicted in Figure 2. Continuous mechanics (80.0%) and elastomeric power chains (70.0%) are preferred for space closure. Elastic separators (99.1%) are widely used.

Table 2: Distribution of Bracket and Bonding Preferences in Orthodontic Treatment

Question	Response	n	%
Which Orthodontic Modality Do You Use Most Frequently?	Aligners (e.g.,Invisalign)	1	0.90
	Conventional metal brackets	83	75.5
	Edgewise metal brackets	24	21.8
	Self-ligating Brackets	2	1.8
Which Bracket Prescription Do You Use Most Frequently?	Andrews	5	4.5
	MBT	90	81.8
	Roth	15	13.6
Which Bracket Types Do You Use Most (Based on Material)?	Ceramic	2	1.8
	Metal	107	97.3
	Self-ligating	1	0.9
Slot Size of Brackets Used	0.018 inch	19	17.3
	0.022 inch	91	82.7
Which Adhesive Do You Most Commonly Use for Bonding?	Chemical-cure Composite Resin	2	1.8
	Glass Ionomer Cement	2	1.8
	Light-cure Composite Resin	106	96.4
Bonding Technique Most Commonly Used?	Direct Bonding	106	96.4
	Indirect Bonding	4	3.6
Type of Molar Attachments Used?	Bands	78	70.9
	Bonded Molar Tubes	32	29.1

Table 3: Distribution of Treatment Strategies in Ort

Question	Response	n	%	P-value
Space Closure Method Used?	Continuous Mechanics	88	80.0	0.0001
	Loop Mechanics	22	20.0	
Preferred Space Closure Technique?	Elastomeric Power Chain	77	70.0	
	NiTi Coil Spring	33	30.0	
Which Type of Separators Do You Use?	Elastic Separators	109	99.1	
	Metal Separators	1	0.9	

The distribution of bracket and bonding preferences in orthodontic treatment and distribution of treatment modalities preferences in orthodontic treatment are given in figure 1 and figure 2 respectively.

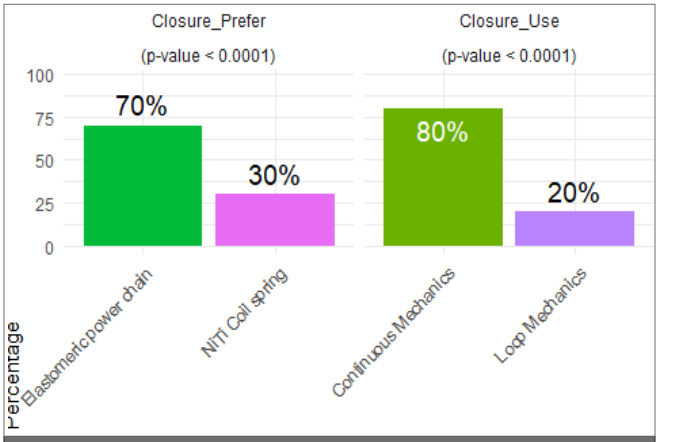

Figure 1: Distribution of Bracket and Bonding Preferences in Orthodontic Treatment

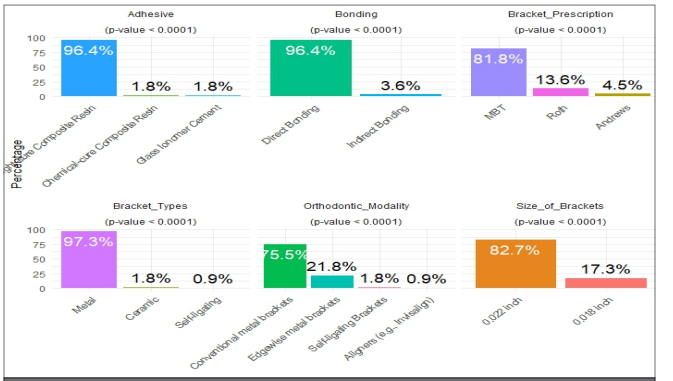

Figure 1: Distribution of Bracket and Bonding Preferences in Orthodontic Treatment

Table 4: Distribution and Association of Used Orthodontic Modalities with Demographic and Professional Characteristics

Demographic and Professional Factors		Which Orthodontic Modality Do You Use Most Frequently?								Chi-square (P-value)
		Aligners (e.g., Invisalign)		Conventional metal brackets		Edgewise metal brackets		Self-ligating Brackets		
		n	%	n	%	n	%	n	%	
Gender	Female	0	0.0	43	51.8	9	37.5	1	50.0	0.480
	Male	1	100.0	40	48.2	15	62.5	1	50.0	
Age	30-40	0	0.0	35	42.2	11	45.8	0	0.0	0.481
	Above 40	0	0.0	5	6.0	3	12.5	1	50.0	
	Below 30	1	100.0	43	51.8	10	41.7	1	50.0	
Educational Qualification	General Dentist	1	100.0	12	14.5	0	0.0	1	50.0	0.144
	Consultant	0	0.0	41	50.2	16	66.7s	1	50.0	
	Resident Orthodontist	0	0.0	30	36.1	8	33.3	0	0.0	

Table 5 and 6 shows non-significant association between demographic variables regarding bracket prescription, types of bracket material used. In contrast the chi-square tests for the table 7 show the significant association regarding choice of bracket prescription and molar band selection. Table 8 shows that none of the demographic factors have a statistically significant impact on the choice of bonding technique or adhesive ($p > 0.05$)

Table 5: Association between Demographic and Professional Characteristics and Bracket Prescription Preferences Among Orthodontists

Demographic and Professional Factors		Which Bracket Prescription Do You Use Most Frequently?						Chi-Square
		Andrews		MBT		Roth		
		n	%	n	%	n	%	
Age	30-40	0	0.00	39	43.33	7	46.67	0.286
	above 40	1	20.00	6	6.67	2	13.33	
	below 30	4	80.00	45	50.00	6	40.00	
Educational Qualification	General Dentist	3	60.00	4	4.44	7	46.67	0.000
	Consultant	1	20	50	55.55	7	46.66	
	Resident Orthodontist	1	20.00	36	40.00	1	6.67	

Table 6: Association between Demographic and Professional Characteristics and Bracket Type Preference Based on Material

Demographic and Professional Factors	Response	Which bracket types you use most based on material?						Chi Square (p-value)
		Ceramic		Metal		Self-Ligating		
		n	%	n	%	n	%	
Gender	Female	0	0.0	52	48.6	1	100.0	0.230
	Male	2	100.0	55	51.4	0	0.0	
Age	30-40	0	0.0	46	43.0	0	0.0	0.184
	Above 40	1	50.0	8	7.5	0	0.0	

Demographic and Professional Factors	Response	Which bracket types you use most based on material?						Chi Square (p-value)
		Ceramic		Metal		Self-Ligating		
		n	%	n	%	n	%	
Educational Qualification	Below 30	1	50.0	53	49.5	1	100.0	0.193
	General Dentist	1	50.0	12	11.2	1	100.0	
	Consultant	1	50.0	57	53.3	0	0.0	
	Resident Orthodontist	0	0.0	38	35.5	0	0.0	

Table 7: Association between Demographic and Professional Factors and Bracket Slot Size & Molar Attachment Preferences

Demographic and Professional Factors		Slot Size of Brackets Used				Chi-square (P-value)	Type of Molar Attachments you Use?				Chi-square (P-value)
		0.018 inch		0.022 inch			Bands		Bonded Molar Tubes		
		n	%	n	%		n	%	n	%	
Gender	Female	7	(36.8)	46	(50.5)	0.277	44	(56.4)	9	(28.1)	0.007
	male	12	(63.2)	45	(49.5)		34	(43.6)	23	(71.9)	
Age	30-40	1	(5.3)	45	(49.5)	0.002	28	(35.9)	18	(56.3)	0.008
	above 40	2	(10.5)	7	(7.7)		4	(5.1)	5	(15.6)	
	below 30	16	(84.2)	39	(42.9)		46	(59.0)	9	(28.1)	
Educational Qualification	General Dentist	8	(42.1)	6	(6.6)	0.001	11	(14.1)	3	(9.4)	0.004
	Consultant	6	32.5	52	57.2		15	42.3	25	78.1	
	Resident orthodontist	5	(26.3)	33	(36.3)		34	(43.6)	4	(12.5)	

Table 8: Association Between Demographic and Professional Factors and Most Commonly used Bonding Technique & Adhesive Most Commonly Used for Bonding

Demographic and Professional Factors	Bonding Technique Most Commonly you Use?				Chi-square	Which Adhesive Do You Most Commonly Use for Bonding?						Chi-square		(p value)
	Direct Bonding		Indirect Bonding			Chemical-cure Composite Resin		Glass Ionomer Cement		Light-cure Composite Resin				
	n	%	n	%		n	%	n	%	n	%			
Gender	Female		52	49.05	1	25.00	0.34	0	0.00	2	100.00	51	48.11	0.13
	male		54	50.94	3	75.00		2	100.00	0	0.00	55	51.88	
Age	30-40		46	43.39	0	0.00	0.12	1	50.00	1	50.00	44	41.50	0.23
	above 40		9	8.49	0	0.00		1	50.00	0	0.00	8	7.54	
	below 30		51	48.11	4	100.00		0	0.00	1	50.00	54	50.94	
Educational Qualification	General Dentist		14	13.20	0	0.00	0.47	0	0.00	1	50.00	13	12.26	0.21
	consultant		57	53.7	1	25.00		2	100.00	1	50.00	55	51.8	
	Resident		35	33.01	3	75.00		0	0.00	0	0.00	38	35.84	

The findings in Table 9 suggest that while age influences space closure method selection, space closure technique preference remains relatively stable across demographic groups.

Table 9: Association Between Demographic and Professional Factors and Preferred Space Closure Methods and Techniques

Demographic and Professional Factors		Space closure method you use commonly?				Chi-square (p-value)	Space closure technique you prefer?				Chi-(p-value)
		Continuous Mechanics		Loop Mechanics			Elastomeric power chain		NiTi Coil spring		
		n	%	n	%		n	%	n	%	
Gender	Female	42	47.72	11	50.00	0.84	38	49.35	15	45.45	0.70
	male	46	52.27	11	50.00		39	50.64	18	54.54	
Age	30-40	36	40.90	10	45.45	0.01	30	38.96	16	48.48	0.35
	above 40	4	4.54	5	22.72		8	10.39	1	3.03	
	below 30	48	54.54	7	31.81		39	50.64	16	48.48	
Educational Qualification	General Dentist	11	12.50	3	13.63	0.51	9	11.68	5	15.15	0.42
	Consultant	44	50	14	63.63		39	50.649	19	57.54	
	Resident Orthodontics	33	37.50	5	22.72		29	37.66	9	27.27	

Discussion

This study dives into the current state of orthodontic practices in Pakistan, shedding light on the tools and techniques orthodontists are using today. The findings reveal a clear preference for tried-and-true methods. Conventional metal brackets are the go-to choice for 75.5% of orthodontists, with the MBT prescription leading the pack at 81.8% and metal brackets dominating at 97.3%. This reliance on traditional techniques highlights their proven effectiveness, durability, and affordability. Orthodontists in Pakistan seem to trust these established methods to deliver solid results. Interestingly, studies from developed countries like the United States and the United Kingdom show a similar fondness for MBT prescriptions, praising their clinical efficiency and biomechanical advantages.[6,7] Another study by Brown and colleagues noted that MBT systems offer superior torque control and better finishing quality compared to other bracket types.[8]

One striking finding is the slow uptake of aligners (0.9%) and ceramic brackets (1.8%), despite their growing popularity in places like North America and Europe. Why the lag? It likely comes down to cost,

limited access to specialized training, and lower patient demand for these options in Pakistan. Aligners, for instance, require advanced digital technology and extensive training, which may not yet be widely available. A study by Patel and team found that aligners are booming in developed regions due to their aesthetic appeal and removability, but developing countries face similar adoption hurdles.[9] Meanwhile, Wang and colleagues pointed out that while aligners boost patient compliance and look great, their effectiveness in complex cases is still up for debate.[10]

When it comes to bonding, Pakistani orthodontists overwhelmingly favor light-cure composite resin (96.4%) and direct bonding techniques (96.4%), aligning with global standards. These methods provide strong adhesion and precise bracket placement, making them a reliable choice. Similarly, 70.9% of orthodontists prefer bands for molar attachments over bonded molar tubes (29.1%), sticking with traditional anchorage methods they find dependable. Research by Williams and team confirms that direct bonding remains the gold standard worldwide, though indirect bonding is gaining traction for its time-saving benefits.[11] Carter and colleagues also highlighted that indirect bonding can improve accuracy and reduce bracket failures.[12]

Pakistan's orthodontic field is buzzing with fresh talent. Half of the orthodontists surveyed are under 30, and 41.8% are between 30 and 40, with 34.5% still in postgraduate training and 52.8% working as consultants. This youthful, dynamic workforce points to a growing specialization in orthodontics. A similar trend was observed in India, where Sharma and team noted a surge of recent graduates entering the field, reflecting heightened interest in orthodontics across South Asia.[13] Roberts and colleagues added that younger orthodontists are often more open to experimenting with new treatment methods compared to their senior peers.[14]

Challenges in Adopting Advanced Technologies and Future Research Directions

Despite global advancements, technologies like self-ligating brackets (1.8%) and aligners (0.9%) remain rare in Pakistan, largely due to economic constraints and limited training opportunities. Kim and team suggest that embracing digital workflows could pave the way for broader access to these modern treatments.[15] Looking ahead, longitudinal studies could track how these trends evolve, while comparing Pakistan's experience with other developing countries might uncover shared challenges and solutions. Exploring patient perspectives on affordability and treatment preferences could also provide deeper insights. Gonzalez and colleagues found that patient education and financial incentives can boost technology adoption, while Martinez and team emphasized that continuing education builds clinicians' confidence in using new tools.[16,17]

Conclusion

This study provides a detailed overview of current trends in orthodontic practice in Pakistan, focusing on the use of fixed appliances and their components among specialist orthodontists. The study reveals that conventional metal brackets with MBT prescription with 0.022-inch slot size remain the most widely used orthodontic modality reflecting international trends in biomechanics and treatment efficiency. Moreover light-cure composite resin and direct bonding is preferred by nearly all orthodontists. Loop and continuous mechanics are both used for space closure with elastomeric power chains widely favored over NiTi coil springs for space closure, suggesting a preference for cost-effective and patient-friendly solutions. Overall, the findings suggest that orthodontic practices in Pakistan align with international standards in many areas. However, barriers to adopting newer technologies remain. The study underscores the importance of continued professional development, expanded training opportunities, and increased accessibility to modern orthodontic solutions. Addressing these challenges will be key to enhancing orthodontic care in Pakistan and ensuring that practitioners are equipped with the latest tools and techniques to provide optimal patient outcomes.

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Author Contributions

1. Samia Rahman – Conceptualization, Study Design, Methodology
2. Bushra Amin – Supervision, Statistical Analysis
3. Asma Javaid – Literature Review, Critical Review
4. Nayab Hassan – Editing, Final Approval of Manuscript
5. Muhammad Zaheen – Data Collection, Data Analysis
6. Ali Hassan Qureshi – Draft Writing, Data Collection

Dental Stem Cells and Their Utilization In Regenerative Medicine: A Cross Sectional Study Among Healthcare Professionals

Tayyaba Nayab[1], Ammara Chaudhry[1], Itsaf Ahmad Shahid[2], Malik Adeel Anwar[3], Naseer Ahmad[4], Minahil Aamir[1]

1. Department of Oral Biology, University College of Medicine and Dentistry, The University of Lahore, Lahore, Pakistan
2. Department of Orthopedic, Ghurki Trust Hospital, Lahore, Pakistan
3. Department of Oral Pathology and Oral Diagnostics, University College of Medicine and Dentistry, The University of Lahore, Lahore, Pakistan
4. Department of Prosthodontics, University College of Medicine and Dentistry, The University of Lahore, Lahore, Pakistan

Abstract

Introduction: Regenerative medicine has been recognized as a trailblazing field that aims to repair, replace, and regenerate damaged tissues and organs to restore their normal function.

Objective: Regenerative medicine is gaining clinical application for treating bone and cartilage injuries, burn victims, heart disease, and neurodegenerative disorders. This research seeks to identify the level of awareness, the perceived benefits and challenges, and the readiness of healthcare professionals to integrate DSC-based therapies into their clinical practice. It aims to identify educational gaps and challenges in adopting DSC-based therapies.

Materials and Methods: A cross-sectional, questionnaire-based study was conducted among health professionals to assess their understanding, awareness, and attitudes regarding dental stem cells and their therapeutic roles in regenerative therapy. A sample of 176 participants from various cities in Punjab was surveyed, and the data was analyzed using SPSS version 25.0 for statistical analysis.

Results: The study surveyed 176 participants (88 dental surgeons, 88 medical doctors), revealing comprehensive awareness of stem cells (96%) and 77% participants considered dental stem cells' regenerative abilities. Dental surgeons demonstrated greater familiarity with dental stem cells' self-renewal and proliferation, while both groups strongly supported increased government awareness campaigns.

Conclusion: Healthcare professionals demonstrated high awareness of dental stem cells, with dental surgeons exhibiting greater knowledge of regenerative capabilities. These findings highlight the need for targeted educational initiatives to enhance clinical integration.

Key Words: Regenerative Medicine, Stem Cells, healthcare, surgeons

Introduction

Regenerative medicine has been recognized as a trailblazing field that aims to repair, replace, and regenerate damaged tissues and organs to restore their normal function. Stem cells, biomaterials, and bioengineering techniques are used to achieve this. [1] Regenerative medicine provides personalized treatments using a patient's or genetically matched cells, reducing immune rejection and improving outcomes.[2] Stem cell therapy, which harnesses stem cells' distinct properties—such as their ability to self-replicate and specialize into a diverse range of cell types—to promote tissue regeneration and healing, is at the forefront of regenerative medicine. Stem cells are categorized based on origin and potency, with various types including embryonic stem cells, perinatal stem cells, induced pluripotent stem cells, and dental stem cells. These sources are regarded as critical for personalized medicine, regenerative medicine, and therapeutic applications.[3]

Dental stem cells (DSCs) have garnered considerable interest due to their ease of access, multipotency, and potential applications in regenerative medicine among the different types of stem cells. These cells are sourced from different dental tissues, including dental pulp, periodontal ligament, dental follicle, and exfoliated deciduous teeth. Stem cells have the capacity to regenerate damaged organs, repair bone and cartilage, facilitate wound healing, and treat neurological disorders. “Immense promise” is held by this technology for treating conditions with limited therapeutic options, such as spinal cord injuries, heart disease, bone degenerative diseases, diabetes, and neurodegenerative diseases.[4]

Research has demonstrated that stem cells, sourced from the dental pulp of adult teeth, exhibit the capacity for dentin-pulp regeneration, illustrating their contribution to dental tissue repair and regeneration.[5] Furthermore, multiple studies have revealed that stem cells obtained from exfoliated deciduous teeth (SHED) have been observed to display higher proliferative rates and increased differentiation potential into various cell types, as opposed to other dental stem cells.[6]

Corresponding Author:
Ammara Chaudhry
Department of Oral Biology, University College of Medicine and Dentistry, The University of Lahore.
Email: ammara.chaudhry22@gmail.com

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The potential of SHED in treating neurological disorders, bone defects, and immune-related conditions has been explored by studies, underscoring the versatility and clinical relevance of these cells. Preclinical studies have demonstrated that osteoblast differentiation and bone formation can effectively be contributed to by DPSCs and SHED when conducted with animal models. Cases of fractures, non-union fractures, craniofacial bone reconstruction, cartilage regeneration, osteonecrosis, and bone defects resulting from trauma or disease can be addressed with this approach. [7,8] Moreover, periodontal ligament stem cells (PDLSCs) exhibit significant potential in regenerating periodontal tissues, which is essential in the treatment of periodontal diseases and the maintenance of oral health. [9]

The varying levels of awareness and understanding of dental stem cells' potential applications among healthcare professionals is also addressed in the literature. Studies have shown that in-depth knowledge and confidence in using these cells in clinical practice are lacking in health professionals. Insufficient exposure to stem cell biology in medical and dental education, combined with the rapid advancements in the field that may not be fully incorporated into the curricula, could be attributed to this knowledge gap. [10] Interest in regenerative medicine in Pakistan is rising, however, its integration is still limited due to a lack of awareness, infrastructure, and research. Dental stem cells offer a promising yet underutilized resource in healthcare. [11,12]

This study intends to address the gaps identified in the literature by assessing the current state of knowledge, attitudes, and practices among healthcare professionals about the application of dental stem cells in regenerative medicine. The findings will inform educational interventions and policy recommendations for enhancing DSC integration into clinical practice.

Materials and Methods

A cross-sectional, questionnaire-based study was conducted to explore healthcare practitioners' understanding, awareness, and attitudes toward the utilization of dental stem cells in regenerative therapy. Participation was voluntary and included licensed dentists and medical doctors. The Institutional Research and Ethics Committee provided ethical approval (ERC APPROVAL NO: UCD/ERCA/24/589). Data were gathered over four months, from June 2024 to September 2024, across various cities of Punjab. Participants included in this research were sampled using a non-probability convenience sampling technique for data collection. The sample size of 176 participants (88 in each group) is calculated with 95% power of the test and 5.8% level of significance and by taking the expected percentage of response of dental and medical doctors towards knowledge regarding stem cells (Dental stem cells may be extracted from the tissues of dental pulp and periodontal ligaments) 50% and 24.60%. The following formula was used to calculate sample size

$$n = \frac{\left\{ z_{1-\alpha/2}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)} \right\}^2}{\left(P_1 - P_2\right)^2}$$

Data entry and analysis were performed using SPSS version 25 software.

A pre-validated self-administered questionnaire was used without any modifications, as originally developed and validated in a previous study. [13] There was a total of 20 closed questions spread throughout two sections of the self-administered survey. General information, such as gender, age, occupation, and level of education, was covered in the first section. In the second section, participants were asked to share details on their understanding, knowledge, and attitudes regarding dental stem cells, and their potential uses in regenerative therapies. Regarding the perception questions, each respondent was asked to indicate their level of agreement with the statement by selecting one of the following options: strongly disagree, disagree, unsure, agree, or strongly agree. The questionnaire was distributed simultaneously through Google Forms. The study's participants were made aware of the objective, the anonymous involvement.

Data Analysis

Data entry and analysis were performed using SPSS version 25. Qualitative variables were presented with frequency and percentage. The Chi-square or Fisher Exact Test was employed to assess the association between qualitative variables, with a P-value of ≤ 0.05 regarded as statistically significant.

Results

This study involved 176 participants, equally split between dental surgeons (n=88) and medical doctors (n=88). Among dental surgeons, 60.2% were male and 39.8% female, while the medical doctors were mostly female (60.2%). Most dental surgeons (77.3%) were aged 20–29, with smaller groups in the 30–39 (20.5%) and 40–49 (2.3%) ranges. For medical doctors, 62.5% were aged 20–29, 27.3% were 30–39, 8.0% were 40–49, and 2.3% were over 50. (Table I)

Table I. Demographic Characteristics of Study Participants

		N(%)	N(%)
Gender	Male	53 (60.2%)	35 (39.8%)
	Female	35 (39.8%)	53 (60.2%)
Age	20–29 years	68 (77.3%)	55 (62.5%)
	30–39 years	18 (20.4%)	24 (27.2%)
	40–49 years	2 (2.3%)	7 (8%)
	>50 years	–	2 (2.3%)

Most respondents (96.0%) were aware of stem cells, and 54.0% believed dental stem cells could potentially replace missing teeth, though 38.6% were unsure. A large majority (77.3%) recognized that dental stem cells can self-renew and differentiate, while 69.3% acknowledged their ability to proliferate. Many also understood their role in neural regeneration (64.2%). However, there was some uncertainty about whether stem cells could cause cancer (40.9%) or if dental stem cells exhibit similar traits to bone marrow stem cells (51.7%). A strong sentiment (72.9%) supported more government campaigns to raise awareness about dental stem cell research. (Table II)

Table II. Awareness and Perceptions of Dental Stem Cells Among Participants

Have you heard about stem cells?	No	7	4.0%
	Yes	169	96.0%
Replacement of missing teeth with stem cell-derived dental implants	No	13	7.4%
	Not sure	68	38.6%
	Yes	95	54.0%
DSCs exhibit self-renewal and multipotent differentiation properties.	No	8	4.5%
	Not sure	32	18.2%
	Yes	136	77.3%
DSCs undergo proliferation via cell division.	Not sure	43	24.4%
	No	11	6.3%
	Yes	122	69.3%
DPSCs exhibit neuro-regenerative and reparative properties.	No	10	5.7%
	Not sure	53	30.1%
	Yes	113	64.2%
Stem cells can contribute to cancer development.	No	43	24.4%
	Not sure	72	40.9%
	Yes	61	34.7%

DSCs differ from bone marrow-derived mesenchymal stem cells in characteristics.	No	30	17.0%
	Not sure	91	51.7%
	Yes	55	31.3%
Dental tissue-derived stem cells classified as adult stem cells.	No	19	10.8%
	Not sure	72	40.9%
	Yes	85	48.3%
Adult stem cells can be sourced from sperm, eggs, and various somatic tissues.	No	56	31.8%
	Not Sure	67	38.1%
	Yes	53	30.1%
MSCs are derived from bone marrow, placenta, umbilical cord, adipose tissue, and dental tissues.	No	19	10.8%
	Not Sure	44	25.0%
	Yes	113	64.2%
DSCs sourced from dental pulp and periodontal ligament tissues.	No	17	9.7%
	Not sure	56	31.8%
	Yes	103	58.5%
DSCs research holds promising potential.	Agree	67	38.1%
	Disagree	3	1.7%
	Neutral	33	18.8%
	Strongly agree	61	34.7%
	Strongly disagree	12	6.8%
I would like to contribute my extracted teeth for use in research and therapy.	Agree	59	33.5%
	Disagree	21	11.9%
	Neutral	42	23.9%
	Strongly agree	41	23.3%
	Strongly disagree	13	7.4%
I would like to preserve my DSCs for personal purposes.	Agree	69	39.2%
	Disagree	11	6.3%
	Neutral	54	30.7%
	Strongly agree	32	18.2%
	Strongly disagree	10	5.7%
Investing in dental stem cell banking and products is lucrative.	Agree	63	35.8%
	Disagree	3	1.7%
	Neutral	67	38.1%
	Strongly agree	35	19.9%
	Strongly disagree	8	4.5%
Governments should promote awareness of dental stem cell research.	Agree	76	43.2%
	Disagree	2	1.1%
	Neutral	25	14.2%
	Strongly agree	67	38.1%
	Strongly disagree	6	3.4%

In comparison between dentists and medical doctors on dental stem cells (Table III), both groups were largely familiar with stem cells (94.3% vs. 97.7%, p=0.444). More dentists recognized the self-renewal abilities of dental stem cells (83.0% vs. 71.6%, p=0.001). Dentists were also more certain regarding the capability of dental pulp stem cells for neural regeneration (70.5% vs. 58.0%, p=0.090) and their ability to proliferate (77.3% vs. 61.4%, p=0.052). Notably, doctors were more likely to believe that stem cells could be derived from sperm and eggs (38.6% vs. 21.6%, p=0.042). Both groups supported further awareness campaigns (44.3% vs. 42.0%, p=0.467).

Table III. Comparison of Stem Cell Awareness Among Professional Groups

Questions	Options	Dentists	Medical Doctor	p-value
		n (%)	n (%)	
Have you heard about stem cells?	No	5(5.7%)	2(2.3%)	**0.444**(F)
	Yes	83(94.3%)	89(97.7%)	
Replacement of missing teeth with stem cell-derived dental implants	No	10(11.4%)	3(3.4%)	**0.064**(C/F)
	Not sure	29(33.0%)	39(44.3%)	
	Yes	49(55.7%)	46(52.3%)	
DSCs exhibit self-renewal and multipotent differentiation properties.	No	7(8.0%)	1(1.1%)	**0.001**(F)
	Not sure	8(9.1%)	24(27.3%)	
	Yes	73(83.0%)	63(71.6%)	
DSCs undergo proliferation via cell division.	Maybe	15(17.0%)	28(31.8%)	**0.052**(C/F) *
	No	5(5.7%)	6(6.8%)	
	Yes	68(77.3%)	54(61.4%)	
DPSCs exhibit neuro-regenerative and reparative properties.	No	6(6.8%)	4(4.5%)	**0.090**(C/F)
	Not sure	20(22.7%)	33(37.5%)	
	Yes	62(70.5%)	51(58.0%)	
Stem cells can contribute to cancer development	No	19(21.6%)	24(27.3%)	**0.106**(C/F)
	Not sure	43(48.9%)	29(33.0%)	
	Yes	26(29.5%)	35(39.8%)	
DSCs differ from bone marrow-derived mesenchymal stem cells in characteristics.	No	18(20.5%)	12(13.6%)	**0.162**(C/F)
	Not sure	48(54.5%)	43(48.9%)	
	Yes	22(25.0%)	33(37.5%)	
Dental tissue-derived stem cells classified as adult stem cells.	No	10(11.4%)	9(10.2%)	**0.863**(C/F)
	Not sure	34(38.6%)	38(43.2%)	
	Yes	44(50.0%)	41(46.6%)	
Adult stem cells can be sourced from sperm, eggs, and various somatic tissues	No	33(37.5%)	23(26.1%)	**0.042***
	Not Sure	36(40.9%)	31(35.2%)	
	Yes	19(21.6%)	34(38.6%)	
MSCs are derived from bone marrow, placenta, umbilical cord, adipose tissue, and dental tissues.	No	13(14.8%)	6(6.8%)	**0.186**(C/F)
	Not Sure	23(26.1%)	21(23.9%)	
	Yes	52(59.1%)	61(69.3%)	
DSCs sourced from dental pulp and periodontal ligament tissues.	No	11(12.5%)	6(6.8%)	**0.004***
	Not sure	18(20.5%)	38(43.2%)	
	Yes	59(67.0%)	44(50.0%)	
DSCs research holds promising potential.	Agree	29(33.0%)	38(43.2%)	**0.298**(C/F)
	Disagree	2(2.3%)	1(1.1%)	
	Neutral	18(20.5%)	15(17.0%)	
	Strongly agree	30(34.1%)	31(35.2%)	
	Strongly disagree	9(10.2%)	3(3.4%)	
I would like to contribute my extracted teeth for use in research and therapy.	Agree	32(36.4%)	27(30.7%)	**0.922**(C/F)
	Disagree	10)11.4%)	11(12.5%)	
	Neutral	19(21.6%)	23(26.1%)	
	Strongly agree	20(22.7%)	21(23.9%)	
	Strongly disagree	7(8.0%)	6(6.8%)	
Would like to preserve my DSCs for personal purposes.	Agree	38(43.2%)	31(35.2%)	**0.688**(C/F)
	Disagree	4(4.5%)	7(8.0%)	
	Neutral	25(28.4%)	29(33.0%)	
	Strongly agree	15(17.0%)	17(19.3%)	
	Strongly disagree	6(6.8%)	4(4.5%)	
Investing in dental stem cell banking and products is lucrative.	Agree	31(35.2%)	32(36.4%)	**0.188**(C/F)
	Disagree	3(3.4%)	0(0.0%)	
	Neutral	34(38.6%)	33(37.5%)	
	Strongly agree	14(15.9%)	21(23.9%)	
	Strongly disagree	6(6.8%)	2(2.3%)	
Governments should promote awareness of dental stem cell research.	Agree	39(44.3%)	37(42.0%)	**0.467**(C/F)

C= Chi square test, F= Fisher exact test

Discussion

The domain of stem cell research has gained significant traction. It presents many applications in medicine and dentistry, primarily due to its prospects for regenerating and repairing damaged tissues. As a result, healthcare professionals are primed to advance stem cell research and guide and implement innovative stem cell therapies within their practice.[14]

The findings of this study illustrate a significant awareness of stem cells among dental surgeons and medical doctors, with an overall awareness rate of 96.0% among the participants. The high overall familiarity with the subject indicates a growing recognition of stem cells' role in modern medicine. This aligns with recent global studies, such as a study conducted in Malaysia, which reports similar high levels of awareness and knowledge about stem cells among healthcare professionals.[13] Furthermore, most participants recognized the potential of dental stem cells for applications in dental implants (54.0%) and their ability to self-renew (77.3%). The application of dental stem cells in tissue engineering and regenerative dental medicine has been well-documented in the literature, and these insights support the feasibility of utilizing these cells in clinical settings.[15] This awareness is crucial, considering the growing emphasis on regenerative medicine and the applications of stem cells in clinical settings. Interestingly, the derivation of adult stem cells from sperm and eggs, where a higher percentage of medical doctors (38.6%) agreed compared to dental surgeons (21.6%), may be explained by the greater exposure of medical professionals to diverse sources of stem cells during their training. This disparity highlights the need for improved interdisciplinary education that includes comprehensive coverage of stem cell sources, characteristics, and applications.

A key therapeutic feature of dental stem cells is their self-renewal ability, recognized by 77.3% of respondents. This, along with their potential for trilineage differentiation,

highlights their value in regenerative medicine. [16] The greater awareness among dental surgeons (83.0%) compared to medical doctors (71.6%) may be attributed to the focus on dental applications of stem cells in their curriculum and clinical training. However, concerns remain about the potential cancer risks of stem cell therapies. While 34.7% believed stem cells could lead to cancer, 40.9% were uncertain, reflecting ongoing debates about their oncogenic potential.[16] These concerns underscore the importance of strict regulation and thorough risk assessment in stem cell applications.

The promising future for dental stem cell research is highlighted by the study's results, with optimism being expressed by 72.8% of respondents. The accelerating pace of advancements in regenerative medicine and tissue engineering, as reflected in recent literature, aligns with this enthusiasm. [3,17] Breakthroughs in regenerative therapies through dental stem cell research have potential benefits beyond dentistry. A significant portion of participants expressed willingness to donate extracted teeth for research (33.5%) and preserve dental stem cells for personal use (39.2%), reflecting growing public acceptance of stem cell banking. This aligns with trends in countries like China, where interest in biobanking and personalized medicine is rising. [18] Additionally, 55.7% viewed the dental stem cell industry as a promising investment, highlighting its potential for growth. Similar positive attitudes have been reported globally, including in Saudi Arabia and Malaysia, despite limited public knowledge.[19,20]

Conclusion

In conclusion, this study offers valuable insight into the awareness and perceptions of dental stem cells among dental surgeons and medical doctors. While both groups show strong overall familiarity, notable differences in specific knowledge areas highlight the need for targeted curriculum enhancements and continuing education programs. Strengthening healthcare professionals' understanding of dental stem cells can support more informed clinical decisions and accelerate progress in regenerative therapies. To fully realize the benefits of this emerging field, curriculum developers and policymakers should prioritize integrated training and interprofessional collaboration, while addressing existing clinical, safety, and ethical challenges.

Disclosure/Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this study, which was conducted solely for academic purposes to contribute to the body of knowledge on dental stem cells in regenerative medicine.

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Author's Contributions

TB, as the corresponding author, conceived the idea, examined cases. AC interpreted data and contributed to manuscript writing. IAS was responsible for results interpretation and manuscript writing. MAA examined cases and assisted in manuscript writing, while RSN also examined cases and entered data into SPSS. NA and MA contributed to manuscript writing.

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Author Contributions

1. Tayyaba Nayab – Conceptualization, Study Design, Supervision, Critical Review
2. Ammara Chaudhry – Methodology, Data Collection, Draft Writing
3. Itsaf Ahmad Shahid – Literature Review, Data Collection, Draft Writing
4. Malik Adeel Anwar – Statistical Analysis, Data Interpretation, Proofreading
5. Naseer Ahmad – Data Collection, Materials Preparation, Literature Support
6. Minahil Aamir – Editing, Final Approval of Manuscript

Shear Bond Strength of Resin-Modified Glass Ionomer Cement as a Result of Enamel Surface Modifications

Anam Fazal[1,2], Asma Shafique[2], Fatima Suhaib[3], Nadia Munir[3], Aamina Sagheer[4], Mehvish Sajjad[4]

1. Director of Diversity, Equity and Inclusion Cambridge Memorial Hospital Volunteer Association, Cambridge, Ontario.
2. Department of Orthodontics, Lahore Medical and Dental College, University of Biological and applied Sciences, Lahore Pakistan.
3. Department of Science of Dental Materials, Lahore Medical and Dental College, University of Biological and applied Sciences, Lahore Pakistan.
4. Department of Periodontology, Islam Medical and Dental college, Sialkot Pakistan.
5. Department of Science of Dental Materials, University college of Dentistry, University of Lahore Pakistan.

Abstract

Objectives: To determine the mean shear bond strength (SBS) of metallic brackets bonded with Resin Modified Glass Ionomer Cement (RMGIC) after deproteinization by using sodium hypochlorite, 5.25% (NaOCl) prior to acid etching.

Methods: The Department of Orthodontics conducted an in vitro experimental study over a period of 2 months. Eighty healthy and fully developed human premolars were randomly allocated into group A and B. Group A teeth were treated with sodium hypochlorite, 5.25% for 1 minute before phosphoric acid, H_3PO_4 (37%) etching and moistened with water, then brackets were bonded using RMGIC as an adhesive material. In Group B, the teeth were treated with H_3PO_4 (37%) only and the brackets bonded directly with RMGIC. The SBS was measured in both groups.

Results: There was a significant difference between the mean shear bond strength (SBS) between the two groups. After deproteinization, it was higher (significant) in group A (11.33) than in group B (6.53) [Mean difference =4.80±0.95; p=0.0005].

Conclusion: Deproteinization with NaOCl (5.25%) for 1min before Phosphoric acid (37%) etching results in significantly higher shear bond strength with RMGIC. Therefore, deproteinization can save chairside time that might get wasted due to frequent debonding of brackets.

Key Words: Bracket Bonding, Deproteinization, RMGIC, Sodium hypochlorite (NaOCl), Shear bond strength.

Introduction

Orthodontic treatment requires a longer span of time and is considered successful if an orthodontist achieve acceptable occlusal relations in minimum time. [1] However, it is inevitable to avoid bond failure which is one of the prime contributory factors of prolonged treatment duration. Bond failure mostly results from moisture contamination, as the blood and saliva obstruct adhesive penetration. [2,3]

RMGIC is a moisture insensitive cement ideally used for bonding in patients with poor oral hygiene. Moreover, it releases fluoride and has a certain degree of anti-cariogenic effect.[4,5,6] This property of RMGIC gives an added advantage of decreasing white spot lesion which have shown to increase by almost 50 % in patients undergoing fixed orthodontic treatment.[7] Despite these properties, it is not preferred by orthodontists as a primary bonding material due to its low shear bond strength (SBS).[8]

Corresponding Author:
Fatima Suhaib
Department of Dental Materials, Lahore Medical and Dental College, Lahore Pakistan
Email: fatimasuhaib83@hotmail.com

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RMGIC has a SBS of approximately 5.71 MPa, which is lower than the ideal value.[8] Bishara et al. considered that the initial SBS of RMGIC is too low for an arch wire to be placed on the first appointment, thus its use might lead to repeated debonding and increase in chairside time.[9] Various enamel conditioning techniques are being developed by orthodontists to increase the retentive properties of RMGIC.[10] Deproteinization is one such non-invasive technique, which not only removes the outer organic layer and acquired pellicle from the tooth,[11] but also helps to improve the SBS of RMGIC.[12,13] Deproteinization is frequently used in endodontic procedures[14] and has been recently introduced in orthodontics by Justus et al. Their study concluded that deproteinization resulted in an increase in SBS of RMGIC to 9.64± 5.01 MPa [8,15]. This technique was also found to be effective before bonding a flourosed tooth by Rekha et al.[1]

Considering the limited data available in this context, this study was designed to assess the effect of deproteinization on the SBS of RMGIC while using metallic brackets. The null hypothesis of the study states that there is no difference in SBS of RMGIC after deproteinization by using sodium hypochlorite, 5.25% (NaOCl) prior to acid etching. The results of the study will add to the existing body of knowledge and will facilitate orthodontists to take informed decisions in conditions where RMGIC is the material of choice.

Materials and Methods

The Department of Orthodontics, Lahore Medical and Dental College (LMDC), conducted an in vitro experimental study from 8th January 2025 to 3rd March 2025 after obtaining permission from the Ethical Review Board (ERB) of the college FD/5507/25.The sample size (80 teeth ;40 per group) was calculated by assuming the power of the t-test to be 80% and a level of significance of 5%, with expected mean bond strength in group A of 13.86±4.41 and group B of 17±5.37.[8] A consecutive non-probability sampling technique was employed to collect the sample.

Caries free, healthy and fully developed teeth of patients of any gender between the ages of 15 to 25 years were included in the study. Previously bonded, restored and hypo mineralized/hypocalcified teeth were excluded from the study.[14] Eighty human premolars extracted before orthodontic treatment (therapeutic extractions), were collected from the OMFS, Oral and Maxillofacial Surgery Department, LMDC, and were randomly assigned to the two groups.

After extraction, the teeth were cleaned and soft tissues were removed and stored in normal saline till the start of the study. The tooth roots were embedded in self-cure acrylic cylindrical blocks measuring 20x20x20 mm to standardize the tooth preparations.[8,13] Each tooth's buccal surface was also kept perpendicular to the base of the acrylic block for ease of handling of tooth at the time of testing. Teeth were randomly assigned to the two groups.

Bonding Protocol

Group A (experimental group)

The buccal surface of each tooth was properly dried after cleaning by fluoride free-pumice. Deproteinization was achieved by applying 5.25% NaOCl (Chloraxid, Cerkamed Medical Company, Poland) on the enamel surface for 1min followed by rinsing and drying with oil-free compressed air. Etching was done for 30 seconds with H_3PO_4 (37%) (Spident Co., Ltd., Korea) followed by washing and drying. The treated enamel surface was then moistened with water according to manufacturer's recommendations and bracket was bonded using RMGIC (Fuji Ortho LC, GC Corp, Tokyo, Japan) as the adhesive material and light cured for 40 sec (10 seconds on each side) utilizing an LED curing light (Rixi, China).

Group B (control group):

The buccal surfaces of the teeth were etched with only orthophosphoric acid (37%) (Spident Co., Ltd., Korea) for 30 seconds followed by washing and drying. The treated enamel surface was then moistened with water following the manufacturer's recommendations and the bracket was bonded using RMGIC (Fuji Ortho LC, GC Corp, Tokyo, Japan) as the adhesive material and cured for 40 secs (10 seconds on each side) utilizing an LED curing light (Rixi, China).

Bracket Specifications

The standard edgewise 0.22x0.28-inch metallic brackets with hooks were used in this study. The bracket base area was 10.5mm±0.5. The brackets were attached on the buccal surface and positioned centrally using a bracket holder. They were pressed against the surface and excess adhesive cement was removed.

Shear bond strength measurement

The bonded specimens were placed in distilled water at a temperature of 37°C for 24 hours. Assessment of SBS was done by an Instron (Dartech, England) testing machine with a crosshead speed of 1 mm/minute to the point of bracket failure (figure 1). The force to bond failure was recorded and calculated. The value in newtons was converted into MPa using the formula shown below.[16]

SBS (mpa) = debonding force (n)/bracket base area (mm^2) (1MPa=1N/mm^2).

Data analysis was done by SPSS version 20 and mean standard deviation (mean SD) was calculated for the quantitative variable of shear bond strength.

Comparison of mean SBS in Group A (experimental) and Group B (control) was done using independent sample t-test. Frequency and percentage were computed for gender. Data were stratified for age and gender. Post-stratification t-test was used taking a p-Value <0.05 as significant.

Results

The mean age of the patients was 19.81±2.77 years [95%CI: 19.20 to 20.43]. There were 38(47.5%) females and 42(52.5%) males. SBS after deproteinization was significantly high in group A (sodium hypochlorite 5.25%, 37% Phosphoric acid and RMGIC) than in group B (37% Phosphoric acid and RMGIC) as shown in Table I. The study showed that the mean SBS of group A was increased by 4.8 MPa. The t-test comparison also indicated that the two means were significantly different (p=0.0005). Stratification analysis revealed that mean SBS was significantly higher in group A as compared to group B as per stratified gender (male, female) as shown in Table II.

Table-I: Descriptive statistics of SBS for both groups (n=80).

GROUPS	n	MEAN(MPa)	Std.Deviation(MPa)
Group A	40	11.33	5.44
Group B	40	6.53	2.56

*n: number of teeth

Table II: Stratification of shear bond strength with respect to gender.

Gender	Group A (n=40)		Group B (n=40)		P-value
	SBS		SBS		
	Mean	SD	Mean	SD	
Male	10.82	3.99	6.40	2.93	0.0005
Female	11.84	6.65	6.68	2.12	0.0005

Discussion

SBS is one of main factors that needs to be considered in the development of adhesive materials used in orthodontics. It must be sufficiently high to withstand the masticatory stresses and prevent fracture of enamel on debonding.[17] RMGIC was introduced in the twentieth century to improve the SBS of the adhesive.[18] It is a hybrid of GIC and composite resin and has the ability to release fluoride. Moreover, the resin component allows for better bond strength[19] although despite better SBS than GIC, RMGIC failed to match the SBS of composite resin. Several studies have been designed across the world to find a

suitable method to improve the SBS of this adhesive.[20]

The present study focused on finding a method by which better retention of metallic brackets could be achieved through enhancing the SBS of RMGIC as an adhesive material. To achieve this objective, enamel deproteinization was done with Sodium hypochlorite (NaOCL) before etching and then bonding the bracket with RMGIC. NaOCL does not harm the healthy tooth structure and is mostly used in endodontics as an irrigant.[21] It was introduced in orthodontics by Justus et al. in 2010.[22] According to them, NaOCL dissolves the organic layer (acquired pellicle) of the enamel and facilitates deeper penetration of etchant in the enamel core, subsequently producing more type 1 and 2 etching patterns. Type 1etching pattern involves dissolution of prism heads, whereas peripheral zones of the prisms are dissolved in type 2 etching patterns. These patterns are proven to be of better quality and most retentive etching patterns in the studies done by Espinosa et al. (2008) and Sharma et al. (2017).[13,14] On the other hand, there is strong evidence that by using phosphoric acid (37%) for etching the enamel surface before bonding orthodontic brackets, [23] only 2% of enamel surface is etched and more than 69% of the surface is not etched at all.

In the present study, Group A (experimental) was exposed to enamel deproteinization before etching with H_3PO_4 (37%) later bonding with RMGIC whereas in the Group B (control), bonding was preceded by etching with phosphoric acid (37%) only. The technique used for the experimental group led to an increase in SBS (11.33 ±5.44 MPA) while it stood at a low (6.53 ±2.56 MPA) for the control group. These results are in line with earlier studies conducted in this context.[7,9,13] The technique was also found to be effective for bonding flourosed teeth and enhance roughness of enamel surface as it results in higher amount of enamel microporosities.[14,24] Despite favourable outcomes demonstrated by numerous researchers, the study conducted by Pereira et al. (2012) revealed contrasting results. They considered the use of polyacrylic acid might be the reason of reduced SBS in their study as it has larger molecules that fail to move deeper in the enamel.[25]

There are various reasons that limit the credibility of any research. Likewise, this study is limited by factors including small sample size, variation in etching time, possible human error during bonding procedure and in vitro rather than in vivo conduct of experiment. In vivo experiments may reveal lower SBS. To overcome these limitations and to study shear bond strength more precisely, it would be ideal to increase the sample size and create suitable standards in the oral environment to conduct a study in vivo.

Conclusion

SBS of RMGIC significantly increases with the use of 5.25% NaOCl as deproteinization agent for 1 minute before acid etching with 37 % $H_3 PO_4$ for bonding metallic brackets as it results in better etching patterns. Deproteinization with NaOCL helps to reduce the surface stress, increases the materials penetration and adherence, resulting in higher SBS. Our results are favourable, suggesting more often use of RMGIC in routine clinical practice, particularly in hypo mineralised teeth and situations where moisture contamination is a major challenge.[15] Furthermore, deproteinization as a routine procedure in enamel pre-treatment saves clinical time that is wasted otherwise due to frequent debonding.

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Author Contributions

1. Anam Fazal – Conceptualization, Study Design, Supervision, Critical Review
2. Asma Shafique – Methodology, Data Collection, Draft Writing
3. Fatima Suhaib – Data Collection, Materials Preparation, Draft Writing
4. Nadia Munir – Data Collection, Statistical Analysis, Interpretation of Results
5. Aamina Sagheer – Literature Review, Data Analysis, Proofreading
6. Mehvish Sajjad – Editing, Final Approval of Manuscript

Epidemiological and Forensic Assessment of Firearm-Related Deaths in Peshawar

Faiza Nadeem[1], Naheed Siddiqui[2], Rabia Khan[3], Anwar Ali[4], Muhammad Ishaq[5], Ihsan Ullah[6]

1. Department of Forensic Medicine, Khyber Medical College, Peshawar Pakistan
2. Department of Forensic Medicine, Khyber Girls Medical College, Peshawar Pakistan
3. Department of Forensic Medicine, KMU-IMS, Kohat Pakistan
4. Department of Forensic Medicine, Muhammad College of Medicine, Peshawar Pakistan
5. Department of Forensic Medicine, Pak International Medical College, Peshawar Pakistan
6. Department of Forensic Medicine, Jinnah Medical College, Peshawar Pakistan

Abstract

Objectives: This study aims to assess the epidemiological pattern of injuries in firearm-related deaths presented to the Forensic Medicine Department of Khyber Medical College, Peshawar. It also seeks to identify risk factors associated with firearm injuries and examine the relationship between demographic factors and firearm deaths in District Peshawar.

Materials and Methods: This cross-sectional analytical study involved 797 firearm death cases at the Forensic Medicine Department of Khyber Medical College Peshawar from 1st July 2023 to 30th June 2024. All firearm death cases were taken as samples presented during the said time. Data was collected via a non-probability convenience sampling technique and analyzed using SPSS version 22. Chi-square was used to assess any association between causes of firearm death and demographic variables.

Results: Among the 797 participants, 94.7% (755/797) were male, while 5.3% (42/797) were female. The mean age was 36.65 ± 13.6 years, ranging from 16 to 80 years. Additionally, 87.8% (700/797) of the subjects were from urban areas, and 12.2% (97/797) were from rural areas. Additionally, 20.3% (162/797) of the subjects sustained a single injury, while 79.7% (635/797) had multiple injuries. Among the 797 subjects, 2.4% (19/797) were cases of suicide. Furthermore, 94.2% (751/797) experienced immediate deaths, whereas 5.8% (46/797) had delayed deaths. In the case of firearm ranges the contact range was 20.5% (163), the close range was 14.7 % (117), the Near shot range was 35.1% (280) and the distant shot was 29.7% (237). A low level of education is significantly associated with firearm deaths.

Conclusion: This study provides valuable insights into the patterns and outcomes of firearm injuries in District Peshawar. The findings align with some global trends while highlighting unique regional differences**.** A low level of education is significantly associated with firearm deaths.

Keywords: Firearm injury, Pattern of injury, Firearm ranges

Introduction

A firearm injury is a penetrating injury from a weapon that uses a charge to fire. Weapons include handguns, rifles, and shotguns. Epidemiological Patterns of firearm injuries typically involve variables such as the type of firearm used, the nature of the injuries, and the demographics of the victims. Studies have demonstrated that firearm injuries often result in severe outcomes due to the critical organs affected and the immediate nature of the trauma[1,2]. Patterns can also vary based on geographical location, socio-economic status, and availability of firearms.[3,4]

Several factors contribute to the patterns of firearm deaths, including demographic variables (age, gender, socio-economic status) and contextual factors (urban vs. rural settings, local laws, and access to firearms). Research indicates that younger males are disproportionately affected by firearm injuries, often in metropolitan areas with higher crime rates.[5,6] Additionally, socio-economic factors such as poverty and lack of education have been linked to increased risk of firearm violence [7,8]

Firearm-related injuries and deaths represent a significant public health concern worldwide, with varying patterns and associated factors that can influence the severity and outcomes of such incidents. Understanding the specific patterns of firearm injuries and the demographic and contextual factors related to these incidents is crucial for developing effective prevention strategies and improving public health responses.[9]

Peshawar District, located in the Khyber Pakhtunkhwa province of Pakistan, has seen a range of firearm-related incidents, reflecting broader patterns across the country. With its unique socio-economic and political landscape, the district serves as an important case for studying the trends in firearm deaths and the factors that contribute to them. Peshawar, as a major urban center in Khyber Pakhtunkhwa, has experienced varying trends in firearm-related incidents. The district's socio-political climate, coupled with local cultural factors, influences the pattern of firearm injuries and deaths[8]. Despite its significance, there is a lack of comprehensive research focusing on the specific patterns and associated factors of firearm-related deaths in District Peshawar.

Corresponding Author:
Naheed Siddiqui
Department of Forensic Medicine, Khyber Girls Medical College, Peshawar Pakistan
naheedsiddiqui@ymail.com

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By examining the types of firearm injuries, the demographic characteristics of the victims, and contextual factors, this research seeks to provide a detailed understanding of the local trends and contributing factors. The findings are expected to inform public health strategies, improve trauma care, and guide policy interventions to reduce firearm-related violence in the region.

Understanding the epidemiological patterns and factors associated with firearm deaths in District Peshawar is crucial for developing targeted interventions and preventive measures. This research will contribute to the broader understanding of firearm-related violence and its implications for public health and safety in the region.

Materials and Methods

It was a Cross-sectional study done in the Forensic Medicine Department at Khyber Medical College, Peshawar, from July 1, 2023, to June 30, 2024. All firearm deaths were taken as a sample, which was presented during the said time. A sample size of 797 was selected. Inclusion criteria were all firearm deaths presented to the department, and cases with incomplete documentation were excluded. Non-probability convenience sampling was done.

The study was conducted after obtaining approval from the ethical board of IREB Khyber Medical College, Peshawar Ethical Number A36/DME/KMC. A pre-designed Performa was used, having a demographic component and closed-ended questions regarding the autopsy cases presented at the forensic medicine department of Khyber Medical College, Peshawar.

Data was extracted using SPSS version 22. Qualitative variables like firearm injury patterns, including ranges, fatal period, organs involved, and type of injury, were presented in the form of tables and graphs, while quantitative variables like age were presented in the form of mean and standard deviation. Chi-square was used to determine any association between firearm deaths and demographic factors. P p-value less than 0.05 was taken as significant.

Results

Out of the total 797 subjects, 94.7% (755/797) were male, while 5.3% (42/797) were female. The mean age was 36.65 ± 13.6 years, ranging from 16 to 80 years. Additionally, 87.8% (700/797) of the subjects were from urban areas, and 12.2% (97/797) were from rural areas.

The organs involved in firearm injury are elaborated on in Table 1. Additionally, 20.3% (162/797) of the subjects sustained a single injury, while 79.7% (635/797) had multiple injuries. Among the 797 subjects, 2.4% (19/797) were cases of suicide. Furthermore, 94.2% (751/797) experienced immediate deaths, whereas 5.8% (46/797) had delayed deaths. In the case of firearm ranges, the contact range was 20.5% (163), the close range was 14.7 % (117), the Near shot range was 35.1% (280), and the distant shot was 29.7% (237). Figure 1 shows the education level of the cases, of which the majority, 45.4% (362), had no formal education, while very few, 10% (30), were graduates and above. Table 2 shows different parameters of a pattern of injury, including firearm ranges, Causes of incident, Fatal period, and type of injury. Figure 2 is a pie chart showing different firearm ranges with the near shot range at maximum, ie, 35.1%. Table 3 is an association of education levels, gender, and area of living with the causes of incidents. Only education is significantly associated with the causes of incidents, with a p-value less than 0.05. The lower the education level, the greater is its association with homicidal and other causes of firearm deaths.

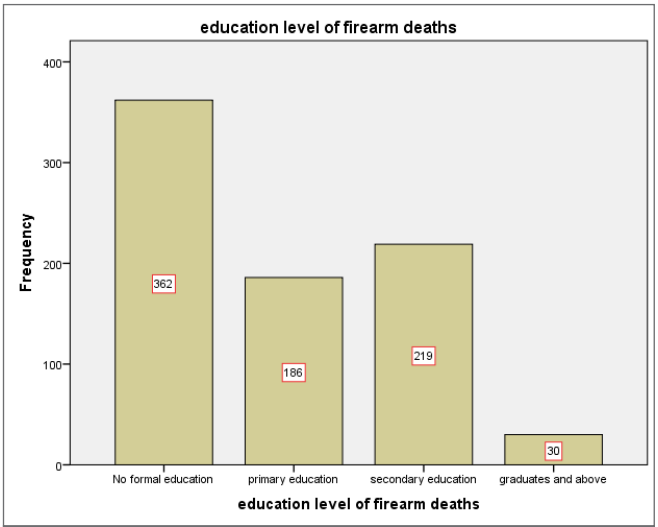

Fig.1: Education level

Organs injured	Frequency (n=797)	Percentages (%)
Lungs	435	54.6
Heart	287	36.0
Brain	265	33.2
Liver	232	29.1
Gut	168	21.1
Great vessels	97	12.2
Limbs	69	8.7
Spleen	23	2.9
Head and Neck	23	2.9
Pancreas	14	1.8

Table 1: Organs involved in firearm deaths

S. no.	Variables	Frequency	Percentages
1	**Firearm ranges**		
	a. Contact	163	20.5
	b. Close range (5-8cm)	117	14.7
	c. Near Shot range (up to 0cm)	280	35.1
	d. Distant shot (>90cm)	237	29.7
2	**Causes of incident**		
	a. Accidental	53	6.6
	b. Homicidal	725	91
	c. Suicidal	19	2.4
3	**Fatal period**		
	a. Immediate	751	94.2
	b. Delayed	46	5.8
4	**Type of injury**		
	a. Single	162	20.3
	b. Multiple	635	79.7

Table 2: Firearm ranges, Causes of incident, Fatal period and type of injury (Pattern)

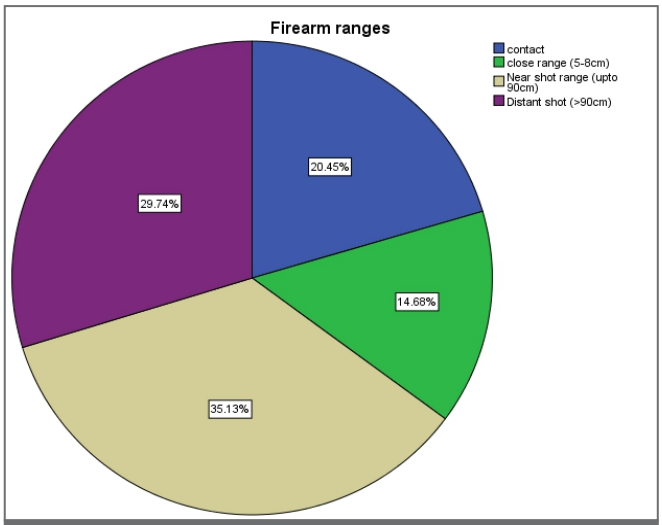

Fig.2: Firearm Ranges in subjects

Table 3: Association of demographic variables with causes of death

S. No	Variable*variable	frequency	Chi-square P value
1	• Male • Female	Accidental: Homicidal: Suicidal 53 : 685 : 17 0 : 40 : 02	0.12
2	• Urban • rural	Accidental: Homicidal: Suicidal 53 : 630 : 17 0 : 95 : 02	0.18
3	• No formal education: • Primary education: • Secondary education. • Graduate and above	Accidental: Homicidal: Suicidal 12 : 339 : 11 16 : 164 : 06 25 : 193 : 01 0 : 29 : 01	0.001

Discussion

The findings of this study on firearm injuries in District Peshawar provide critical insights into the demographic characteristics, injury patterns, and outcomes associated with such incidents. The results reflect trends that are consistent with and diverge from other research on firearm-related trauma, highlighting both common patterns and unique regional differences.

The predominance of male victims (94.7%) mirrors the overwhelming male dominance in firearm injury statistics reported in contemporary research. Studies indicate that over 90% of firearm injury patients are male, a pattern attributed to higher participation in risk-taking behaviors, occupational exposure, and involvement in interpersonal violence[1,2]. For instance, Holland et al.[3] documented similar male predominance in U.S. emergency department surveillance data, with trends persisting over multiple years.

The mean age of 36.65 years and concentration of cases among young adults (51.2% aged 16–30 years) correspond with recent epidemiologic findings. Peta et al.[4] and Koenig et al.[5] noted that firearm injuries are heavily concentrated in the late-teen to early-adulthood range, a group considered particularly vulnerable due to increased social exposure, gang activity, and interpersonal conflicts. The higher incidence of firearm injuries in urban areas (87.8%) compared to rural areas (12.2%) aligns with global patterns that show a concentration of firearm violence in urban environments. Urban areas, with their higher population density and socio-economic disparities, tend to have higher rates of violent crime and firearm-related incidents [6,7]

Urban predominance in firearm injuries (87.8% in this study) is consistent with analyses showing higher firearm injury rates in metropolitan centers. Morrison et al.[8] and Johnson et al.[9] have described socio-cultural and demographic factors underlying urban firearm violence, while Adams et al.[10] reported a persistent concentration of firearm-related morbidity and mortality in densely populated areas.

The finding that 79.7% of subjects sustained multiple injuries is consistent with the high-energy nature of firearm trauma. Firearm injuries often involve multiple body parts due to the impact of bullets, which can result in complex trauma requiring advanced medical intervention [11, 12] Documented frequent involvement of vital thoracic and cranial structures, as seen here with lung (54.6%), heart (36.0%), and brain (33.2%) injuries. Such patterns carry high mortality risk, as confirmed by recent findings on organ-specific firearm trauma outcomes.

The striking immediate mortality rate (94.2%) parallels high lethality rates documented in recent firearm injury outcome studies[13,14]. Rapid exsanguination, CNS disruption, and cardiac compromise remain leading causes of pre-hospital and emergency department death.

The high rate of immediate deaths (94.2%) among the subjects underscores the severe impact of firearm injuries. This finding is in line with other studies showing that firearm injuries frequently result in rapid fatalities due to the critical nature of the injuries [14, 15.] The lower rate of suicides (2.4%) in this study contrasts with findings from other regions where suicides constitute a significant proportion of firearm-related deaths. For instance, a study by Johnson[16.] found that suicides account for a substantial percentage of firearm deaths in the United States, indicating regional differences that may reflect varying patterns of firearm access and mental health issues.

Overall, these findings affirm that while Peshawar's firearm injury profile shares global patterns—male predominance, concentration in younger age groups, urban clustering, and high lethality—there are distinct regional nuances, particularly in the mechanisms of injury and the low suicide proportion. These insights underscore the importance of context-specific prevention strategies, integrating both public health and law enforcement interventions.

The patterns identified in this study have important implications for public health interventions. The high incidence of firearm injuries in young males and urban areas suggests a need for targeted prevention strategies focusing on violence reduction, improved trauma care, and addressing socio-economic factors that contribute to firearm violence. Additionally, the severe nature of the injuries observed highlights the importance of trauma preparedness and response systems in managing firearm-related emergencies effectively.

Some of the limitations of the study were its cross-sectional design, which cannot be generalized, and a single setup study, which includes referral cases as well.

Conclusion

This study provides valuable insights into the patterns and outcomes of firearm injuries in District Peshawar. The findings align with some global trends while highlighting unique regional differences. A low level of education is significantly associated with firearm deaths.

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Author Contributions

1. Faiza Nadeem – Conceptualization, Study Design, Draft Writing
2. Naheed Siddiqui – Methodology, Data Analysis, Supervision
3. Rabia Khan – Data Collection, Literature Review, Draft Writing
4. Anwar Ali – Statistical Analysis, Data Interpretation
5. Muhammad Ishaq – Data Collection, Materials Preparation
6. Ihsan Ullah – Critical Review, Final Approval of Manuscript

Assessing The Knowledge of The Patients About The Scope of Oral and Maxillofacial Surgery

Adil Sanan[1], Haseeb Ullah[2], Fahad Qiam[3], Asmat Ullah[4], Fahad Ashfaq[5], Samavia Mazhar[6]

1. Department of Oral Medicine/ Oral Diagnosis, Abbottabad International Medical Institute, Abbottabad, Pakistan
2. Morriston hospital United Kingdom
3. Department of Oral and Maxillofacial surgery, Sardar Begum Dental Hospital Peshawar, Pakistan
4. Department of Oral Medicine, Khyber College of Dentistry Peshawar Pakistan
5. Department of Dental Materials, Abbottabad International Medical Institute, Abbottabad, Pakistan
6. Department of Periodontology, Abbottabad International Medical Institute, Abbottabad, Pakistan

Abstract

Introduction: Oral and maxillofacial surgery (OMFS) is a comparatively new surgical specialty that primarily emphasizes identifying and managing disorders of the head and neck, bridging dentistry and medicines.

Objectives: The basic aim of the study is to assess the knowledge of the patients about the scope of oral and maxillofacial surgery.

Material and Methods: This cross-sectional survey was done in Peshawar, Pakistan, between April 1, 2020, to May 30, 2020, with a total of two hundred and sixty-five participants (n = 265). Individuals from the general population, licensed dentists, and medical experts from the private and public healthcare sectors participated in this study.

Result: We surveyed 256 participants, of whom 39% were illiterate. 94% of those individuals were unaware of a department called maxillofacial surgery that specializes in treating head, neck, and face illnesses. 19% of the population was in elementary school, of which only 2% were aware of a "special doctor" for their requirements since their parents were concerned about their illness and were finally referred by another doctor (80%) or a relative (20%). 15% of students with secondary/intermediate education and 5% of those recognized maxillofacial surgeons as acceptable physicians for their treatment, primarily for dental extractions and/or palatal cleft patients who had been receiving therapy from infancy or post-operative TMJ ankyloses patients.

Conclusion: Much of the common public was not aware of the scope of Oral and Maxillofacial surgery. While the majority of medical graduates surveyed knew that maxillofacial surgeons treat facial injuries, the vast majority did not know that these specialists treat a wide variety of certain other disorders affecting the head and neck. The need for spreading awareness among the population regarding the domains of Oral and Maxillofacial surgery is evident.

Keywords: OMFS, Disorder, Patients, Knowledge, Research

Introduction

Oral and maxillofacial surgery (OMFS) is a comparatively new surgical specialty that primarily emphasizes identifying and managing disorders of the head and neck, bridging dentistry and medicines.[1,2] OMFS is the surgical specialty dealing with the diagnosis and surgical treatment of illnesses of the mouth, jaws, face, and neck. These are highly trained medical professionals equipped to treat a wide array of oral and face disorders.[3] Additionally, traumatology, dentofacial deformities, head and neck cancers and reconstruction, and temporomandibular diseases have all benefited from the OMFS's rapid growth over the last decade.[4] However, there are still discrepancies in how well students, healthcare professionals, and the general population understand the scope of OMFS and how familiar they are with OMFS surgeries, even though OMFS is recognized as a speciality of the facial skeleton by substantial hospitals around the globe.[2,5] Previous study in Kuwait by Haron et al. examined both dental and medical practitioners' assessment of OMFS. It revealed a discrepancy in health provider consultations for different head and neck disorders relying on a questionnaire survey examining 26 procedures.[6] Similar research by Alnofaie et al. in Saudi Arabia revealed substantial disparities in how dentists and medical professionals perceive OMFS.[7]

One of the fastest-growing fields in medicine, oral and maxillofacial surgery in Pakistan is concentrated in the country's major urban centers. Throughout its history, Pakistan has seen a significant expansion of the breadth of the specialized field. It began as a small oral surgical program in the early 1990s, treating only simple cases of maxillofacial trauma and injuries to the teeth and gums. Maxillofacial surgeons in Pakistan now treat patients for a wide range of conditions, including facial trauma, cleft lip and palate, bone grafting, facial deformity repair, craniofacial surgery, cosmetic facial surgery, TMJ surgery, implant surgery, and more complex treatments.[8,9]

Even with all the progress made, the dentistry and medical communities still have a minimal understanding of maxillofacial surgery. General public knowledge is significantly lower. Researchers in the United States and the United Kingdom found that the medical and dentistry communities and the general public had a limited

Corresponding Author:
Fahad Qiam
Department of Oral and Maxillofacial surgery, Sardar Begum Dental Hospital Peshawar, Pakistan
Email: fahad.qiam@gmail.com

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understanding of the services provided by maxillofacial units.[9] According to research performed in England by Ameerally et al., up to 79% of the population is unfamiliar with the OMFS unit, and roughly 74% are confused about its function.[10] Despite widespread familiarity with the term "specialty," Ifeacho et al. discovered that healthcare practitioners lacked an understanding of the therapeutic benefits of this study area.[11] Hunter et al. observed that healthcare providers unfamiliar with this area did not recommend patients suffering issues overlapping with specific other disciplines to maxillofacial and oral surgeons.[12]

If there is a lack of understanding in industrialized nations, the situation in a developing nation like Pakistan would likely be worse. Because of this, OMFS specialty must exercise its entire scope of practice to be recognized. It is crucial to increase awareness about the value of OMFS and the surgeon's expertise in this area of medicine. In addition, it is necessary to raise public knowledge of OMFS so that patients may seek the correct referral pattern from their physicians. In the long run, this will improve both the degree of success achieved and the quality of health care delivered. In addition, this will allow us to reevaluate current referral practices, launch much-needed awareness programs amongst healthcare providers better to educate them on the breadth of the specialty, and fine-tune the OMFS-related material of all medicine and dentistry school curricula. The basic aim of the study is to assess the knowledge of the patients about the scope of oral and maxillofacial surgery.

Materials and Methods

This cross-sectional survey was done in Peshawar, Pakistan, between April 1, 2020, and May 30, 2020. Participants residing in the city of Peshawar were eligible for inclusion in the study. Individuals of all age groups were considered for participation. Individuals who did not provide informed consent for participation were excluded from the study. Individuals who were unable to effectively communicate or comprehend the survey questions due to language barriers or cognitive impairments were excluded from the study. Individuals from the general population, licensed dentists, and medical experts from the private and public healthcare sectors participated in this study. All respondents were above 18 (guardians in case of patients younger than 18 years), and they signed a consent form indicating their understanding and acceptance of the survey's terms and conditions, including the confidentiality clause. A structured questionnaire was prepared to assess the participants' knowledge regarding oral and maxillofacial surgery (OMFS). The questionnaire included a series of both multiple-choice and open-ended questions, designed to cover various aspects of OMFS, including its scope, common conditions treated, surgical procedures involved, and potential outcomes. The variables studied consisted of demographic information such as age, gender, and education level, as well as participants' awareness of OMFS as a medical specialty, their knowledge of conditions treated by OMFS, their understanding of surgical procedures, and their familiarity with the potential outcomes and benefits of OMFS. This questionnaire was verbally translated into the local language for the understanding of the patients. Data was analyzed using SPSS version 19.0. Descriptive statistics, including frequencies and percentages, were employed to summarize the participants' knowledge and awareness levels regarding oral and maxillofacial surgery.

Results

We surveyed 256 participants, of whom 39% were illiterate. 94% of those individuals were unaware of a department called maxillofacial surgery that specializes in treating head, neck, and face illnesses. 19% of the population was in elementary school, of which only 2% were aware of a "special doctor" for their requirements since their parents were concerned about their illness and were finally referred by another doctor (80%) or a relative (20%). 15% of students with secondary/ intermediate education and 5% of those recognized maxillofacial surgeons as acceptable physicians for their treatment, primarily for dental extractions and/or palatal cleft patients who had been receiving therapy from infancy or post-operative TMJ ankyloses patients.

Approximately 16% of our research participants were undergraduates seeking treatment for severely decayed teeth, opting for orthognathic surgery (100% from recommendation by an orthodontist), or suffering from temporomandibular joint discomfort.

Table 01: Distribution of participants

Education Level	Percentage out of a total of 256 patients	Maxillofacial Surgery Special Doctor Awareness (%)
Illiterate	39%	4%
Primary Schooling	19%	2%
Secondary/ Intermediate Education	15%	5%
Undergraduate Student	16%	4%
Postgraduate Student	11%	20%

Only 4% of the people with no educational background knew that a maxillofacial surgeon was involved in their treatment. Eleven percent of the people we talked to were post-graduate students. Among them, twenty percent admitted that they had heard of the maxillofacial surgical department as the place to go for issues involving the head, neck, and face. Of these individuals, 2% sought an implant-supported prosthesis, and 4% had previously had an experience with a maxillofacial surgeon about maxillofacial trauma.

The results of the survey indicate that a minority (25%) of participants correctly recognized that oral and maxillofacial surgeons should be consulted for trauma to the head and neck. While a portion (15%) of participants acknowledged the need to consult oral and maxillofacial surgeons for cancer of the oral cavity and face, the majority (85%) were unaware of this role. Although some participants (20%) recognized the role of oral and maxillofacial surgeons in managing painful conditions, the majority (80%) were not aware of this aspect.

Table 02: Awareness of knowledge in all participants

Question	Yes (%)	No (%)
Should oral and maxillofacial surgeons be consulted for trauma to the head and neck?	25%	75%
Should oral and maxillofacial surgeons be consulted for cancer of the oral cavity and face?	15%	85%
Should oral and maxillofacial surgeons be consulted for swellings or lesions of the oral cavity and face?	22%	78%
Should oral and maxillofacial surgeons be consulted for acquired and developmental anomalies such as cleft lip and palate, post ablative surgery defects, etc.?	10%	90%
Should oral and maxillofacial surgeons be consulted for painful conditions of the oral cavity and face?	20%	80%
Should oral and maxillofacial surgeons be consulted for simple or complicated removal of teeth?	8%	92%
Should oral and maxillofacial surgeons be consulted for infections of the oral cavity and face?	13%	87%
Should oral and maxillofacial surgeons be consulted for the placement of implants?	12%	88%

Chi-square tests conducted on the data show significant associations between education level and awareness of dental treatments, as evidenced by Pearson's Chi-square value of 55.114 (df=5, p=0.001), Likelihood ratio value of 60.499 (df=5, p=0.000), and Linear-by-linear association value of 29.209 (df=2, p=0.000), based on 256 valid associations.

Table 03: Different education levels of patients to show how education level affects awareness

	High School or Below	College	Bachelor's Degree	Master's Degree	Ph.D. or Higher
Tooth Extraction	65%	75%	85%	90%	95%
Dental Implant Placement	60%	70%	80%	85%	90%
Wisdom Tooth Removal	70%	75%	85%	88%	92%
Orthognathic Surgery	30%	40%	55%	65%	75%
Temporomandibular Joint Surgeries	40%	50%	60%	70%	80%
Facial Trauma Management	50%	55%	65%	75%	85%

Table 04: Chi-square tests

	Value	df	Asymptomatic significance (two-sided)
Pearson's Chi-square	55.114	5	.001
Likelihood ratio	60.499	5	.000
Linear-by-linear association	29.209	2	.000
No. of valid associations	256		

Discussion

Understanding and perceptions of the OMFS specialty are vital to its growth. Due to OMFS' extensive area of practice that overlaps with several medical disciplines, there is a substantial variance in the referral priorities of health professionals, students, and the wider population.[7,13] According to Jensen, it might be challenging to determine which clinical specialization is most suited for a given situation because of the overlapping in scope between nearly all of them. [14] For this reason, it is crucial for every health sector to create transparent clinical practice guidelines and inter-departmental referral channels. In the long run, efficient referral protocols improve the quality of treatment provided to patients, reduce the strain on healthcare resources, and boost the quality of care.[15,16]

According to research by Laskin[17], Lesny[18], and Langdon[19], most medical postgraduates know OMFS as a department, but most of them are unaware of the extensive clinical spectrum of this specialty. Comparable findings were found in the research we conducted. According to research performed in England by Ameerally et al., upwards of 79% of the population was unaware of the OMFS section, and only around 74% of those aware of it could correctly describe its function.[10]

How the community perceives OMFS is just as crucial as how doctors and nurses feel about it. Those living in Pakistan can visit any private sector clinic, regardless of whether or not they have insurance. The risk of incorrect self-referrals offsets unfettered access's advantages (such as quick patient turnover).[8] In the current study, among those with secondary or intermediate education, 5% found maxillofacial surgeons to be suitable doctors, most often for tooth extractions and/or palatal cleft patients who had been undergoing therapy since childhood, or for patients with TMJ ankyloses who had had a surge. Among those with primary education, 2% found a maxillofacial surgeon to be a suitable doctor, most often for tooth extractions and palatal cleft individuals undergoing therapy since childhood or post-operative TMJ ankyloses patients.[20]

According to study conducted by Mohammad et al (2021), there is a need to increase awareness especially towards cosmetic surgery procedures, and conduct health campaigns regarding oral and maxillofacial surgery among healthcare professionals, especially medical doctors, and the general public. These results represents the values as our study related to it. According to Lau SL, medical conditions presented to medical postgraduates may fall within the purview of various specialties. Notably, oral and maxillofacial surgeons possess the capability to address all of the mentioned conditions. While there may be some overlap in responsibilities among specialties, there exists no absolute delineation of who should manage specific cases. This determination is contingent upon the individuals' training and the prevailing medical culture in different locales. Lau's study revealed that postgraduates affiliated with medical colleges linked to dental institutions exhibited superior proficiency in referring patients with diverse conditions within the realm of oral and maxillofacial surgery compared to those from medical colleges without such affiliations. Typically, a dental practitioner would refer such cases predominantly to an oral and maxillofacial surgeon, while a medical professional might approach it differently. Our findings indicate that most medical and dental clinicians will refer to OMFS for jaw fractures, orbital fractures, and dental trauma instead of ENT, GS, or PS, which is consistent with Rocha et al.'s findings. Ameerally et al., [8] did a study in England and shown that around 74% did not understand the role and scope of OMFS and up to 79% of the general population had not heard of OMFS.

Conclusion

Much of the common public was not aware of the scope of Oral and Maxillofacial surgery. While the majority of medical graduates surveyed knew that maxillofacial surgeons treat facial injuries, the vast majority did not know that these specialists treat a wide variety of certain other disorders affecting the head and neck. Graduates of those medical colleges that also have a dentistry school are more familiar with the range of services provided by OMFS than their counterparts who do not. The need for spreading awareness among the population regarding the domains of Oral and Maxillofacial surgery is evident.

CONFLICT OF INTEREST: None
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Author Contributions

1. Adil Sanan – Conceptualization, Study Design, Supervision, Critical Review
2. Haseeb Ullah – Methodology, Data Collection, Draft Writing
3. Fahad Qiam – Data Collection, Literature Review, Draft Writing
4. Asmat Ullah – Statistical Analysis, Data Interpretation, Proofreading
5. Fahad Ashfaq – Data Collection, Materials Preparation, Literature Support
6. Samavia Mazhar – Editing, Final Approval of Manuscript

Comparison of Success Rate by Evaluating Postoperative Pain Intensity After Root Canal Instrumentation with 'K' Hand Files and Rotary One Shape File

Muhammad Bader Munir[1], Ahmad Naeem Orakzai[2], Affan Jabbar[3], Zubaida Shireen[4], Rida Mujeeb[3], Emaan Fatima[5]

1. Department of Operative Dentistry, Akhtar Saeed Medical & Dental College, Lahore, Pakistan.
2. Department of Operative Dentistry, De'montmorency College of Dentistry, Lahore, Pakistan.
3. Department of Operative Dentistry, Azra Naheed Dental College, The Superior University, Lahore, Pakistan.
4. Department of Operative Dentistry, Lahore Medical and Dental College, Lahore, Pakistan.
5. Department of Dentistry, Al Mustafa Medical & Dental Trust Hospital, Chishtian, Pakistan.

Abstract

Introduction: The dental pulp presents with a variety of configurations and shapes throughout the dentition. Therefore, it is important that one must thoroughly know about tooth morphology, and one should carefully interpret any radiographic documentation plus one must adequately access and explore the pulp chamber and root canal system before initiating the root canal procedures, whether nonsurgical ones or surgical ones.

Background: Root canal treatment is the procedure in which infected pulp is removed to eliminate microbial invasion and to maintain tooth form and function. It includes access cavity preparation, working length determination, adequate cleaning and shaping and obturation of root canals.

Objective: To compare the success rate by assessing the level of postoperative pain following root canal instrumentation using a manual K-file against a Rotary One shape file.

Material & Methods: Using a random selection process, 112 patients were split into two groups. In group A patient, root canals will be prepared by K hand files and in group B patients, root canals will be prepared by rotary one shape file. Patients were recalled after 72 hours to evaluate postoperative pain and score was recorded according to verbal rating scale (VRS).

Results: Significant association was found regarding Success in both groups, i.e. Group A (K hand files), Group B (Rotary One shape file) with p-value = 0.036.

Conclusion: Within the confines of this study, it is possible to draw the conclusion that the hand K-file was found to have a significantly higher success rate for postoperative pain intensity after root canal instrumentation when compared to the Rotary One shape file and significant association was found between hand K- file and Rotary One shape file in terms of pain after endodontic treatment.

Keywords: Root Canal Preparation, Postoperative pain, Root canal instrumentation, 'K' hand files, Rotary one shape file

Introduction

The dental pulp presents with a variety of configurations and shapes throughout the dentition. Therefore, it is important that one must thoroughly know about tooth morphology, and one should carefully interpret any radiographic documentation plus one must adequately access and explore the pulp chamber and root canal system before initiating the root canal procedures, whether nonsurgical ones or surgical ones. The clinician encounters difficulties in achieving predictable outcomes with root canal procedures. The clinician is challenged to perform adequate enlarging, shaping, cleaning, disinfection, and obturation of the pulpal space to achieve predictable outcomes with root canal procedure.[1]

The goal remains to preserve natural teeth with optimal function and aesthetics. Despite advancements like nickel-titanium rotary instruments, outcomes haven't improved significantly. This challenges evidence-based practice, which demands better results from new methods. Still, some studies suggest certain canal preparation and disinfection techniques are more effective.[2,3]

NiTi file possesses transformational elasticity, which is also referred to as pseudoplasticity. This refers to the ability of the file to deform and then return to its original shape.[4] This feature means that usually NiTi instruments are made by milling instead of twisting; twisted instruments involve plastic deformation and are used, for example, to create stainless steel K-files. In the same way as the application of deforming forces, heat can also lead to the phase transition from austenite to martensite and vice versa.[5]

The One Shape rotary file system is a single-file, continuous rotation NiTi instrument developed to simplify and expedite root canal shaping. Designed with a unique asymmetrical cross-section and progressive pitch, it enhances flexibility,

Corresponding Author:
Affan Jabbar
Department of Operative Dentistry, Azra Naheed Dental College, The Superior University, Lahore, Pakistan.
affanjabbar173@gmail.com

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debris removal, and cutting efficiency while maintaining the original canal curvature. This system enables complete canal preparation with a single instrument, reducing treatment time and procedural errors.[4]

Furthermore, systems like One Shape facilitate the use of a single-cone obturation technique with a matching taper, making the canal filling process more straightforward than traditional methods. The use of a reciprocating single-file rotary system for cleaning and shaping root canals has gained popularity in endodontic therapy due to their simplicity and reduced technical sensitivity, Technical sensitivity refers to how dependent a procedure's success is on the clinician's skill and precision. Rotary systems like One Shape help minimize this sensitivity by standardizing motion, reducing the number of instrumentation steps, and maintaining canal anatomy with greater consistency. These advantages lead to fewer procedural errors such as ledging, canal transportation, or instrument separation, especially in less experienced hands.[6,7]

However, the shorter procedure time (mainly during instrumentation) obtained with a reciprocating file also can reduce the antimicrobial efficacy of solutions, which depends The lowering of microbial content in the root canal system may be jeopardized when the activity of irrigating solutions is decreased, which can consequently impede the healing process of apical periodontitis. Moreover, some research have revealed that reciprocating NiTi files are linked to more extrusion of debris than rotational NiTi files, a disadvantage that increase the possibility of postoperative complications including more incidence and severity of postoperative discomfort.[8,9]

Among these, the most significant contributor to postoperative discomfort is the accidental extrusion of dentin chips, necrotic debris, bacteria, or pulpal tissue remnants into the periapical region during the preparation process. Because this debris varies depending on the instrument and the instrumentation technique, it is preferable to use an instrument that causes less pain by extruding less material into the periapical area.[10]

For decades, research has resulted in the development of a full sequence, variable taper rotary instrument, ProTaper Universal (PTU) that was manufactured by Dentsply Maillefer. Regarding shaping abilities, this system has showed positive outcomes. Nevertheless, its drawbacks include the learning trajectory, instrument fatigue, and the increased number of instruments. The latest 5th generation of file is made in a way that the Centre of mass and/or rotation is offset. This minimizes file to the root dentin interaction by generating a mechanical wave of motion along the active length of the file.[11]

The main aim of this randomised clinical trial was to evaluate the two systems indicated above in relation to postoperative pain. This was done with the intention of achieving the highest possible level of support for evidence-based clinical practice.[12]

Materials and Methods

This Randomized Control Trial was conducted at Department of Operative Dentistry, de'Montmorency / Punjab Dental Hospital, Lahore.The duration of study was 6 months from 15th Aug 2022 to 14th Feb 2023. Ethical approval was granted from same institute having ethical number RTMC DSG22019/099/2983 It was non-probability consecutive technique. The sample size was calculated using a two-proportion test to compare the expected success rates (absence of postoperative pain) between two groups. A significance level of 5% and a power of 80% were used. Based on the expected proportions of success in each group, the formula for comparing two independent proportions was applied. This resulted in a sample size of 56 participants per group, totalling 112 participants, to detect a meaningful difference at 5% of level of significance and 80% of power of test and taking expected success rate in terms of absence of postoperative pain in each group i.e. 83.3% in K hand files and 62.50% in rotary one shape file system.

The inclusion criteria was Patients aged 15 to 30 years (both genders), and a mature single rooted tooth with closed apex as seen radio-graphically with clinical symptoms of pain and tenderness on percussion by taking history and clinical examination. While, exclusion criteria were mobile teeth with advanced periodontitis as seen clinically and radiographically, limited mouth opening less than 40 mm as measured by scale, immunocompromised patients with the history of diabetes, heart diseases or cancer etc, presence of any root canal fracture, root resorption sclerotic canals and periapical radiolucency assessed radiographically.

The study was carried out on patients who met the inclusion criteria and were visiting the Operative outpatient department of Punjab Dental Hospital/De' Montmorency College of Dentistry in Lahore. Ethical permission from the Hospital Committee was obtained. For bias elimination, entire research was completed by a single operator. The patient gave informed consent. There were no ethical concerns or risks to the patient. Demographic information like name, age, gender and address were obtained. Clinical examination 112 of patients was done after taking detailed history. Preoperatively radiograph was taken in each patient for assessment of periapical status of teeth preoperatively. Lottery method was used to divide patients in two groups of 56 each randomly in group A and B. In group A patient, root canals were prepared by K hand files and in group B patients, root canals were prepared by rotary One shape file. For group A, local anesthesia was given and rubber dam isolation was done, access cavity was made, canal orifices were identified and initial instrumentation was done with 08, 10 K-files. Working length was confirmed radiographically, instrumentation was done with K files. Canals were irrigated with 2.25% sodium hypochlorite during cleaning and shaping. Paper points were used to dry canals and obturated with gutta percha points by lateral condensation method.

For group B local anesthesia was administered and isolation was done using rubber dam. Access cavity was made; canal orifices were identified. Initial instrumentation was done using 08, 10, 15 K-files and glide path was made. Working length was determined radiographically. Shaping was done with rotary one shape single file in continuous mode of rotation. The file was gently advanced using light pressure toward the apex with a slow, controlled pecking motion. The rotational speed and torque were set to 400 rpm and 2.5 N·cm, respectively, as recommended. Canals were cleaned and shaped. Sodium hypochlorite 2.25% was used as an irrigant during instrumentation. Paper points were used to dry the canals and obturated with single cone obturation technique and permanent restoration was done with amalgam or light cure composite resin. Patients were recalled after 72 hours to evaluate postoperative pain and score was recorded according to verbal rating scale (VRS), a simple and reliable subjective tool that categorizes pain intensity based on verbal descriptors. The scale includes four levels: (1) No pain; the treated tooth felt normal, (2) Mild pain; slight discomfort without the need for analgesics, (3) Moderate pain; discomfort that was either tolerable or made tolerable with analgesics, and (4) Severe pain; pain that disturbed normal activity or sleep, with little or no relief from analgesics. For the purpose of this study, a score of 1 on the VRS (No pain) was considered a successful outcome after 72 hours post-treatment.

The analysis of the data was carried out with SPSS version 26. For qualitative as well as quantitative variables, calculations of

descriptive statistics were calculated. Standard deviation (SD) along with Mean was also calculated for quantitative variables. This was done regarding age of the patients. For qualitative data such as gender and success, researchers calculated the frequencies and percentages when postoperative pain was absent after non-surgical endodontic retreatment. Stratification controlled effect of modifiers such as gender and age. Following stratification, the Chi Square test was used to compare success rates between two groups. A P-value of 0.05 or less was regarded as significant.

Results

Table 1 and table 2 showed distribution of age, percentage of gender and success of the patients included in the sample respectively. Significant association was found regarding Success in both groups ((Group A (K hand files), Group B (Rotary One shape file)) with p-value = 0.036 (Table 2). The Success in both group ((Group A (K hand files), Group B (Rotary One shape file)) was noted concerning age (below 20 years and above 20 years), it was found that there was significant association for < 20 years age group and there was no significant association for ≥ 20 years age group (Table 3). The success of the instruments in both group ((Group A (K hand files), Group B (Rotary One shape file)) was noted concerning gender, it was found that there was no significant association for female but there was significant association regarding male patients with p-value= 0.006 (Table 3).

Table 1. Descriptive Statistics (n = 112)

Category	Frequency (n)	Percentage%
Total Patients	112	100
Males	53	47.30
Females	59	52.70
Age	**Minimum**	**Maximum**
	15	30
	Mean	**SD**
	22.26	4.878

Table 2. Stratification of Success with respect to pain in both groups (n = 112)

Group	Success		Total	P-value
	Yes	No		
Group A (K hand files)	45	11	56	0.036
Group B (Rotary One shape file)	35	21	56	
Total	80	32	112	
Percentage	71.4	28.6	100.0	

Chi-square test was applied

Table 3. Stratification of Success in both groups with regards to age and gender (n = 112)

	Group	Success (Yes)	No	Total	P-value
Age (< 20 years)	Group A (K hand files)	17	3	20	0.050
	Group B (Rotary One shape file)	12	9	21	
Age (> 20 years)	Group A (K hand files)	28	8	36	0.259
	Group B (Rotary One shape file)	23	12	35	
Gender (Male)	Group A (K hand files)	22	3	25	0.006
	Group B (Rotary One shape file)	15	13	28	
Gender (Female)	Group A (K hand files)	23	8	31	0.811
	Group B (Rotary One shape file)	20	8	28	

Discussion

In this study of 112 patients, the minimum age was 15 years and the maximum age was 30 years, with a mean age of 22.26 ± 4.878 years. (Table 1). There were 53 (47.3%) male patients and 59 (52.7%) were female patients (Table 1). The Success in both group ((Group A (K hand files), Group B (Rotary One shape file)) was noted concerning age (below 20 years and above 20 years), it was found that there was significant association for < 20 years age group and there was no significant association for ≥ 20 years age group (Table 3). This may be due to fact that patients under 20 years due to better healing capacity and less complex root canal anatomy compared to older patients. Younger teeth generally have wider canals and less calcification, facilitating more effective treatment.The success of the instruments in both group ((Group A (K hand files), Group B (Rotary One shape file)) was noted concerning gender, it was found that there was no significant association for female but there was significant association regarding male patients with p-value= 0.006 (Table 3).

Other studies found that at six hours the variations in postoperative pain between Group A (PTU) and Group B (PTN) were not statistically significant. The comparison between these two systems (PTU and PTN) is important because both are widely used rotary file systems with different design features that may influence clinical outcomes such as postoperative pain. Understanding any differences helps clinicians choose the most effective and patient-friendly system for root canal treatment. This could be related to the study's in vivo, controlled, and randomised design.[13]

A study found a pattern in the intensity of pain experienced by patients within the group. The highest intensity of pain, if any, was recorded 6 hours after therapy, and then it decreased continuously (statistically significant, P < 0.05), resulting in no pain in both groups (Group A (PTU) and B (PTN) at 72 hours.[14,15]

Our investigation yields statistically significant, P < 0.05 outcomes that match those obtained (Group A, K hand files; Group B, Rotary One shape file by Kherlakian et al[16]. and Relvas et al.[17] In addition to the Hawthorne effect, the loss of the local analgesic effect during the immediate therapy following the endodontic procedure is another potential contributor to this outcome.

Furthermore, as revealed in this study, establishing the glide path before K hand files resulted in less postoperative discomfort and faster symptom resolution[18]. Previous research has also shown that this is the case for postendodontic pain.[19]

The preparation time of each instrumentation system was also calculated because most clinicians consider canal preparation time because of its impact on patient comfort and irrigation time.[6]

The variation in the canal preparation time was clearly rather large. Group A (PTU) needed far more time than Group B (PTN), with 11.28 ± 1.72 min against 5.493 ± 1.06 min, P < 0.001.[13] The findings resemble those of a Bürklein et al. study .[20] This could be the result of the different files used—that is, five for PTU group on comparison with only three for PTN group.[21]

Pain after endodontics does not determine success. Endodontic treatment's success or failure is decided by long-term results rather than the presence or absence of short-term postoperative pain.

It should be underlined that additional such research with a larger sample size and association of greater number of variables are needed since the outcomes of one clinical study cannot be generalised to all clinical situations.

Conclusion

Within the confines of this study, it is possible to draw the conclusion that the hand K-file was found to have a significantly higher success rate for postoperative pain intensity after root canal instrumentation when compared to the Rotary One shape file. Furthermore, a significant association was discovered between the hand K-file and the Rotary One shape file in terms of pain after endodontic treatment.

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Author Contributions

1. Muhammad Bader Munir – Conceptualization, Study Design, Supervision, Critical Review
2. Ahmad Naeem Orakzai – Conceptualization, Study Design, Draft Writing
3. Affan Jabbar – Literature Review, Data Collection, Processing, Materials, Draft Writing
4. Zubaida Shireen – Literature Review, Materials, Draft Writing
5. Rida Mujeeb – Data Collection, Processing, Analysis and Interpretation
6. Emaan Fatima – Literature Review, Analysis and Interpretation

Surgical Approaches to Infratemporal Fossa: A Case Series and Brief Review of Literature

Taj Uddin[1], Alaf Khan[2], Zubair Durani[1]

1. Department of Oral and Maxillofacial Surgery, Rehman College of dentistry, Peshawar Pakistan
2. Department of Oral and Maxillofacial Surgery Bacha Khan Dental College, Mardan Pakistan

Abstract

Introduction: Skull base is an intricate region of head and neck in terms of surgical access owing to its well concealed location and complex anatomy.

Objective: This study aims to provide findings from 9 patients in whom various approaches were used to access infratemporal fossa.

Materials and Methods: it was a case series study conducted at Departmen of Oral and Maxilofacial Surgery, Rehman Medical Institute Peshawar. From 2016 to 2024 9 patients underwent surgery to access infratemporal fossa using different surgical approaches including superiolateral, transmandibular and transmaxillary approach. The patient population included cases of foreign bodies lodged in the infratemporal fossa as well as lesions arising from or encroaching on infratemporal fossa.

Results: Superiolateral approach was most commonly used (4 cases). combined, inferior and anterior approaches were also employed to access infratemporal fossa.

Conclusion: surgical access to infratemporal fossa presents complex challenge. The surgical approach should be chosen on case to case basis after thorough deliberation and planning.

Keywords: Surgical Access, Surgical Approaches, Infratemporal Fossa.

Introduction

Skull base is an intricate region of head and neck in terms of surgical access owing to its well concealed location and complex anatomy.[1] The skull base can be generally divided into three sub regions i.e the anterior, middle and posterior skull base[2]

Infratemporal fossa constitutes an important region of the middle skull base. It is a deep anatomical space bounded anteriorly by maxilla, posteriorly by the tympanic and mastoid portions of the temporal bone, medially by lateral pterygoid plates, pterygopalatine fossa, nasopharynx, laterally by the ramus of the mandible and superiorly by the floor of the middle cranial fossa.[3] Many important structures including the Pterygoid muscles, Maxillary artery, Mandibular nerve, Otic ganglion, Chorda Tympani and Pterygoid venous plexus are housed in this important space[4].

Diverse group of pathologies including both malignant and benign tumours can arise from infratemporal fossa.[5] Tumours in this region may remain asymptomatic when small until the result in clinically overt mass in lateral upper neck, temporozygomatic region and oropharynx. These tumours may also present with voices changes, cranial nerve deficits and difficulty in swallowing.[6] In addition to tumours, infratemporal fossa is relatively common site for accidentally and iatragonically displaced foreign bodies.[7]

Over the years many approaches have been used for surgical access to infratemporal fossa. Transmandibular, transmaxillary, transparotid-transcervical and the transcervical approaches are most commonly used approaches as reported in the literature. In addition to this several other novel approaches have been proposed. All these approaches come with distinct advantages as well as shortcomings. Specific approaches are selected on case to case basis.[6]

This study aims to present findings from cases of infratemporal fossa lesions that were managed with different surgical approaches. It also aims to present a brief review of the literature.

Corresponding Author:
Alaf Khan
Department of Oral and Maxillofacial Surgery Bacha Khan College of Dentistry, Mardan Pakistan
Email: dralafkhan@gmail.com

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Materials and Methods

Patient Population

This is a retrospective study that reports findings from 9 patients who presented to Department of Oral and Maxillofacial Surgery Rehman Medical Institute Peshawar from 2016 to 2024. 7 patients were male and 2 patients were female. The age range was 12 to 72 years. The patients were operated on by a single surgical team lead by a single surgeon under general anesthesia.

Patient Presentation

Three patients presented with foreign body which were lodged in infratemporal fossa. The first patient (Case 1) presented with history of assault. He was stabbed with a knife that got stuck in his face. Knife was penetrating into ITF through temporal region and only the handle was sticking out. The second patient (Case 2) got accidentally stabbed by pencil. The pencil penetrated through the orbit into right infratemporal fossa. The pencil was subsequently retrieved at other centre but eraser head of pencil was left behind. Attempt was made to remove the foreign body through transantral endoscopic approach but was not successful. Case 3 was 11 years old male who presented with the history discharging sinus at right parotid region. There was history of penetrating trauma.

Imaging revealed a piece of wood measuring about 3 cm was stuck deep in the infratemporal fossa. Three cases were of extensive ameloblastoma two of mandible (case 7 and 9) and one of maxilla (case 5) were extending into infratemporal fossa. Case 8 presented with large carotid body tumour that necessitated wide dissection into infratemporal for exposure of carotid vessel and subsequent repair. Patient with biopsy proven SSC of right maxilla (case 4) that was extending to infratemporal fossa also required surgical access for complete excision. The last patient (case 6) was a case of extensive AVM of right mandible region. The patient had several episodes of accidental exsanguination. His Hb was low. He underwent pre surgical embolization of the feeding arteries followed by excision.

Investigation/imaging

All patients underwent CECT scan for assessment of the lesion and localization of the foreign body. Three patients underwent ct angiogram in addition to ct scan. In one patient it was done to assess the relation of foreign body(knife) with vessels in the inframtemporal fossa.

The other patient was a case of arterio venous malformation of mandible that was encroaching on the infratemporal fossa and CT agniogram was done for presurgical embolization.

Surgical Approaches

Superiolateral access.

Three patients (case 1,2 and 3) were approached using superiolateral access. A preauricular question mark incision in Bramely Alkayat fashion was used with elevation of the skin flap while leaving the pericraniun, elevation of the temporalis muscle, and osteotomy of the zygomatic arch for improved access. In one patient (case 1) strip of bone from zygoma was removed corresponding to part of knife that was lodge in the ITF. Part of this zygomatic bone was small and not replaced after retrieval of the foreign body. Once the zygomatic arch was reached, periosteum was incised and reflected, plates were adapted to the arch with two screws, across the planned osteotomy site. The plates were then removed and osteotomy was done and the arch was raised with the flap to allow access to the ITF. After retrieval of the foreign body the arch was fixed using the preadapted plates. And the flap was closed in layers.

Anterior Access

The anterior access was used in a case (case 4) of extensive squamous cell carcinoma of maxilla and ameloblastoma of midface (case 5), extending to infratemporal space. The Weber-Fergusion incision with infraorbital extension (deiffenbach variantion) was used.

The incision starts with midline lip split with chevron. The incision then follows then nasal sill and alar base and extends upward in the lateral nasal wall and then extended into infraorbital crease. Intraorally the incision extended in the ipsilateral labio buccal vestibule. The full thickness flap was reflected. The lesion was exposed and incised enblock with osteotomy in the infraorbital rim region and hard palate

Inferior Access

In two cases, arterio venous malformation of mandible (case 6) and carotid body tumour (case 8) inferior access was used. In these trans cervical- transmandibular approach a lip splitting incision extended posteriorly along a neck skin crease between mandibular first and second premolar on the left side. The mandibular segment was rotated laterally. The lesion was exposed upto skull base. The internal carotid artery was clamped. The tumor was excised enblock and internal carotid was reconstituted using graft.

In th case of arteriovenous malformation after exposure through transcervical approach with lip split, the lesion was excised resulting in hemimandibular defect.

Combined Access

In the two cases of ameloblastoma of left mandible extending into infra temporal fossa, combined inferior and superiolateral access were used to excise the lesion.

Results

	AGE	GENDER	DIAGNOSIS	ACCESS	COMPLICATION	Morbidity	Other
1	71	Male	Foreign body (knife) infratemporal fossa	Supeiorlateral	Temporal nerve palsy	Zygomatic arch was osteotomised	
2	12	Male	Foreign body (pencil tip) infratemporal fossa	Superilolateral	None	Zygomatic osteomy + coronoidectomy	Failed attempt with anterior appraoh
3	11	Male	Foreign body(wood) in infratemporal fossa	Superiolateral	None		
4	56	Female	OSCC maxillary alveolus	Anterior	Numbness ION region, trismus		
5	65	Female	Ameloblastoma	Superolateral			
6	9	Male	AVM	Inferior			Spontaneous mandibular regeneration
7	61	Male	Ameloblastoma	Combined			
8	21	Male	Carotid body tumor	Inferior	Vagal nerve palsy + injury mandibular premolar		
9	42	Male	Ameloblastoma	combined	Facial nerve injury+ partial wound dehiscence		history of segmental resection and reconstruction with iliac crest graft

DISCUSSION

Infratemporal fossa is unique in a sense that it lies at the cross roads of several surgical domains including neurosurgery, ENT, ophthalmology and maxillofacial surgery. Consequently, the surgical access to this region is of interest to several specialites.[7]

Surgical access to infratemporal fossa presents a complex challenge. The complex surgical anatomy, varied clinical presentation, concealed location and diversity of pathologies all add to the surgical difficulty. The available surgical approaches are complex, carry high risk of morbidity and often require combined approach for adequate access and visualization.[8,9]

Since 1961 when Fairbanks-Barbosa first reported infratemporal fossa approach for advance maxillary tumors, there has been considerable development in the surgical approaches to infratemporal fossa lesions. Improved imaging technologies, advances in endoscopes and robotic surgeries have contributed to these developments.[10]

Tumour of ITF may remain asymptomatic and ultimately present as painless expanisile mass or may present with non-suggestive symptoms like neuralgias, headache, facial paresthesia and otological symptoms. Hence diagnosis is often delayed, consequently many tumours in this region tend to be relatively extensive at presentation and hence present surgical challenge.[9] Foreign bodies in this region often present with vague pain, recurrent swelling of face or as draining sinus.

Unless a tumour secondarily extends to ITF from adjacent region, deciphering the nature of lesion is difficult. Often surgeons have to rely on the radiological characteristics of the lesion to have a clue about the nature of the lesion. Incisional biopsy is inadvisable in most cases. However, it is recommended in cases where the tumours encroaches near the surface. FNAC/FNAB can be done but they are frequently inconclusive and sometimes misleading. CT or MRI is usually done. Ct or MR angiography is sometimes advised to ascertain the relationship of the lesion with vital vasculature of neck.

Various surgical approaches can be employed to access the infratemporal fossa, each with its advantages and limitations. Commonly used surgical approaches include endoscopic,

transzygomatic, orbitozygomatic, transmandibular, transmaxillary, approaches.[12,13]

Superior access through the transzzygomatic approach provides a versatile access to the infratemporal fossa. This approach usually results in cosmetically acceptable scar and it can be combined with transmaxillary and transmandibular approaches to further improve access. The access tends to be very good to the lateral part of infratemporal fossa and this approach puts temporal branch of facial nerve at risk.[14]

Anterior transfacial approaches are well suited for tumours extending from ITF to maxilla or nasophaprynx. Anterior access using the weber-ferguson incision with or without maxillary swing is frequently employed for tumours of ifratemporal fossa. This approach involves inferior extension of the lateral rhinotomy incision to include lip split. It provides good access to both the lateral and medial part of infratemporal fossa. Unsightly scare may result from this approach and in addition lower lid ectropion, oronasal fistulas, velopharyngeal disorder and injury to teeth are also possible.[15]

For inferiolateral tumours of infratemporal fossa especially when they are extending to paraphyrngeal and masticator space transmandibular access is thought to provide good exposure. This approach approach combines a cervical incision with lower lip split. Median or paramedian osteotomy of mandible is done allowing lateral swing of the mandibular segment. It allows good control of major neck vessels and also accommodates incisions for neck dissection. Possible complications include scar and deformity of lower lip, lip paresthesia, lingual and hypoglossal nerve injury, injury to teeth, malunion and non union.[16]

Although open surgical approaches provide good access, recently endoscopic approaches have received renewed interest from head and neck surgeons. Endoscopic approaches promise good cosmetic outcome and less surgical morbidity however they are more ideally suited for benign tumours and retrieval of foreign bodies. [17]

Conclusion

Surgical access to infratemporal fossa varies from case to case basis and requires detailed planning.

In general, superior-lateral access is suited for retrieval of foreign body especially after failed endoscopic approach and superior-lateral lesions of infratemporal fossa. Anterior approach is employed in cases where the lesion is involving the posterior maxilla. Inferio-lateral approach provides excellent access and used for inferior lesion of the ITF. In more extensive lesions combined access may be employed to get better access.

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Author Contributions

1. Taj Uddin – Conceptualization, Study Design, Case Documentation, Draft Writing
2. Alaf Khan – Methodology, Literature Review, Data Interpretation
3. Zubair Durani – Supervision, Critical Review, Final Approval of Manuscript