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Fractured Systems and Fading Funds: Rebuilding Resilient Health Systems in Low Middle-Income Countries amidst Economic, Security and Policy Instability

Sanaa Masood Aslam¹

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The history of security measures to protect against infectious diseases dates back many decades ago. Nevertheless, context in which modern day health security has been framed and rationalised was in fact set in the late 1980s' when industrialisation and widespread urbanisation opened doors to zoonotic and infectious diseases with uncontrolled spread, having potentials of a deadly pandemic with significant implications on markets and economies became prominent in scholarly writings.¹ A renewed interest in health security measures to strengthen public health capacities, was awakened following the 2014 Ebola virus outbreak in West Africa with the introduction of Global Health Security Agenda (GHSA) to which many LMICs are signatories off.²

The international health fundings' trajectory also mirrors global responses to health crises. A notable increase in health fundings began in the 1990s as a response to public health emergencies such as HIV/AIDS, malaria, tuberculosis and the Global Fund was established in 2002 to combat the aforementioned crises. This growth has however, remained uneven and inconsistent, often swayed by national priorities or as a sequelae to immediacy of crises, changing health priorities of donor countries/ organisations. The recent COVID-19 pandemic has, nonetheless, already unveiled flaws in preparedness and response including, limited financial investments in health systems, lack of emergency funds surge, reallocation of health resources, insufficient commitments and others consequently, undermining health, globally.

In September 2022, a novel multilateral funding tool, the Pandemic Fund, was created and unveiled at the G20 Joint Foreign ministers and Health Ministers' meeting in Bali, Indonesia, with the aim to bolster pandemic prevention, preparedness, and response in low-middle income countries through financial support/ aid, technical and expert guidance

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from various partners (national, regional, global). The fund prioritizes bio-surveillance,

lab advancements for rapid diagnosis, and capacity building of health worker training. With the World Bank being its trustee and WHO chairing its technical advisory panel, the Fund was successful in moving critical financial investments awarding US\$885 million, catalysing additional US\$ 6 billion from partners covering investment gaps in nearly 75 low-middle income countries via 47 capacity building, surveillance and technical support projects. The fund has been pivotal in galvanising multi-sectoral co-ordinations and cooperations, incentivising countries to improve their domestic input for sustainability of financial investments and moving additional international resources for pandemic preparedness.³ As calls for additional funding of \$10.5 billion per annum to support the global pandemic preparedness response (PPR) arose, to strengthen the global PPR financing architecture, The World Bank launched the Financial Intermediary Fund (FIF) as a collaborative partnership between donors, co-investors/ potentially implementing political systems, civil society organizations/ foundations with World Bank as a host and WHO as the technical lead.⁴

Financial disruptions courtesy the ongoing global recession and more recently global trade/ tariff conflicts and their forecasted implications on Health Security Agendas, nationally and globally, have prompted scholars to rethink and re-evaluate the global development finance system. An example of the same is the establishment of IMF's Resilience and Sustainability Trust in April 2022 (Centre for Global Development, 2024) to assist vulnerable LMICs facing long-term structural risks such as climate change, poverty, public health crises including epidemics and pandemics endure these external shocks which otherwise pose a risk to their macro economic stability and balance of payments through long term concessional financing (Global Development Policy Centre, 2024). Similarly, the World Bank also started restructuring with the introduction of reforms aimed at expanding its lending capacity to adapt to these evolving needs of LMICs.⁵

Global Health investment gaps significantly undermine

health security and sustainability of ongoing public health initiatives in LMICs where health systems are already strained. Recessions and inflation coupled with debt burdens, and shifting international donors' priorities severely reduces both domestic and external health financing. Thereby, jeopardizing essential health services such as immunizations, disease surveillance, and emergency preparedness. LMICs are seen struggling to fulfill co-financing obligations and/or are falling behind pledged international aid transitions, which ultimately slows progress toward Universal Health Coverage (UHC).

Donor countries, facing their own fiscal constraints, tend to scale back commitments, leading to unpredictability in development assistance for health. Fragmented and misaligned aid in domestic health systems has further complicated efficient resource use. Moreover, financial instability also deters investments in health infrastructure, innovation, and workforce development; all core components of resilient health systems.

In response to economic crises, governments in LMICs are pushed to mobilize ministries in strategic plans with the object of fiscal consolidation while safeguarding essential health services. Efficiency, prioritization, and innovation becomes critical for which a shift of stakeholder's perspectives becomes inevitable. Stewardship by implementing vertical programs within the broader health system infrastructure also improve resilience and sustainability. In spite of the delays in the scale and speed of interventions courtesy financial disruptions, coordinated efforts to enhance public financial management, horizontally, across social sectors can bolster health resilience whilst safeguarding vulnerable populations.

Sustaining health initiatives amidst reduced pecuniary investments is challenging yet possible provided strategic shifts are made. For this purpose, International financial institutions such as the IMF and multilateral development banks (MDBs) play a crucial role. As IMF programs adjust macroeconomic frameworks, health ministries and partners are often mobilised to ensure essential health services are protected. IMF and MDBs' monetary contributions in existing programs can be leveraged into protecting essential healthcare services, such as immunizations, Labs and capacity building through collaborative re-assessments and revisions in the context of macro-economic landscape of LMICs. For this purpose, newer instruments such as debt-for health swaps, converting debt repayments into health spendings, spending in other sectors such as social protection can result in beneficial health outcomes.⁶

Reallocations within the existing national budgets can support efficiency gains targeting cost effectiveness of interventions alongside public-private partnerships in infrastructure and service delivery in LMICs ensure health equity, accountability and resistance to financial shocks.⁶ Increasing health taxes on products like tobacco, alcohol, and sugary drinks can raise significant revenue while promoting healthier behaviour. These revenues, if reinvested in health systems, could help close funding gaps. Green taxes and subsidy reforms may offer similar benefits. Not only would such measures promote healthier behaviours but when reinvested in the health system, these policies can close the donor aid gaps.⁶

Alternatively, fiscal consolidation through macroeconomic modalities such as blended financing, i.e. combining concessional loans and grants with the purpose of driving sustainability in national healthcare can help LMICs mitigate implications of financial disruptions on WHO identified threats. Often LMICs resort to adapting policies, and/ or re-evaluating cofinancing requirements to reflect on economic realities and endure financial disruptions.

With efficiency gains becoming censorious champions in surviving economic recessions, LMIC governments should also focus on reducing wasteful health spending through cost-effective practices such as rational use of high-cost medicines. While such reforms take time and political will, they can help stretch limited budgets further.

In sum, a comprehensive approach, protecting essential services, leveraging global financing, cutting inefficiencies, raising revenues through health taxes, and reprioritizing national budgets is much needed to sustain health financing and system resilience in the face of mounting macroeconomic shocks to ensure health security at national and international forums. Sustaining global public health initiatives amidst reduced financial resources is challenging but possible, provided strategic shifts are made. Efficiency, prioritization, and innovation have become critical. Governments and health actors must focus on protecting essential health services, eliminating inefficiencies (such as procurement waste or duplicated reporting), and adopting cost-effective interventions. Country ownership and smarter integration of vertical programs into broader health systems can improve resilience. Additionally, investing in preventive care and primary healthcare can yield long-term cost savings. While reduced resources may limit the scale and speed of interventions, with careful planning, collaboration, and governance reforms, essential global health

goals can still be upheld.

DISCLAIMER

None.

CONFLICT OF INTEREST

None to declare.

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Multicenter, Cross-sectional Survey on Oral and Maxillofacial Surgery Cases and its Management in Pakistan during the COVID-19 Pandemic: A National Perspective

Mor Khan Shar,¹ Faheem Ahmed,² Hamza Hassan Mirza,³ Asif Ali,⁴ Asif Nazir Chaudhary,⁵ Zahoor Ahmed Rana⁶

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ABSTRACT

Objective: The objective of this study was to perform a multicenter, cross-sectional analysis to assess the maxillofacial cases presented and their management in a Pakistani population during the COVID-19 Pandemic along with academic activities.

Materials and Methods: The study was conducted from April 30, 2020, to Oct 30, 2020, in different maxillofacial centers across the country. The questionnaire aimed to elicit information regarding the maxillofacial services provided during the pandemic, the use of personal protective equipment, the effect on academic activities, the development of new standard operating procedures, and other aspects. All these data were collected through an online Performa and data was analyzed through SPSS 23.0v.

Results: The results showed that the COVID-19 pandemic has adversely affected maxillofacial services provided in Pakistan. Elective surgeries have been largely reduced whereas emergency services are being delivered in all centers. Academic activities have been negatively impacted, and alternate means of communication are being employed. The provision of personal protective equipment has become the focal point in delivering health services along with the formation of standard operating procedures for managing patients during the pandemic.

Conclusion: Maxillofacial surgeons must remain updated to use the information and inform new guidelines to help patients in a way that minimizes the risk to the operating team and provides the best level of care to the patients during this crisis.

Keywords: COVID-19, Maxillofacial surgery, Pandemic, Pakistan

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INTRODUCTION

The first case of novel coronavirus (COVID-19) reported in China dates back to November 17th of 2019. It was reported by a 55-year-old resident of the Hubei province of China as stated by South Morning China Post. A single case turned into an epidemic and then traversed the globe to be declared a pandemic by World Health Organization (WHO) on 11th March 2020.¹ COVID-19 had the potential to cause severe acute respiratory tract infection among infected humans with high-grade fever, dry cough, and dyspnea.² Many other symptoms were reported related to COVID-19 disease including gastrointestinal disturbance, anosmia, ageusia, headache, myalgias, arthralgias, and sore throat.³ Several anecdotal reports have reported neurologic, psychiatric, and ophthalmologic symptoms as well. Transmission is from person to person via hands, saliva, nasal droplets, and surface contacts.^{4,5} Nations across the world took drastic measures to limit the spread of the virus which included wearing masks at all times outside, social distancing, working from home, and closing educational institutions.⁶ Preventing transmission of infection through the use of personal protective equipment (PPE) i.e face masks, gloves, goggles, respirators, gowns, and face shields were mandatory in hospitals around the world.⁷

Healthcare systems and organizations took drastic measures to adapt to the continuously evolving political and economic circumstances during this pandemic.^{8,9} The rapidly spreading characteristic potential of this virus advocated restrictions on mass gatherings affecting every field of life including teaching institutions, social gatherings, sports activities, airports, banks, and even hospitals are not spared from modifications to execute routine work and services.⁴ The world was responding with behavior modifications like social distancing, lockdowns, and quarantine of suspected cases as well as restricting practices that generated aerosols since the virus was known to spread by the airborne route.¹⁰

All the elective procedure of dentistry whether they were endodontics, restorative dentistry prosthodontics, periodontics etc. were suspended during pandemic but the emergency procedures of OMFS were continued such as emergency tooth extraction, facial space infections management, minor soft tissue injury, tooth avulsions, dentoalveolar injuries.

Other surgical fields such as general surgery, plastic surgery studies cannot be extrapolated to Oral and maxillofacial dynamics as the Oral and Maxillofacial surgeon works directly at the site of COVID virus inoculation making Maxillofacial surgeons particularly susceptible to this virus owing to the nature of their work

and the kind of instrumentation.¹¹

Taking into consideration these modifications in providing health care, this study was done to assess how the Maxillofacial Surgery Departments all over Pakistan are affected and managing the patients in the COVID-19 pandemic situation. To the authors' knowledge, there is no such study done yet in the country highlighting the specialty-related challenges being faced and the steps taken to address them.

MATERIALS AND METHODS

This cross-sectional study was conducted from April 30, 2020, to Oct 30, 2020, in different maxillofacial centers across the country. The ethical approval for this study was obtained from the Ethical review board of Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan (Reference no. ERB No. F. 1-1/2015/ERB/SZABMU/572). The reliability of the questionnaire was assessed using Cronbach's Alpha ($\alpha = 0.83$). For validity, the Content Validity Index (CVI) was calculated for each item, and the Scale-Level Content Validity Index (S-CVI) was determined based on expert evaluations through Focus Group Discussions (FGDs) and the Delphi method. The CVI for individual items was found to be above the accepted threshold (typically ≥ 0.78), and the overall S-CVI for the scale was above 0.90, indicating good content validity. These results demonstrate that the questionnaire is both reliable and valid for the intended purpose.

The questionnaire was directed toward the head of departments of Oral and Maxillofacial Surgery across the country working in private or government setup. The soft copy questionnaire was distributed through WhatsApp or Email whatever the particular recipient deemed convenient. Consent was taken at the beginning of the form and were informed that the data provided will be used for educational purposes. The participants filled out the form online and hence omitted the physical contact that may have been unavoidable if hard copies of the questionnaire were distributed.

RESULTS

The questionnaire consisting of different questions regarding maxillofacial surgery during the novel Coronavirus pandemic was distributed. Data was collected and stratified in which we got a response from 20 major maxillofacial centers in Pakistan.

Services and elective surgeries

The results showed that all 20 centers are providing emergency services. Outpatient services have been suspended in the majority of the maxillofacial centers. The pattern of trauma management has also changed with closed treatment being preferred to minimize aerosols as shown in Table 1. Various elective surgeries have also been suspended.

Table No 1: Frequency of Services Provided in Maxillofacial Centers During a Pandemic

Question	Variables	Frequency (N)	Percentage (%)	
Services provided by a maxillofacial center for the general population during the Covid-19 outbreak	Emergency services	Yes	20	100
		No	0	0
	Facial space infection treatment	Yes	15	75
		No	5	25
	Indoor facility(ward)	Yes	13	65
		No	7	35
	Surgical exodontia	Yes	10	50
		No	10	50
	Oncology surgical management	Yes	9	45
		No	11	55
	Outpatient department (OPD)	Yes	7	35
		No	13	65
	Elective surgeries/ procedures	Yes	4	20
		No	16	80
	Implantlogy	Yes	1	5
		No	19	95
	Reconstruction surgeries	Yes	1	5
		No	19	95
	Any other elective surgical procedure	Yes	1	5
		No	19	95
Benign pathologies treatment	Yes	0	0	
	No	20	100	
Pre-prosthetic surgical procedures	Yes	0	0	
	No	20	100	
Cleft lip and palate repair	Yes	0	0	
	No	20	100	
Orthognathic surgical procedures	Yes	0	0	
	No	20	100	
TMJ surgeries	Yes	0	0.0	
	No	20	100	

Academic activities and consultations

Around 12 (60%) centers are still conducting morning rounds while other institutions are using telephonic and online methods for patient consultations and decisions. Other academic activities are being conducted through the zoom online application in 15 (75%) centers, module in 2 (10%), physically in 1 (5%), and suspended in 2 (10%) centers as shown in Table no 2.

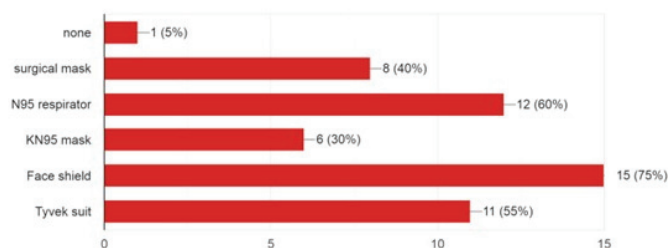
Table No 2: Frequency of Various Forms of Conduction of Academic Activities

Question	Variables	Frequency (N)	Percentage (%)	
Academic activities during the Covid-19 outbreak	Zoom online sessions	Yes	15	75
		No	5	25
	Any other online application	Yes	6	30
		No	14	70
	Module application	Yes	2	10
		No	18	90
	Physical presence in auditorium / lecture hall	Yes	1	5
		No	19	95
	No academic activity	Yes	2	10
		No	18	90

Personal protective equipment

The results show PPEs are being used in almost all the major maxillofacial centers. They include surgical masks, KN95 masks, N95 respirator masks, face shields, Tyvek suits, and gowns. Priority is being given to respirator masks and face shields as they provide the closest protection for surgeries in and around the oral cavity (Figure 1).

Figure No 1: Frequency of Various PPE's Used in Maxillofacial Centers



Covid-19 facilities and SOPs

The results show that 16 (80%) out of 20 maxillofacial centers are equipped with an isolation ward for Covid-19 positive patients. 15 (75%) have a sample collection facility while 12 (60%) have a sample testing facility. 18 (90%) centers have formed their own SOPs for managing patients during the covid-19 crisis (Table No 3).

Table No 3: Maxillofacial Centers Affiliated Hospitals Providing COVID-19 Related Services

Question	Variables		Frequency (N)	Percentage (%)
COVID-19 facilities	Isolation facility	Yes	16	80
		No	4	20
	The COVID-19 sample collection facility	Yes	15	75
		No	5	25
	COVID-19 sample testing facility	Yes	12	60
		No	8	40
SOP's following	Own	18	90	
	Others	2	10	

DISCUSSION

The novel Sars-Cov-2 pandemic rattled the health systems of the most prosperous countries of the world and adversely affected the provision of healthcare services due to the rapidly increasing cases afflicted with the deadly virus.¹³ The situation in Pakistan was no different from the rest of the world.¹⁴ Boasting a population of 220 million, the country was struggling to manage the rapidly rising cases at that time of an economic crisis. As of 1st July 2020, the total number of Sars-Cov-2 cases in Pakistan were reported around 213,000.¹⁵ Many health services were suspended as the hospitals were facing shortages of ventilators, beds, personal protective equipment, and other medical supplies. The residencies, fellowships, and other academic activities were also affected because of the increased risk of virus transmission to frontline health professionals. All elective surgeries were halted at the time.

This study was conducted to ascertain the effect of the Covid-19 crisis on every aspect of maxillofacial surgery in Pakistan. Dentists and maxillofacial surgeons are in the highest risk category for contracting the virus as their work involves the oral cavity and working with aerosols.¹⁶

Therefore it is imperative that the risk of acquiring the virus be thoroughly determined and measures are taken to prevent or minimize the risk of transmissions from patient to doctor and then to other health professionals. For this purpose, a questionnaire was designed and distributed to 20 renowned centers of maxillofacial surgery throughout Pakistan covering in detail the impact of Covid-19 on outdoor and indoor services, maxillofacial procedures and SOPs formed to effectively deal with the crisis and inform guidelines on how to minimize the risk of virus transmission while providing the needed dental and maxillofacial care.

Surgical triage was systematized everywhere in the world, giving priority to lifesaving operations and elective surgeries being deferred.^{17,18} The results collected showed that emergency services were being offered in all centers and outpatient services in 35% of centers. Trauma was managed on a priority basis and the pattern of trauma management was also seen to be shifted from open reduction to closed reduction as the risk of virus transmission was higher with aerosol-producing equipment used in open reduction and fixations. Most elective surgeries were also suspended throughout the country. Around 15 (75%) centers were treating facial space infections amid this crisis, while only 9 (45%) were offering surgical oncology services and 10 (50%) were performing complex exodontia. These results coincide with studies done on dental procedures amid Covid-19 in other countries. Guo et al¹⁹ report that emergency dental services such as treatment of dental trauma, acute pulpitis, cellulitis, and abscesses were being provided by dental centers in China. Another study conducted in Germany by Al-Halabi et al²⁰ reported the suspension of all elective dental procedures and provision of only urgent dental care to patients in need under strict guidelines.

The survey also showed that 18 (90%) of maxillofacial departments in the country established their own departmental SOP for managing patients amid this crisis. Departmental academic activities also suffered at the hands of Covid-19 but did not stop. Journal clubs and presentations were managed on zoom online application²¹ in 15 (75%) centers while the rest were using other online software for a similar purpose. Telephonic communication was; head of a department and consultants' prevalent means of staying up to date and advising indoor patient management rather than physical rounds. The reduction

of health personnel for indoor and emergency services also became a part of the SOP. This sudden transition to online interactive learning taught us the incorporation of IT technology in new levels of blended learning.²²

The use of personal protective equipment (PPE) became standard practice for health professionals working in hospitals as their safety means that they can work efficiently and serve those in need of medical help. The emphasis at that time was on the efficient supply and usage of PPE all over the world.²³ The PPEs that were supplied in Pakistan were mask, gloves, face shield, goggles, and Tyvek suits. The face shield became an integral part of a maxillofacial surgeon's PPE working in the Covid-19 crisis. According to the survey, the face shield was preferred more than N95 masks and Tyvek suits by the maxillofacial centers of Pakistan for their working personnel. The results do not show a marked difference in preference between N95 respirator, KN95, and simple surgical mask. Hirschmann et al²⁴ conducted a systematic review regarding the use of PPEs for orthopedic and trauma surgeons and collected data from six countries concluding that PPE had a vital role in the safety of a surgeon and should consist of gowns, specialized face masks, gloves, and goggles or face shields.

There are no universal guidelines on the regulation of maxillofacial surgery or other health services during the Covid-19 pandemic yet due to the novelty of the virus and the continuing change in evidence regarding its characteristics, transmission, and the role of PPE. Hence, these aspects are also limitations of this study.

CONCLUSION

The Novel SARS-Cov-2 affected all health care services at a huge scale which was unprecedented in the history of mankind, including Oral and Maxillofacial surgery worldwide. There was an unrest and delay in decision making and policy making. Timely policy development and plan implementation in case of such an outbreak or any other natural calamity should be done so that early measures are taken to limit the spread of the disease and continue the health care services and academic activities.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

An ethical clearance letter was obtained from the Institutional Research Board Shaheed Zulfiqar Ali Bhutto Medical University. (Ref No F.1-1/2015/ERB/SZABMU/672 dated:18/05/2020)

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Frequency and Risk Indicators of Dental Caries in Schoolchildren of Rawalakot, Azad Jammu and Kashmir

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ABSTRACT

Objective: The study evaluated the frequency of dental caries and their risk indicators among schoolchildren elevated and living in areas of low fluoridated. These indicators included socioeconomic status, toothbrushing habits, sweets consumption, pattern of dental visits, and salivary mutans streptococci levels (assessed only in 12-year-olds).

Materials and Methods: This community survey was conducted in schoolchildren of Rawalakot, Azad Jammu and Kashmir (AJK). The study children included a random sample of three age groups: 6 years (n=450), 12 years (n=230), and 15 years (n=180) from randomly selected schools in Rawalakot, AJK. For the study conducted between February and May 2023. The dmft (decayed, missing, and filled primary teeth) and DMFT (decayed, missing, and filled permanent teeth) and decay-missing-filled surfaces (dmfs/DMFS) indices were employed to document the frequency of caries.

Results: In 6-year-olds, the caries-free frequency in primary dentition was 58%. The dmft and dmfs mean was 1.9 and 3.7 respectively, while the score of DMFT and DMFS was 0.5. Nearly 90% of dmft score was due to active decay. Children with lower socioeconomic status had significant high dmft and dmfs scores, as well as a greater proportion of individuals with a combined dmft + DMFT score of ≥ 1 . Among 12-year-olds, 55% had caries history, with mean DMFT and DMFS scores of 1.5 and 2.2, respectively. The filled component constituted the majority of scores. Children were mostly caries-free and had lower DMFT, DMFS, and DT scores if they regularly visited dentist for routine checkups, had higher socioeconomic status (although this not being associated to DMFT), frequently less consumed sweets, and had lower levels of streptococcus mutans. Among 15-year-olds, 70% had a history of caries, with mean of 1.7 DMFT and 3.5 DMFS scores, and a high frequency of the filled teeth (FT).

Conclusion: Children who regularly visited dentist for routine checkups had significant low caries experience, as well as low DMFT, DMFS, and DT scores, compared to those who attended irregularly. Additionally, children from lower socioeconomic backgrounds mostly have high DMFS scores.

Keywords: Child, Dental Caries, Streptococcus Mutans

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INTRODUCTION

Recent epidemiological data show a significant decrease in caries prevalence among children in many developed countries.¹ Numerous cariologists have sought to understand the reasons behind this decline in caries prevalence. The most significant and likely reason identified is the increased use of fluoride toothpaste.² In contrast, several factors have been suggested as responsible for the development of dental caries, including oral hygiene practices, sugar consumption, and characteristics of saliva.³

In Pakistan, there has been a growing interest in community dentistry in recent years.⁴ Many epidemiological studies have been conducted to assess the oral health and intervention needs of special groups.⁵ However, there is limited specific information available regarding the representative child and adolescent population. In a study of children ages 6–12-year-olds, 74% were found to have caries, with a mean dft score of 2.29.⁶ In a survey of 12-year-olds, caries prevalence was 55%, with a DMFT of 1.87.⁷ Among 3 to 15-year-olds who used low fluoride, the prevalence was 69% with a DMFT of 2.76.⁸

This study aimed to report the results of a survey on the dental caries experience and potential risk indicators among schoolchildren of Rawalakot, AJK.

MATERIALS AND METHODS

This community survey was conducted in schoolchildren of Rawalakot, AJK. Inclusion criteria was school children of either gender aged between 6 and 15 years. Children with physical and mental retardation, and chronic illness were excluded from the study.

A non-probability stratified sampling of three age groups: 6 years (n=500), 12 years (n=250), and 15 years (n=200), both genders from randomly selected schools in Rawalakot, AJK. WHO sample size calculator was employed with the following parameters; 95% confidence interval, alpha type I error 5%, and prevalence of dental caries was 70%.⁸ For the study conducted between February and May 2023, the schools informed and invited the parents of children to participate in the study.

The dental examinations were performed at the school using portable equipment by a single examiner, with the subjects seated on a chair in a room. The examiner

underwent training and calibration. Examination of caries using a sterilized mirror and probe, without the use of radiographs. The dmft (decayed, missing, and filled primary teeth) and DMFT (decayed, missing, and filled permanent teeth) and decay-missing-filled surfaces (dmfs/DMFS) indices were employed to document the frequency of caries. The number of natural teeth was clinically recorded based on WHO criteria.⁹

All 12 and 15-year-old children completed a pretested, structured questionnaire before the dental examination, supervised by the same examiner. For 6-year-olds, parents/guardians completed the questionnaire on their behalf. The questionnaire covered sociodemographic information, sweet consumption, frequency of oral hygiene practices, fluoride use, and dental service utilization. The sociodemographic details included gender, age, the child's residential status, and the employment status of parent(s) or guardian(s).

The concentration of streptococci mutans in saliva was assessed using the 'spatula method' only in 12-year-olds. Following two minutes stimulation of saliva secretion, a sterile wooden spatula was rotated in the subject's mouth. Excess saliva was removed by withdrawing the spatula through closed lips. Both sides of the spatula were pressed onto selective MSB agar (Mitis Salivarius agar supplemented with sucrose and bacitracin), which was poured into RODAC plates. Colony counts showing typical mutans streptococci morphology were conducted per 1.5 cm² after 48 hours of anaerobic incubation.¹⁰

Stepwise multiple linear regression and multiple logistic regression analyses were conducted on the 12- and 15-year-olds children to determine the variables influencing dental caries outcomes such as caries-free status, DMFT, DMFS, and DT. For 6-year-olds, the analyses focused on caries-free status, dmft, and dmfs.

The variable salivary streptococcus mutans was included in all models for the 12-year-old children. The outcome "caries free status" was divided into two categories: "caries free" (dmft + DMFT = 0) and "caries" (dmft + DMFT ≥ 1). Data regarding the deciduous dentition were excluded from the 12-year-old group. Adjusted odds ratio (OR) with 95% confidence interval (CI) was computed. The data were analyzed using SPSS v 23.

RESULTS

A few children from the original sample did not participate in the study, resulting in a final sample of (n=450) for 6-year-olds, (n=230) for 12-year-olds, and (n=180) for 15-year-olds, corresponding to response rate was respectively 90%, 92%, and 90%. The study sample was born, raised, and currently living area with low water fluoridation. Nearly all children use fluoridated toothpaste (99%).

Since no significant difference in caries frequency by gender, results are presented in a combined form. Table 1 displays the caries experience in deciduous dentition

based on various explanatory variables in children of 6-year-olds. Frequency of children without caries in their primary dentition was 58%; overall mean dmft and dmfs were respectively 1.9±1.1 and 3.7±2.1, and both the mean DMFT and DMFS were 0.5±0.2. The distribution of the different components of the dmft indicated that nearly 90% of the score was due to active decay observed during the examination. The dental health status was significantly associated with the parents' occupation, as children from low socioeconomic backgrounds had higher dmfs values (p = 0.035) and a higher proportion of caries (dmft + DMFT ≥ 1) (OR: 1.62, 95% CI: 1.2–1.88, p = 0.003).

Table No 1: Caries experience in 6-year-old children, n=450

		f	%	Caries free %	DMFT	DT	MT	FT	DMFS	DS	MS	FS
Gender	Male	216	48.0	64.8	1.4	1.1	0.2	0.3	1.8	2.1	0.1	0.3
	Female	234	52.0	65.0	1.2	1.0	0.2	0.3	2.1	2.5	0.2	0.3
Parents employment status	High profession	70	15.6	70.0	1.2	1.1	0.2	0.1	2.8	2.3	0.2	0.3
	Lower profession	195	43.3	55.4	1.9	1.6	0.2	0.1	3.8	3.2	0.1	0.3
	Cleric	23	5.1	34.8	2.1	2.0	0.2	0.1	3.5	3.2	0.2	0.1
	Commercial job	113	25.1	45.1	2.3	2.1	0.2	0.2	4.8	4.4	0.1	0.1
	Farmers	49	10.9	44.9	1.9	1.8	0.2	0.2	4.2	3.6	0.4	0.2
Toothbrushing habits	< Once a day	113	25.1	49.6	2.1	1.9	0.2	0.2	4.4	4.2	0.2	0.2
	Once a day	162	36	43.2	2.2	2.0	0.2	0.2	4.3	3.7	0.3	0.1
	> Once a day	175	38.9	53.1	1.8	1.5	0.2	0.1	3.6	3.9	0.1	0.4
Dental visits	Never	315	70.0	44.8	2.2	2.0	0.2	0.2	4.5	4.0	0.2	0.1
	Routine checkup	135	30.0	56.3	1.6	1.3	0.2	0.1	3.0	2.4	0.1	0.3
Sweets consumption	Never	158	35.1	53.2	1.9	1.7	0.2	0.2	4.2	4.0	0.2	0.1
	< Once a day	207	46.0	49.3	1.9	1.6	0.2	0.1	3.3	2.8	0.1	0.2
	Each day	54	12.0	48.2	1.9	1.6	0.2	0.1	3.5	3.0	0.2	0.3
	> Once a day	31	6.9	29.0	2.6	2.2	0.1	0.2	4.6	4.0	1.2	0.2

Table 2 displays the caries experience based on various explanatory variables in 12-year-old children. Nearly all children had detectable levels of salivary mutans streptococci (98%). Over half (55%) had caries history (DMFT ≥ 1). Mean DMFT was 1.5±1.2 and DMFS was 2.2±1.3, with filled teeth accounting for the majority. Children were mostly caries-free and had lower DMFT, DMFS, and DT scores if they regularly visited dentist for routine checkups, had a high socioeconomic status (although this not being associated to DMFT), frequently less consumed sweets, and had lower levels of salivary mutans streptococci (Table 4).

Table No 2: Caries Experience in 12-Year-Old Children, N=230

		f	%	Caries free %	DMFT	DT	MT	FT	DMFS	DS	MS	FS
Gender	Male	112	48.7	65.2	1.2	1.3	0.2	0.1	1.2	1.4	0.2	0.4
	Female	118	51.3	70.3	1.1	1.2	0.1	0.1	1.7	1.6	0.3	0.2
Parents employment status	High profession	65	28.3	60.0	1.1	0.2	0.2	0.5	1.9	0.4	0.4	0.5
	Lower profession	92	40.0	44.6	1.5	0.4	0.2	0.9	2.4	0.6	0.3	1.2
	Cleric	10	4.3	40.0	1.3	1.0	0	0.2	1.8	1.4	0	0.3
	Commercial job	23	10.0	56.5	1.3	0.3	0	0.9	1.8	0.6	0	1.1
	Farmers	40	17.4	40.0	1.8	0.9	0.2	0.7	2.4	1.9	0.2	1.2
Toothbrushing habits	< Once a day	23	10.0	56.5	1.2	0.4	0	0.5	2.2	1.2	0	1.1
	Once a day	46	20.0	45.7	1.7	0.7	0.2	0.8	1.8	1.4	0.1	1.1
	> Once a day	161	70.0	50.0	1.4	0.4	0.2	0.8	1.4	0.8	0.3	1.1
Dental visits	Never	127	55.2	44.9	1.6	0.6	0.2	0.8	1.7	1.1	0.3	1.1
	Routine checkup	103	44.8	60.2	1.3	0.3	0.2	0.8	1.9	0.7	0.2	1.2
Sweets consumption	Never	23	10.0	60.9	1.3	0.2	0.2	0.9	1.9	0.6	0.1	1.2
	< Once a day	138	60.0	59.4	1.1	0.3	0.2	0.6	1.8	0.6	0.1	1.1
	Each day	35	15.2	40.0	1.7	0.7	0.2	0.8	2.9	1.5	0.2	1.2
	> Once a day	34	14.8	38.2	2.3	0.8	0.1	1.2	3.9	1.5	0.6	1.7
Streptococci mutans saliva	1 – 30	81	35.2	65.4	0.8	0.2	0.2	0.4	1.2	0.5	0.2	0.5
	31 – 60	104	45.2	50.0	1.4	0.3	0.2	0.9	2.2	0.7	0.1	1.2
	61 – 100	23	10.0	30.4	2.1	1.2	0	1.2	3.5	2.2	0	1.5
	> 100	22	9.6	31.8	2.5	1.5	0.2	1.1	3.5	2.8	0.2	1.5

Table 3 presents the caries experience based on various explanatory variables in 15-year-old children. Over two-thirds (70%) had caries history (DMFT ≥ 1). Mean DMFT and DMFS was 1.7±1.8 and 3.5±4.7, respectively, with the filled teeth (FT) comprising 75% of the total. The regression analysis results indicated that children without caries experience and with lower DMFT, DMFS, and DT scores were more likely to visit a dentist for routine checkups than those who only sought dental care when experiencing pain or discomfort. Additionally, children from low socioeconomic backgrounds were mostly have high DMFS scores (Table 4 & 5).

Table No 3: Caries Experience in 15-Year-Old Children, N=180

		f	%	Caries free %	DMFT	DT	MT	FT	DMFS	DS	MS	FS
Gender	Male	86	47.8	69.8	1.3	1.0	0.1	0.2	1.5	1.8	0	0.1
	Female	94	52.2	75.5	1.1	0.9	0.1	0.2	1.9	1.4	0.1	0.1
Parents employment status	High profession	72	40.0	37.5	1.7	0.5	0.2	1.9	3.3	0.9	0.5	1.7
	Lower profession	75	41.7	36.0	1.3	0.5	0.2	1.5	3.1	0.9	0.5	1.5
	Cleric	6	3.3	16.7	2.4	0.5	0.2	1.7	6.2	1.4	0.4	4.2
	Commercial job	16	8.9	31.3	2.0	0.6	0.1	1.1	4.6	1.4	0.7	2.3
	Farmers	11	6.1	27.3	2.5	0.9	0.2	1.2	5.8	1.7	1.6	2.3

Toothbrushing habits	< Once a day	2	1.1	50.0	0.9	0.9	0	0	0.9	0.9	0	0
	Once a day	27	15.0	33.3	2.1	0.6	0.2	1.3	3.8	0.8	0.4	2.4
	> Once a day	151	83.9	35.1	1.7	0.5	0.1	1.1	3.7	0.9	0.7	1.8
Dental visits	Never	82	45.6	30.5	2.1	0.7	0.1	1.1	4.6	1.4	0.8	2.2
	Routine checkup	98	54.4	40.8	1.4	0.4	0.2	1.8	3.0	0.7	0.6	1.5
Sweets consumption	Never	27	15.0	40.7	1.2	0.4	0	1.7	2.1	0.7	0.2	1.8
	< Once a day	109	60.5	31.2	2.1	0.5	0.1	1.1	4.1	0.9	0.8	2.1
	Each day	19	10.6	36.8	1.2	0.5	0.1	1.4	2.8	0.8	0.7	1.1
	> Once a day	25	13.9	32.0	2.1	0.6	0.1	1.2	4.3	1.2	0.8	2.1

Table No 4: Logistic and Linear Regressions to Estimate the Association of Caries with Potential Risk Factors in 12-Year-Old Children, N=230

Caries-free status	OR	SE	95% CI	p value
Toothbrushing habits	1.1	0.1	0.8 – 1.7	.814
Dental visits	0.6	0.2	0.3 – 0.9	.002
Sweet consumption	1.28	0.2	1.1 – 1.9	.022
Streptococci mutans	1.8	0.3	1.4 – 2.3	.0001
Parent's employment	1.4	0.2	1.1 – 1.8	.011
Fluoride supplement	1.2	0.3	0.8 – 1.7	.594
DMFT	Coefficient	SE	t	p value
Dental visits	0.5	0.3	- 1.1	.031
Sweet consumption	0.4	0.2	4.3	.001
Streptococci mutans	0.7	0.2	6.1	.0001
Parent's employment	0.3	0.2	2.9	.072
Fluoride supplement	0.3	0.2	2.2	.384
Constant	0.1			
DMFS				
Dental visits	0.9	0.4	- 3.2	.041
Sweet consumption	0.7	0.3	4.5	.001
Streptococci mutans	2.1	0.2	6.5	.0001

Parent's employment	0.4	0.2	3.6	.023
Fluoride supplement	0.6	0.3	2.8	.094
Constant	1.1			
DT				
Dental visits	0.3	0.2	- 3.1	.043
Sweet consumption	0.3	0.1	3.0	.004
Streptococci mutans	0.4	0.1	7.1	.0001
Parent's employment	0.2	0.1	4.7	.0001
Constant	0.5			

Table No 5: Logistic and Linear Regressions to Estimate the Association of Caries with Potential Risk Factors in 15-Year-Old Children, N=180

Caries-free status	OR	SE	95% CI	p value
Toothbrushing habits	1.0	0.3	0.6 – 2.8	1.00
Dental visits	0.7	0.2	0.5 – 1.0	.041
Sweet consumption	2.1	0.2	0.9 – 2.4	.852
Parent's employment	2.3	0.2	1.0 – 2.5	.111
Fluoride supplement	2.2	0.3	0.8 – 2.9	.551
DMFT	Coefficient	SE	t	p value
Dental visits	0.7	0.3	- 1.2	.032
Sweet consumption	0.2	0.2	0.8	.571

Parent's employment	0.2	0.2	2.5	.272
Constant	3.7			
DMFS				
Dental visits	0.5	0.6	- 3.6	.023
Sweet consumption	0.5	0.4	2.5	.271
Parent's employment	0.8	0.3	3.7	.011
Constant	4.7			
DT				
Dental visits	0.3	0.2	- 3.5	.027
Sweet consumption	0.1	0.1	0.8	.571
Parent's employment	0.1	0.1	1.0	.442
Fluoride supplement	0.1	0.2	0.9	.532
Constant	0.7			

DISCUSSION

This study aimed to assess the frequency of caries in 6-year-old children and adolescents aged 12 and 15 in AJK. Comparing our results with recent findings, we found them to be very similar to those reported in similarly aged children in many other regions of Pakistan with comparable lifestyles. Our caries-free frequency in children of 6-year-olds, 58%, and the dmft, 1.9, were similar to those in Peshawar, which reported values of 55% and 1.87, respectively.⁷ In 12-year-olds, our caries-free frequency of 55% and DMFT of 1.5 were similar to the values reported in the Peshawar study, 74% and 1.1 in Quetta, and 57% and 1.3 in Southern Punjab.^{6,7,11} Furthermore, our frequency was notably lower than that observed in the previously mentioned national survey in Pakistan, suggesting an improving trend in oral health with a decline in caries prevalence.¹² The levels of caries among 15-year-olds, with a DMFT of 1.7 and a caries-free frequency of 70%, appeared to be similar to the values of 2.8 and 69% reported in Abbottabad.⁸ It's worth noting that our DMFT in 12-year-olds was approximately half of the WHO global goal for the year 2020, which is 3. Additionally, the frequency of caries-free 6-year-old children has almost reached the recommendation of

50%.¹³

Socioeconomic status was associated with children's caries experience, as those with parents with a low educational level were more likely to have dental caries and a high level of untreated caries compared to those from higher socioeconomic backgrounds. A similar finding has also been reported in earlier investigations in other countries.^{14,15}

All caries outcomes in 12-year-olds who consumed sweets several times a day were significantly higher compared to the values reported in children with lower consumption. This finding supports associations observed in previous studies.^{16,17} Assessing children's sweet consumption accurately is challenging, and therefore, it is possible that the percentage of those consuming sweets several times a day is underestimated.

Our children appeared to have a good toothbrushing frequency, and in line with previous findings, we did not find any difference in caries experience between those with high or low toothbrushing frequencies.¹⁸ However, there was a trend towards a higher DMFT/DMFS and fewer caries-free children among those with the lowest frequencies.

Consistent with earlier studies, streptococcus mutans appears to contribute to development of dental caries and in increasing mean DMFT and DMFS scores.^{19,20} However, comparison with these studies should be approached with caution, as important differences in methodology should be taken into account. These differences include factors such as the age of the sample selected and the method used for the estimation of mutans streptococci. Additionally, an intriguing finding was the association of the bacteria with untreated caries. This could be explained by the fact that open cavities increase the number of oral sites for mutans streptococci.

CONCLUSION

The children in AJK showed a high proportion of conservatively treated disease, and for 12-year-olds, the WHO goal for the year 2020 has already been achieved. One possible reason for the low caries frequency in our sample could be the use of fluoride toothpaste during the development and eruption of children's teeth.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

Ethical approval was provided by the Ethical Review Committee at AK CMH Rawalakot. Ref no: 14/SKBZAN/CMHRWKT

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Comparison and Assessment of Communication Skills in Traditional and Integrated Undergraduate Dental Education

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ABSTRACT

Objective: To compare and assess the communication skills of undergraduate dental students of traditional and integrated system of education.

Materials and Methods: Verbal and written consent was taken from dental students. They were then observed while interacting with patients during their clinical rotation using Kalamazoo Essential Communication Checklist (adapted) KEECC-A. KEECC-A consists of seven items scale on which scoring was done and these items corresponds to seven elements of a doctor's communication. All the obtained data was then put into SPSS to obtain comparison of Means and Levene's test. Results were derived based on data obtained.

Result: A total 100 of dental students were observed during their clinical rotations, and were assessed using Kalamazoo Essentials Elements Communication Checklist(adapted) KEECC-A. It consists of seven items, the means of item 1: Builds a relationship, for group-a and group-b is same whereas the means of item 2: Opens the discussion, item 3: Gathers information, item 4: Understands the patient's perspective, item 5: Share information, item 6: Reaches agreement, item 7: Provides closure, have significant difference in their values. Group-b has higher means, which shows the students in this group have done better. Levene's test result shows only Item-1 have a value of p higher than 0.05, whereas (item-2) to (item-7) have value of p less than 0.05, which shows significant difference between both groups.

Conclusion: The conclusion of this study is that dental students from integrated system have done well in (item-2) to (item-7) and performance of item-1 in both group-a and group-b is similar. Therefore, it is concluded that an integrated system is better than a traditional system.

Keywords: Communication, Curriculum, Dental Students, Education, Kalamazoo, Undergraduate

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INTRODUCTION

Soft skills have long been recognized as essential in the field of dentistry. Among them, communication skills are particularly critical, as they influence patient trust, treatment adherence, and overall satisfaction. The development of these skills should begin early in professional education, enabling students to build and refine them throughout their training and into clinical practice.¹

Modern dental education is transitioning from a traditional, discipline-focused, and teacher-centered model to a competency-based, student-centered approach.² In this shift, vertical and horizontal integration in the curriculum allows students to apply knowledge creatively, develop interpersonal skills, and communicate effectively with patients from the outset.

One of the pre-requisites of a competent dentist is that they should be able to communicate effectively with patients as well as show empathy towards them along with being observant regarding their needs and respond aptly.⁶ Healthcare professionals that have good communication skills can deliver quality treatment, boost patient satisfaction, and improve patient outcomes.¹

Communication skills play a vital role in dentistry, as they are essential for building trust and fostering understanding between the dentist and the patient.³ In traditional dental curricula, typically spanning four years, the first two years focus primarily on theoretical instruction and foundational sciences such as dental anatomy, physiology, pathology, pharmacology, microbiology, and dental materials. The final two years emphasize clinical subjects and hands-on practice. In contrast, integrated curricula expose students to clinical settings and patient interactions from the beginning of their education. This early exposure allows students to apply theoretical knowledge in real-world situations, potentially enhancing the development of essential communication skills. Despite this shift, limited evidence exists on how these two curricular models differ in fostering communication competence among dental students, highlighting a gap this study aims to address.

Currently, there has been a shift towards including more interdisciplinary and patient-centered approaches in dental education, which may involve more hands-on and simulation-based learning experiences and a stronger

emphasis on communication, ethics, and professionalism from the beginning of dental school.⁵

Soft skills, including interpersonal communication, professionalism, leadership, adaptability, and time management, are essential for dental professionals to function effectively in clinical settings.^{1,4} To ensure the development of these competencies, it is crucial to integrate them into the dental curriculum from the onset of professional education.¹ Emphasizing these skills early helps students gradually refine them throughout their academic and clinical training, better preparing them for real-world challenges.

There has been a global transition in dental education from traditional, teacher-centered approaches to competency-based, student-centered models.² In competency-based education, curricular integration, both horizontal and vertical supports active learning, critical thinking, and the development of essential professional behaviors.⁴ These modern curricula emphasize the holistic preparation of students, not only in clinical competence but also in non-technical skills like communication and ethical practice. However, despite growing recognition of their importance, the structured teaching and assessment of communication skills are still inconsistently applied, particularly in some traditional systems.⁶ This inconsistency highlights the need for a clearer understanding of how different curricular structures influence the development of soft skills, especially communication, among undergraduate dental students.

The significance of this study lies in its contribution to understanding the development of soft skills, particularly communication, among undergraduate dental students enrolled in traditional and integrated curricula in Pakistan. Despite global advancements in competency-based dental education, there is limited local evidence comparing how these two curricular models impact students' communication competencies. This gap underscores the need for data-driven insights to inform curriculum improvements. Therefore, the rationale of this study is to evaluate the differences in communication skills between students in traditional and integrated programs, with the goal of recommending educational enhancements. The study aims to assess and compare the communication skills of undergraduate dental students in both systems using the adapted Kalamazoo Essential

Elements Communication Checklist.

MATERIALS AND METHODS

The study included third-year BDS students from participating institutions who were undergoing their clinical rotations in the Outpatient Department (OPD). A total of 50 students were selected from each institution, representing both traditional and integrated curriculum models. These students were observed and assessed while interacting with patients during their clinical sessions. Verbal consent was obtained from all participants prior to observation.

Ethical approval for the study was obtained from both participating institutions. The dental college following the traditional curriculum granted approval under reference number Rawal/RDC/ERC/22/06 on April 13, 2022. The institution implementing the integrated curriculum provided approval under reference number IIDC-training/19/151 on April 18, 2022.

The approach used in this study is quantitative as it involves statistical analysis of numerical data collected from group-a and group-b. The goal is to identify differences and similarities among both groups and to draw conclusions about the groups being studied. According to the educational approach this study is a comparative cross-sectional quantitative type based on survey.²⁰

The study took place at two places:

- Participating dental college of traditional curriculum, **a**
- Participating dental college of integrated curriculum, **b**

The study started from April, 2022 and ended in December, 2022, so total duration was 8 months after the IRB and synopsis approval.

Kalamazoo Essential Elements Communication Checklist, adapted, KEECCA was used as the data collection tool.⁷

There are different tools present for assessing communication skills, whereas Kalamazoo Essential

Element Communication Checklist is used for assessing medical or dental students by observing their interactive skills. The Kalamazoo Consensus Statement along with skill competencies for each activity identifies the seven evidence-based “essential elements,” of efficient doctor-patient communication. KEECC is one of the key communication techniques, which were outlined for the establishing therapeutic interactions with patients and family. KEECC-A tool had a Cronbach α value of 0.84, which hence proved that this tool has high reliability, and it is an updated, construct-valid version.

Group statistics demonstrate how different the two groups are from one another and reveal which group would have a higher mean, variation between the two student groups’ combined scores and the scores they received in each of the seven categories.

The KEECC-A scale recognizes 7 key components of communication in clinical interactions, each of these components define 3-4 parameters to evaluate the candidate on five points Likert scale from poor to excellent.

The rating done on a Likert scale is as following:

1= Poor, 2= Fair, 3= Good, 4= Very Good, 5= Excellent

The scoring was done and the mean scores of the participants were recorded in each of 7 categories.⁹

Following are the 7 categories on which the scoring was done:⁷

- a) Builds a relationship: In this category, dental students were observed while greeting patients and according to the concern and care, they show towards the patients.
- b) Opens the discussion: In this category, dental students were observed while asking patients about their complaints and reason for coming to see the doctor.
- c) Gather information: In this category, dental students were observed while gathering information regarding complaints of patients and the way they question them.

- d) Understands the patient’s perspective: In this category, dental students were observed asking beliefs and concerns of patients and what would be their expectations regarding treatment.
- e) Shares information: In this category, dental students were observed while they explained the diagnosis and treatment plan to patients.
- f) Reaches agreement: In this category, dental students were observed while they were inquiring about a patient’s ability to follow a treatment plan.
- g) Provides closure: In this category, dental students were observed while summarizing the treatment plan and closing the interview.

50 students each from an integrated and traditional system of curriculum were selected.

All of the dental students of third year who participated were doing clinical rotations and were chosen by a non-probability, convenient sampling technique.¹⁹ Students of both genders, male and female, participated equally in this study.

Figure no. 1 and Table no. 1 shows the T-test, it is used to compare the means of two groups, to know whether the values of both groups are different significantly or same to a certain degree. Independent sample test further consists of two parts, (A) Levene’s Test for Equality of Variances and (B) t-test for Equality of Means. SPSS version 26.0 shows a variance homogeneity test, which is known as Levene’s test (Table no.2).

Table no.1: Comparison of Means (n=50)

Item number	Group A	Group B	Total
Item 1 (Build relationship)	4.66 ± 0.688	4.68 ± 0.471	4.67 ± 0.587
Item 2 (Opens the discussions)	3.28 ± 0.927	4.28 ± 0.757	3.78 ± 0.980
Item 3 (Gathers information)	2.56 ± 1.280	3.66 ± 0.848	3.11 ± 1.214
Item 4 (Understand the patients perspective)	2.50 ± 1.216	3.90 ± 0.953	3.20 ± 1.295
Item 5 (Share information)	2.34 ± 0.745	3.42 ± 0.835	2.88 ± 0.956
Item 6 (if reach agreement)	1.14 ± 0.351	3.62 ± 1.141	2.38 ± 1.503
Item 7 (Provide closure)	1.56 ± 0.644	3.94 ± 0.935	2.75 ± 1.438

Table No. 2: Levene’s Test

Item number	Variance	Sig. (2-tailed) P value	Mean difference + standard error difference deviation
Item 1 (Build relationship)	Equal variance assumed	0.866	-0.020 ± 0.118
Item 2 (Opens the discussions)	Equal variance assumed	0.000	-1 ± 0.169
Item 3 (Gathers information)	Equal variance assumed	0.000	-1.100 ± 0.217
Item 4 (Understand the patients perspective)	Equal variance assumed	0.000	-1.400 ± 0.219
Item 5 (Share information)	Equal variance assumed	0.000	-1.080 ± 0.158
Item 6 (if reach agreement)	Equal variance assumed	0.000	-2.480 ± 0.169
Item 7 (Provide closure)	Equal variance assumed	0.000	-2.380 ± 0.161

Figure No 1: Presents the Mean Score Comparison of Seven Communication Skill Items between Group A (Traditional Curriculum) and Group B (Integrated Curriculum).

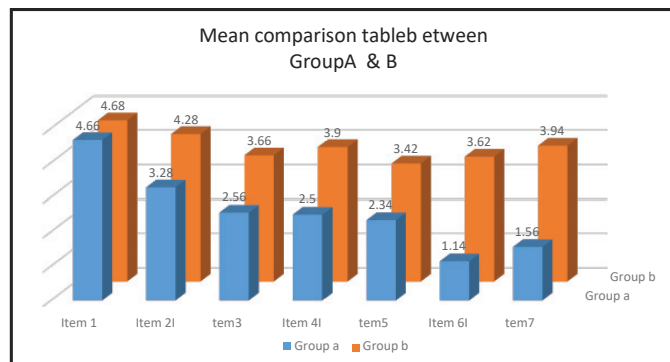
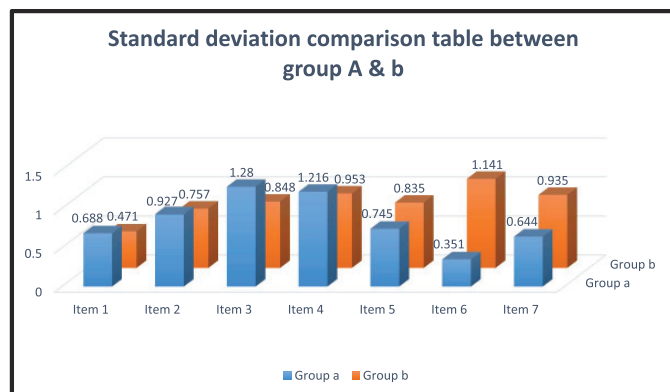


Figure No 2: Illustrates the Comparison of Standard Deviation (SD) Values For Seven Communication Skill Items between Group A (Traditional Curriculum) and Group B (Integrated Curriculum).



RESULTS

The study included 100 third-year dental students, with 50 participants each from institutions following traditional (Group A) and integrated (Group B) curricula. All participants were undergoing clinical rotations at the time of data collection. A non-probability, convenient sampling technique was used to recruit the students. The gender distribution comprised 72 females and 28 males, with equal representation from both curriculum models. The overall response rate was 100%.

To compare the communication skills between the two groups, an independent samples t-test was applied using SPSS version 26.0. Prior to comparison, Levene’s Test for Equality of Variances was conducted to assess the homogeneity of variance. The analysis indicated a statistically significant difference in mean communication

scores between students in the traditional and integrated curriculum groups.

Students enrolled in the integrated curriculum demonstrated higher average scores in communication competencies compared to those in the traditional curriculum. These findings suggest that early exposure to clinical environments and a competency-based, student-centered approach in the integrated system may play a pivotal role in enhancing communication skills among dental students.

DISCUSSION

There are many elements that need to be focused on with regards to teaching communication skills, one is the lack of empathy seen among the dentists, this ability of empathy is basically associated with communication and to understand what the patient is going through.⁸ Element of empathy have shown to decline as gradually the dental graduates increase seeing the number of patients and that is why a dental graduate should be given the interpersonal skills training throughout their dental college life as well as in professional practical life.¹⁰ Holden, says that students of dentistry know what to say but do not know how to say it. In another article Chilcutt stated that training to enhance an individual’s interpersonal skills have been seen in dental schools but emphasis on team communication is lacking, he also said that lack of training in leadership and communication skills can lead to increased staff related stress and high turnover in dental practice.

Van Der Molenet et al. studied the effectiveness of a communication skills training program in reducing patients’ anxiety and fear of dental procedures. Communication skills training improves the knowledge and behavior of dentistry students, he also it improves the ability to communicate with patients and they become more aware of their limitations.

It is suggested in one of the studies that the patient’s satisfaction becomes maximum if the doctors have taught the communication skills as a part of curriculum in initial years of their school as well as it boosts their competency resulting in more satisfied patients in future.¹¹ An integrated curriculum system allows for better coordination and resource utilization, which can reduce redundant work and costs.¹³

Clinicians' interpersonal skills have a huge impact on quality of patient care, and it ultimately leads to better health outcomes down the road. A decrease in medical lawsuits resulting from alleged medical malpractice is another benefit of improved communication between the patient and the doctor.¹⁴ It also increases compliance and fosters trust. To develop more clinically competent doctors, medical students need to be taught effective communication and counseling approaches.

The Kalamazoo Consensus Statement along with skill competencies for each activity identifies the seven evidence-based "essential elements," of efficient doctor-patient communication. KEECC is one of the key communication techniques, which were outlined for the establishing therapeutic interactions with patients and family. The main purpose of the assessment is to see whether the particular behavior is inculcated in the professionals during their early years or not.¹² One of the useful tools to assess the communication skills of health professionals is Kalamazoo Essential Element Communication Checklist, which consists of 7 components.¹⁵

In our study, the Kalamazoo Essential Communication Checklist—a valid and dependable gauge of doctor communication abilities—was utilized to evaluate the students' communication abilities. Doctor patient communication that should be more patient-centered is taught through clinical intervention in integrated curriculum and it aims to impart a specific behavior based on predetermined values and ideas, and it also necessitates some certain level of emotional involvement. Efficient communication skills training assumes that students understand how these abilities are essential prerequisite competencies that they should develop while studying.⁴ Integrated curriculum system in dentistry promotes the retention of information as it presents a comprehensive understanding of the subject matter. Students are trained to link various disciplines, which helps in retaining the information for a longer period. The traditional curriculum system, on the other hand, teaches each subject in isolation, which may not promote retention of information.⁵

One study published in the European Journal of Dental Education found that an integrated curriculum system led to better knowledge retention and improved clinical

reasoning abilities among dental students compared to a traditional curriculum system. In the healthcare field, effective communication is essential for a positive patient-doctor relationship and as a result, satisfaction level of patients and their management improves. An integrated system helps in improving communication abilities of students and eventually improving their problem solving skills. There are two curriculums, which are used in Pakistan. First one is traditional, where students start interacting with the patients from the 3rd year of their medical school. Whereas second is integrated, where students start engaging with patients from the 1st year of their medical school.¹⁶

An integrated curriculum system in dentistry combines several disciplines into a cohesive program of study, rather than teaching each subject in isolation.¹⁸ This approach aims to improve student learning by promoting critical thinking, problem solving, and application of knowledge to clinical practice.⁴ In accordance with cognitive, psychomotor and affective domains of the Bloom's taxonomy, the proposed integrated dentistry is a system that divides traditional disciplines into themes.¹⁷ As recommended by PMDC, a healthcare professional should be an effective communicator with excellent interpersonal skills. The limitation of our study is that data was collected only from the dental students of third year because the final year of group-a institute was not practicing integrated system and dental students of first and second year from group-b were not practicing traditional system.

CONCLUSION

The conclusion to our study is that the soft skills of students taught by integrated curriculum had performed better in majority of the items (according to the KEECC-A tool) than those students who were taught by traditional curriculum.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

Ethical approval was provided by the Ethical Review Committee at Rawal Institute of Health Sciences Ref No:

RIHS/IRB/24/013.

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AUTHORS CONTRIBUTION

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Pre-Operative Anxiety Patterns in Patients Undergoing Impacted Lower Third Molar Extraction

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ABSTRACT

Objective: This study aims to determine the correlation between the State-Trait Anxiety Inventory (STAI-S) and the Amsterdam Preoperative Anxiety and Information Scale (APAIS) before the extraction of impacted third molars.

Materials and Methods: Patients reported to the OMFS department for the extraction of impacted third molars were selected based on a thorough history, clinical examination, and radiographic evaluation. During their initial visit, patients completed the STAI-S and STAI-T scales to measure their anxiety levels. Following the completion of these scales, detailed information about the surgical and anesthetic procedures, as well as potential complications, was provided. Informed consent was obtained. Prior to the surgery, patients completed the APAIS to measure their dental anxiety.

Results: A total of 50 patients, comprising 13 males and 37 females, having a mean age of 28.86 ± 5.85 years. The average scores on the APAIS and STAI-S scales were 17.06 ± 2.49 and 23.48 ± 2.35 , respectively. A positive correlation ($r = 0.606$) was observed between the APAIS and STAI-S scales before the removal of impacted third molars.

Conclusion: The study concludes that there is a positive correlation between the STAI-S and APAIS scales in patients before the extraction of impacted third molars.

Keywords: Anxiety, Oral Surgical Procedures, Impacted tooth

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INTRODUCTION

Globally, the extraction of impacted third molars stands as the most routine minor oral surgical procedure. Nearly all patients undergoing third molar extraction experience some degree of anxiety both before and during the procedure.¹ Anxiety, characterized by feelings of nervousness and apprehension, and is accompanied by autonomic nervous system activation. It is a pervasive issue in dental practice, affecting both simple and more invasive procedures.² Anxiety can be identified by an increase in sympathetic nervous system activity. Triggers include the use of needles for local anesthesia, high-frequency vibrations from dental drills, and the fear of the procedure itself.³

Apprehensive patients often exhibit uncooperative behavior during procedures, which can increase the stress levels of the operating surgeon and potentially reduce the efficiency and success of the operation.⁴ Such patients typically require longer operation times, are less satisfied with their treatment, and are more prone to postoperative complications. To minimize anxiety, various strategies can be employed, including the use of hypnotic and sedative agents, scheduling early morning appointments, and ensuring effective local anesthesia.⁵

Anxiety is commonly examined in two distinct forms: trait anxiety and state anxiety. Trait anxiety is considered a stable aspect of personality, while state anxiety is a transient response to specific situations.⁶ Beatriz et al. found that Patients exhibiting high levels of both trait and state anxiety demonstrated greater dental anxiety, with a notable pattern of dental fear observed more frequently in women. The study reported a correlation between the State-Trait Anxiety Inventory (STAI-S) and the Amsterdam Preoperative Anxiety and Information Scale (APAIS), with a correlation coefficient of $r=0.509$.⁷

Numerous studies have examined the relationship between state anxiety, trait anxiety, and dental anxiety, particularly in the context of lower third molar surgery. The findings indicate that higher anxiety levels are associated with female gender, younger age, lower socioeconomic status, and lower educational attainment. The APAIS scale is widely used to measure preoperative dental anxiety, and significant correlations have been found between state anxiety and dental anxiety.⁸

The aim of this study is to explore the correlation between the scales used to measure anxiety. Despite the widespread application of both the APAIS and STAI in clinical research, there is notable lack of research directly comparing these two tools within same patient population particularly among patients undergoing third molar surgery. Absence of comparative data limits our understanding of whether these instruments measure the same constructs or capture different aspects of anxiety. This knowledge could lead to the development of targeted initiatives and sessions to address and mitigate anxiety and depression in these patients, which may guide the development of targeted interventions to reduce preoperative anxiety and enhance surgical outcomes.

MATERIALS AND METHODS

This cross-sectional study was conducted by the Department of Oral & Maxillofacial Surgery at a tertiary care hospital, over a period of six months. The sample size, determined using the WHO sample size calculator with a 95% confidence level, a 5% level of significance, and a correlation coefficient of 0.509¹ for the STAI-S and APAIS scales. A total of 50 patients were enrolled through non-probability consecutive sampling, with inclusion criteria covering both genders aged between 16 and 45 years., requiring extraction of impacted third molars, classified as ASA grade 1, non-smokers, non-alcoholics, not allergic to any medications, and without a history of third molar surgery. Exclusion criteria ruled out those on anxiolytic medication, with systemic diseases or compromised immune systems, drug allergies, unwillingness to participate, and pregnant females. Upon presenting to the OMFS department, eligible patients underwent history taking, clinical examination, and radiographic evaluation.

Patients completed the STAI-S (Y-1) and STAI-T (Y-2) scales to assess state and trait anxiety before receiving procedural information. After this, the surgical and anesthetic procedures and potential complications were explained, and informed consent were taken as well as ethical approval was obtained (FF/FUMC/215-515/PHY/24). General patient data, including age and gender, were recorded. Prior to surgery, patients also completed the APAIS to measure dental anxiety. Statistical analysis was conducted using SPSS version 22.0, calculating means and standard deviations for quantitative variables, including age, STAI-S, and APAIS scores, and frequency

and percentage for qualitative variables such as gender, socioeconomic status, and education. Pearson correlation was used to determine the relationship between STAI-S and APAIS scales before the extraction. Stratification by age, gender, socioeconomic status, and education was conducted, followed by post-stratification Pearson correlation analysis, with a p-value of < 0.05 considered statistically significant.

RESULTS

Of the 50 patients included in the study, 13 (26%) were male and 37 (74%) were female, as illustrated in Figure 1. The mean age was 28.86 ± 5.85 years, with a range of 20 to 40 years. Educational status was categorized as educated or non-educated, with 37 patients (74%) classified as educated. Socioeconomic status was assessed based on monthly income, categorized as low (<20,000 PKR), middle (20,000–50,000 PKR), and high (>50,000 PKR). The majority of participants, 33 (66%), belonged to either the low or middle-income groups, as detailed in Table 1

The objective of the study is to determine the correlation between STAI-S and APAIS scales before extraction of impacted third molar. Correlation (r) value between APAIS and STAI-S scale was r=0.606 which statistically significant (p-value 0.000) showing that there is a positive correlation found between state anxiety and dental anxiety, as shown in Table 2.

Effect modifier like age was stratified and compared with the correlation between STAI-S and APAIS scales before extraction of impacted third molar. Among patients with age 31-40 years, average APAIS and STAI-S was 17.00+2.81 and 22.69+2.43 Effect modifier like gender was stratified and compared with the correlation between STAI-S and APAIS scales before extraction of impacted third molar. Among female patients, average APAIS and STAI-S was 18.10+0.93 and 24.62+1.

Effect modifier like education level was stratified and compared with the correlation between STAI-S and APAIS scales before extraction of impacted third molar. Among educated patients, average APAIS and STAI-S was 17.16+2.16 and 23.56+2.24. Effect modifier like socio economic status was stratified and compared with the correlation between STAI-S and APAIS scales before

extraction of impacted third molar. Among patients who belonged to low socio economic status, average APAIS and STAI-S was 17.12+2.54 and 23.54+2.51, as shown in Table 3.

Table No.1: Descriptive statistics of Demographic data.

Variable		Frequency	Percentage	Mean age
Education level	educated	37	74.0	28.86+5.85
	non educated	13	26.0	
	Total	50	100.0	
Socio-economic status	low	33	66.0	
	middle	15	30.0	
	upper	2	4.0	
	Total	50	100.0	
Education level	educated	37	74.0	
	non educated	13	26.0	
	Total	50	100.0	

Table No 2: Descriptive Statistics of APAIS And STAI-S Scale

	n	Minimum	Maximum	Mean	Std. Deviation
APAIS scale	50	12.00	23.00	17.06	2.49
STAI-S scale	50	19.00	28.00	23.48	2.35

Correlation of APAIS and STAI-Scale

		STAI-S scale
APAIS scale	Pearson Correlation	.606
	Sig. (2-tailed)	.000
	n	50

Table No 3: Data Stratification with Comparison of Mean Change in Anxiety of A Patient Undergoing 3rd Molar Surgery Before & After Disclosure of Information Regarding Procedure

variable		N	APAIS scale	STAI-S scale
AGE	20–30 years	27	17.11±2.24	24.14 ±2.10
	31–40 years	23	17.00 ±2.81	22.69 ±2.438
	CORELATION(R)		0.877	0.028
GENDER	MALE	13	14.07 ±3.12	20.23 ±0.59
	FEMALE	37	18.10 ±0.93	24.62 ±1.51
	CORELATION(R)		0.000	0.000

Socio-economic status	low	33	17.12 ± 2.54	23.54 ± 2.51
	middle	15	16.86 ± 2.61	23.20 ± 2.17
	upper	2	17.50 ± 0.70	24.50 ± 0.70
	Total	50	17.06 ± 2.49	23.48 ± 2.35
	CORRELATION (R)		0.623	0.628
Education level	educated	37	17.16 ± 2.16	23.56 ± 2.24
	non educated	13	16.76 ± 3.34	23.23 ± 2.74
	CORRELATION (R)		0.630	0.662

DISCUSSION

Everyone experiences fear and anxiety, albeit in different forms. Fear is an emotional, physiological, and behavioral response to a recognized external threat, while anxiety is an unpleasant emotional state with less clear causes, often accompanied by physiological changes and behaviors similar to those caused by fear. Emotional and psychological factors can significantly influence hormonal, vascular, and muscular functions, potentially leading to issues such as pain, jaw movement disturbances, xerostomia, and ulcerations.⁹

Emotional factors profoundly affect both the oral cavity and the body. Many oro-mucosal diseases may arise directly from emotional stress or indirectly from psychological changes. Dental treatments frequently induce fear and anxiety among patients. Despite the pain-relieving benefits of anesthetics, the prospect of undergoing dental procedures often triggers significant anxiety.¹⁰ anxious reactions to specific stimuli can be seen as adaptive physiological mechanisms in unfamiliar situations. However, numerous studies over the past 50 years have consistently shown that such anxiety negatively impacts surgical outcomes. Patients with moderate to high anxiety levels experience more intense postoperative pain, greater psychological comorbidity, and higher incidence of post-traumatic stress reactions.¹¹

One of the most common sources of preoperative dental anxiety is tooth extraction surgery. Anxiety not only causes emotional distress but can also provoke behaviors that complicate procedures, prolong interventions, and hinder postoperative recovery. Studies indicate that dental anxiety is more severe in certain population groups, with younger individuals, those with lower

socioeconomic status, and those with lower education levels experiencing greater anxiety compared to older, more affluent, or better-educated individuals.¹²

Various scales have been developed to measure dental anxiety, including Corah's Dental Anxiety Scale (DAS), Kleinknecht's Dental Fear Survey (DFS), Spielberger's State-Trait Anxiety Inventory (STAI), Litt's Oral Surgery Confidence Questionnaire (OSCCQ), Gale's Ranking Questionnaire (RQ), Stouthard's Dental Anxiety Inventory (DAI), Weiner's Fear Questionnaire (FQ), Morin's Adolescents Fear of Dental Treatment Cognitive Inventory (AFDTCI), the Visual Analog Scale (VAS), and the Original Questionnaire.¹³

Hermes et al.¹⁴ conducted a study involving a large group of patients from different medical departments undergoing general anesthesia, sedation, and local anesthesia. They concluded that anxiety is a personal issue unaffected by the surgical field. However, their study excluded patients undergoing more invasive procedures due to trauma and tumors, whose psychological states might differ. In contrast, our study included all voluntary patients awaiting surgery, revealing that the nature of the surgical intervention does not significantly influence anxiety and fear levels. Including a general anesthesia group might have shown differences in anxiety levels, as general anesthesia and sedation can alleviate anxiety by allowing patients to undergo treatment unconsciously.

Patients with prior unfavorable experiences are likely to experience higher anxiety levels in subsequent procedures. Conversely, a painless, stress-free procedure with no postoperative issues can reduce anxiety for future treatments. López-Jornet et al.¹⁵ found significantly lower anxiety levels over a 7-day follow-up in patients who had undergone tooth extraction without complications. However, negative treatment experiences can overshadow the anxiolytic effect and patient expectations. Additionally, informing patients about the procedure can sometimes trigger additional stress. Literature offers mixed conclusions on whether explaining procedures or previous experiences affect anxiety levels.¹⁶

Fear and anxiety in dentistry are often linked to poor oral hygiene resulting from low socioeconomic status, lack of self-confidence, psychological issues, and low morale. Other contributing factors include age, gender, education

level, and personality. McGrath and Bedi reported higher anxiety levels among individuals with a low standard of living. Low education levels and socioeconomic status were also associated with poor anxiety outcomes. However, some authors argue that dental anxiety is higher among well-educated individuals.¹⁷

In our study, 26% of the participants were male and 74% were female, similar to Liu et al.'s study¹⁸, which included 36.24% males and 63.76% females. The mean age of participants was 28.86 ± 5.85 years, compared to 24.2 ± 4.5 years in another study. Our findings showed a correlation of $r=0.606$ between the STAI-S and APAIS scales before the extraction of impacted third molars, aligning with a previous study that reported a correlation of $r=0.509$.¹

Fear and anxiety are common emotional responses in dental settings, particularly in relation to surgical interventions. While fear typically arises from identifiable external stimuli, anxiety tends to be a more diffuse emotional state, often without a clear source. Both responses can affect the physiological, hormonal, vascular, and muscular systems—manifesting as pain, disturbances in jaw function, xerostomia, and ulcerative lesions.⁹

In dentistry, tooth extraction—especially of impacted third molars—is frequently associated with heightened preoperative anxiety. This anxiety may not only cause emotional distress but also complicate the procedure itself, prolong recovery time, and negatively impact postoperative outcomes. Numerous studies have demonstrated that individuals with moderate to high levels of anxiety report more intense postoperative pain, increased psychological comorbidities, and are at greater risk for post-traumatic stress reactions.¹⁰

Socio demographic variables such as age, education level, and socioeconomic status appear to significantly influence dental anxiety. Multiple studies have shown that younger individuals, patients with lower educational attainment, and those from disadvantaged socioeconomic backgrounds report higher levels of anxiety¹¹. However, this is not universally agreed upon. Some research suggests that more highly educated individuals may exhibit increased dental anxiety, potentially due to heightened health awareness or greater exposure to

negative information.¹²

To assess anxiety, various validated instruments have been employed, including the State-Trait Anxiety Inventory (STAI), Corah's Dental Anxiety Scale (DAS), the Dental Fear Survey (DFS), and the Amsterdam Preoperative Anxiety and Information Scale (APAIS), among others. These scales help clinicians quantify the subjective experience of anxiety, guiding management strategies and improving patient care.¹³

In our study, we found a significant correlation ($r = 0.606$) between the STAI-S and APAIS scores prior to third molar extraction. This finding is consistent with previous literature, such as a study that reported a correlation coefficient of $r = 0.509$ between these scales¹². The mean participant age was 28.86 ± 5.85 years, slightly higher than reported in similar studies (e.g., 24.2 ± 4.5 years) [Ref]. Additionally, our sample consisted of 26% males and 74% females, a distribution similar to Liu et al.'s cohort, which included 36.24% males and 63.76% females.⁶

Interestingly, our findings support previous work by Hermes et al.¹⁴, who reported that anxiety levels were independent of the surgical specialty. However, unlike their study which excluded patients undergoing more invasive or oncological procedures our study included all voluntary patients scheduled for oral surgery. This broader inclusion criterion supports the hypothesis that anxiety levels are more strongly associated with individual psychological profiles than with the type of procedure alone.

Moreover, patient experience plays a pivotal role. A positive, pain-free procedure can reduce future anxiety, while a traumatic experience may exacerbate it. López-Jornet et al.¹⁵ found reduced anxiety over a 7-day follow-up in patients who had uncomplicated extractions. However, our data suggest that the benefits of a smooth procedure may be overshadowed if patients have had prior negative experiences or are predisposed to anxiety. The literature remains divided on whether pre-procedure information helps alleviate or exacerbate anxiety, with some studies advocating transparency and others suggesting it may intensify patient stress.¹⁶

Our results reinforce the complex interplay between

emotional, psychological, and demographic factors in dental anxiety. They align with much of the existing literature while adding depth by including a broader surgical sample and using multiple validated anxiety measurement tools. This study has several limitations that may affect the generalizability of its findings. The use of non-probability sampling introduces potential selection bias, limiting the representativeness of the sample. Additionally, being a single-center study, the results may not be applicable to broader populations or different clinical settings. The reliance on self-reported questionnaires, while based on validated scales, may be subject to response bias. Furthermore, factors such as psychological comorbidities and detailed prior dental experiences were not fully explored, which may have influenced anxiety levels.

CONCLUSION

The study concludes a positive correlation between STAI-S and APAIS scales before extraction of impacted third molar. Further studies at multiple setups must be conducted in order to know the correlation of APAIS and STAI scales in cases before extraction of lower third molar impaction so that initiatives and sessions will be done to rule out the anxiety level of such patients for better management in the future.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

An ethical clearance letter was obtained from the Ethical Review committee of Foundation University School of Health Sciences, Ref No: FF/FUMC/215-515/phy/24

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The Correlation between Chronological Age and Cervical Vertebral Maturation Stages in Adolescent Female Orthodontic Patients of South Punjab

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ABSTRACT

Objective: The aim of this study was to assess the correlation between the chronological age at menarche and peak of skeletal maturity using cervical vertebral maturation stages (CS) on lateral cephalometric radiograph in the female orthodontic patients of south Punjab.

Materials and Methods: Lateral cephalograms of 100 female patients (9-15 years) were collected from the outpatient department (OPD) of Orthodontics department, CIMS Dental College, Multan. CS stages were determined on lateral cephalometric radiograph using the latest Bacetti's CS method. The patients self-reported their menarcheal ages and were confirmed by the patients' mothers. The association between CS and chronological age at menarche was evaluated.

Results: In this study, menarche was observed to occur between the ages of 12 and 13 years, corresponding to CS3 and CS4. The correlation coefficient between chronological age and CS was found to be 0.588, indicating a moderate to strong positive correlation

Conclusion: Cervical Vertebral Maturation is correlated moderately with the chronological age. For a better assessment of peak pubertal growth in females, history of menarche should be considered.

Keywords: Adolescent, Cervical Vertebrae, Growth and Development, Puberty

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INTRODUCTION

Orthodontic treatment is indicated in both dental and skeletal discrepancies. This entails the evaluation of the patient's growth status in order to maneuver among the preventive, interceptive or corrective orthodontics. Growth is a process which starts at conception and continues throughout a person's life but at a slower rate after the 2nd decade of life. A crucial part of this routine is determination of the peak pubertal growth spurt which is significantly important for treating skeletal class II growth modification cases. There are various methods used for growth assessment. These include measurement of overall height, dental age, and chronological age, maturational and skeletal age. Skeletal age in orthodontic patients can be determined either by using hand and wrist radiography or cervical vertebral maturation staging. The advantage of the later is that no additional x-ray exposure is required as the lateral cephalogram is usually customary for orthodontic patients. In addition to being a regular diagnostic tool, lateral cephalogram, also offer the benefit of skeletal maturity assessment due to the clear visibility of the cervical vertebrae.

Along with this, data collection is easy because it is collected verbally without the need for radiography or longitudinal height measurements. Some studies confirm the reliability of cervical vertebral maturation method for determining the pubertal growth stages while others say otherwise. According to Schoretsaniti et al, for more precise growth estimation, the CVM method should be corroborated with other maturity indicators. This renders menarche as an indicator of choice for determining peak growth potential in females.

Among women, there is a stronger correlation between skeletal age and menarcheal age. In southern Punjab population of Pakistan, menarcheal data has been studied, but its relationship to skeletal maturity is still unknown. The objective of our research is to correlate the chronological age in adolescent females and their onset of menarche with the peak of skeletal growth using CS in south Punjab.

MATERIALS AND METHODS

Across sectional research was carried out in female patients reporting in out-patient department of Orthodontics in CIMS Dental College, Multan. The study protocol was approved by the Ethical Review Committee of the

hospital. The study duration was 06 months (October 2023 to March 2024). A sample of 100 female patients was collected using convenience sampling technique. The inclusion criteria consisted of female patients within the age range of 9 to 15 years, with normal growth and development, and no systemic conditions affecting bone development, and had high-quality lateral cephalometric radiographs with good contrast. The exclusion criteria were the female patients above the age of 15 years, having any hormonal disturbance, patients with abnormal cervical vertebrae or with any syndrome. The patients were informed about the study, its importance and confidentiality of the data collected. A written consent form was signed by both the patients and parents. Lateral cephalograms were taken and the history of menarche was recorded on the same date. The menstrual status reported by the patients was further reconfirmed by asking their mothers.

Each lateral cephalometric radiograph was assessed by tracing the odontoid process and the bodies of the second, third and fourth cervical vertebrae on an acetate paper using 4H pencils on an illuminator. It was then assigned to one of the six cervical vertebral maturation stages (CS) according to Baccetti et al's latest definition by evaluating the outline and morphological changes of these cervical vertebrae (Fig. 1). These tracings were evaluated by an independent evaluator to eliminate inter-operator error. The collected data was analysed by using SPSS (version 22). Spearman rank order correlation coefficient test was used to see the relationship between the chronological age at menarche and the CS stages. P value ≤ 0.05 was taken as statistically significant.

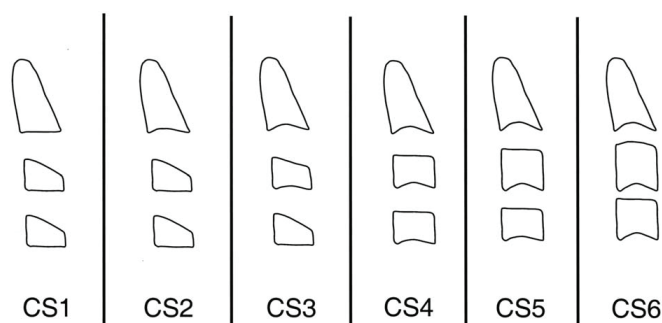


Fig.1 Six stages of cervical vertebral maturation

RESULTS

The mean chronological age and number of the 100 female subjects in each of the Cervical vertebral

maturation stages is given in table 1. Among these, 69 reported with the positive history of menarche. The mean age of the patients in this post-menarche group was 13.49 years (Table 2). All the 69 patients in the post-menarche phase had the skeletal maturation stage beyond the CS2 while the remaining 31 subjects in pre-menarche group had skeletal maturation below CS4. The distribution of the subjects according to the age at menarche is shown in table 3.

In this study, menarche was observed to occur between the ages of 12 and 13 years, corresponding to CS3 and CS4. The Spearman rank-order correlation coefficient was applied to assess the relationship between chronological age at menarche and CS stages. A p-value of ≤ 0.05 was considered statistically significant. The correlation coefficient between chronological age and CS was found to be 0.588, indicating a moderate to strong positive correlation. (Table 4)

Table No 1: Mean Chronological Age and Number of Subjects in Each of the Cervical Vertebral Maturation Stages (CS)

CVM	Mean Age	N	Std. Deviation
1.00	9.7000	10	.67495
2.00	11.7500	12	1.13818
3.00	12.8095	21	1.20909
4.00	13.4828	29	1.21363
5.00	13.6667	18	1.02899
6.00	13.7000	10	1.15950
Total	12.8100	100	1.63111

Table No 2: Mean Chronological Age in Post Menarche Group

Mean Age	N	Std. Deviation
13.4928	69	1.19587

Table No 3: CVM Maturation Stages of the Patients with Positive History of Menarche at Different Ages

		CVM					Total
		2.00	3.00	4.00	5.00	6.00	
AGE	10.00	1	0	0	0	0	1
	11.00	0	1	2	1	0	4
	12.00	0	3	3	1	2	9
	13.00	0	4	4	4	2	14
	14.00	1	4	11	9	3	28
	15.00	0	1	6	3	3	13
Total		2	13	26	18	10	69

Table No 4: Spearman Correlation Coefficient between Age at Menarche and CVM Stages

Spearman correlation coefficient	Value	Significance
	0.588	0.000

Spearman correlation = 0.588
 P < 0.01 (highly significant)

DISCUSSION

Several studies have shown a positive association between chronological age and CVM stages in both genders. There is not much published literature with regards to the association between chronological age in adolescent females and cervical vertebral maturation stage.⁴ We also correlated menarcheal history with these parameters to find the association of this biological indicator with other skeletal indices.

The period of physical and psychological development known as adolescence typically lasts from puberty to maturity. During adolescence, growth rate accelerates and reaches a peak velocity then it decreases till adulthood.⁴ Skeletal maturity indices are commonly used in orthodontics as these are closely related to somatic and sexual maturity.⁴ Fishman has stated that in normally growing patients, maturational indicators provide more reliable information than chronological age, so the skeletal age should be used.⁴

Eddie Hsiang-Hua Lai studied association between menarcheal age and skeletal maturation indices in Taiwanese female Orthodontic patients.⁴ They found that a large number of girls had already achieved peak of growth before the onset of first menstruation. Their findings suggested that menarche usually follows the pubertal growth spurt by about 1 year and occurs after

Cervical Vertebral Maturation stage III (CVMS III). Maria Inês Magalhães et al in their systematic review and meta-analysis estimated the average age in years, corresponding to each of Baccetti's CVM staging.⁴ Their results showed average age at CS3 and CS4 is 12 to 13.4 years. This result is close to our findings as well. Numerous studies confirmed that girls usually mature earlier as compared to boys with an average difference of two years.⁴ In addition to maturing later than girls, boys also exhibit a notably higher growth velocity peak scale. Menarche or the onset of menstruation marks the start of fertility and is a crucial indicator of a girls' sexual maturity. The mean menarcheal age of Pakistani girls is between 12 to 14 years with the mean age being 11.73 years.^{4,10} The mean menarcheal age of the females of Multan was found to be 12.72 years.⁴ Menarcheal onset age is affected by the socioeconomic status, nutritional conditions and environmental influences.

Lateral cephalometric radiograph is a routine investigation in all orthodontic patients. The change in cervical vertebrae's shape and size in growing individuals has been used as a biological indicator for last few decades. Using the cervical vertebral maturation stages method does not need an extra radiograph i-e hand and wrist because lateral cephalometric radiograph serves this purpose as well. The prediction of pubertal growth spurt makes it possible to estimate the ideal timing for the treatment especially in orthodontic growth modification.¹⁰ At present, cervical vertebral maturation stages (CS) have been used to evaluate the skeletal growth potential with special regard to mandibular growth.¹¹ The growth changes in superior and inferior surfaces of each vertebra, modifies the vertebrae's size and form. Baccetti et al revised the original Hassle and Farman CVMS method. This methodology was used in our study due to its broad application and acceptability.¹² Six developmental stages are categorized, which are determined by certain physical traits of the 2nd, 3rd and 4th cervical vertebrae. These attributes include the height, form, and inferior border contour of their vertebral bodies. The mandibular growth spurt, according to studies conducted in this regard, takes place between the CS3 and CS4.

Our results show the correlation between chronological age and skeletal maturation evaluated by CS method was 0.588. Sierra also found the relationship between chronological and skeletal age assessment which proved

to have high correlation (0.58 to 0.71).¹¹ This moderate to high significant correlation implies that when an orthodontic female patient is presented in the age of 12-13 years with a positive history of menarche, she has attained the peak pubertal growth.

Our study emanated that female patients' average age at menarche was 12-13 years and menarche on average occurred between CS3 and CS4. This association indicates that functional jaw orthopaedics can be started in female patients after attaining menarche with a predictable residual growth.¹¹

As the patient data was collected from one hospital and sampling was carried out using convenience sampling technique, our data may not reflect the whole female population of southern Punjab. It is advised that more research be done using a more diverse sample collection to examine the longitudinal links between the age of menarche and the stages of skeletal development in Pakistani women.

CONCLUSION

Cervical Vertebral Maturation is correlated moderately with the chronological age. For a better assessment of peak pubertal growth in females, history of menarche should be considered.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

Ethical approval was taken from Ethical Committee of Armed Forces of Dentistry Rawalpindi (Ltr no: 918/Trg Dated 13 May 2020)

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AUTHORS CONTRIBUTION

Conception and design of the study: A. Akram
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 Analysis and interpretation of data: M. K. Mahmood, R. Anwar

Drafting of the manuscript: A. Akram, R. Anwar
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Approval of the final version of the manuscript to be published: A. Akram, M. A. Rana, R. Anwar, M. K. Mahmood, M. Mushtaq

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Formulation of Dispersible Tablet Based on Extract from Cassia Fistula Leaves and Evaluation of its Anti-Fungal Effect on Heat Cure Acrylic Resin

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ABSTRACT

Objective: The objective of this research paper was to investigate the antifungal outcome of dispersible tablets based on cassia fistula leaf extract on acrylic resin infected with candida albicans.

Materials and Methods: This cross-sectional analysis was piloted at the G7 campus of Riphah International University from January 2017–January 2019. For this, the ethanolic extract of cassia fistula leaves was obtained and the excipients for the tablet along with the extract obtained were mixed. This mixture was then proceeded through a sieve to acquire granules which were dried and compressed. Afterward, acrylic discs were prepared and inoculated with candida albicans. These discs were then soaked overnight in three different tablet solutions including the placebo tablet solution. The discs were removed after 24 hours and inoculated into a specific media, Sabouraud Dextrose Agar.

Results: The formulated tablet based on cassia fistula leaf extract was found to be equally effective when compared to the commercially available tablet (Poligrip) showing no growth of candida albicans on the SDA plates

Conclusion: The study concluded that the formulated denture cleansing tablets based on extract obtained from cassia fistula leaves could be used as a prophylactic denture hygiene measure against candida albicans and staphylococcus aureus. Denture cleansing tablets based on natural sources can be equally effective as compared to chemical-based formulations in addition to being not only non-toxic, and non-irritant, but also cost-effective.

Keywords: Acrylic resin, Antibacterial, Antifungal, Candida Albicans, Cassia fistula, Dental, Denture, Senna extract, Staphylococcus Aureus, Stomatitis.

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INTRODUCTION

Dental surgeons frequently encounter patients with bacterial and fungal diseases of the oral mucosa in association with dental appliances as the denture support functions as a substrate for microbe attachment and biofilm development leading to denture-related stomatitis (DRS) and fungal infections caused as a result of *candida albicans*.¹ Clinicians prescribe antifungals, oral hygiene instructions, and prosthesis adjustments to treat the condition. However, there is a likelihood of *candida* re-colonization after cessation of therapy, making re-treatment common. This exposure of patients to antimicrobials makes them susceptible to adverse effects notably medication resistance.¹

In contrast, natural herbal alternatives to combat disease have low toxicity levels, reduced effects on the environment, and increased acceptance by the general population which can be used as an alternative to antimicrobial therapy.² Dentures are commonly used by the elderly population and owing to their dwindling motor coordination skills, mechanical cleaning is not a viable option. However, denture soaking agents are preferable attributable to their easy handling.^{3,4} Commercially available chemical cleansers contain a variety of active agents with favorable results against DRS.⁵ Some of the commonly known chemical cleansers include sodium hypochlorite, alkaline peroxide, and glutaraldehyde.⁶

Although chemical cleansers possess antimicrobial activity against denture biofilms they also have toxic effects and their extensive use influences the composition and integrity of acrylic-based dentures.^{1,7} The active ingredient in these cleansers leads to several allergic reactions like tissue damage, and the Food and Drug Administration (FDA) warned manufacturers to consider the use of alternate ingredients.⁸ Consequently, extensive research is being employed around the world to explore the benefits of natural over synthetic medicines.⁹

Cassia fistula is a plant whose leaf extract has been used as an antibacterial and antifungal agent.¹⁰⁻¹¹ However, there is no reported literature on the practice of *cassia* leaf extract as a denture cleaner. Therefore, the research paper aimed to establish the anti-fungal potential of the extract of the leaves of *Cassia Fistula* in vitro and to formulate a dispersible tablet based on the extract to be used as a denture cleanser.

MATERIALS AND METHODS

This cross-sectional analysis was piloted at the G7 campus of Riphah International University. Fresh and healthy leaves of the plant cassia fistula were collected and verified by the pharmacognosy department at Riphah Institute of Pharmaceutical Sciences (RIPS) and by the Herbarium of Pakistan, Quaid-I-Azam University, Islamabad vide number 133567. The investigation was endorsed by the Ethical Review Committee of Islamic International Dental College (IIDC), Riphah International University, Islamabad, Pakistan vide letter: IIDC/IRC/2016/001/011.

Formulation of Dispersible Tablets:

To prepare the tablet, Primogel was used at a concentration of 0.9 gm. A mix constituting 7.8 gm of sodium bicarbonate, 3.5 gm citric acid, and 5.2 gm of sodium carbonate was used with Primogel. Methylparaben (0.2 gm) and propylparaben (0.1 gm) were added as antimicrobials while 0.2 gm of sodium lauryl sulfate (SLS) and 0.9 gm of magnesium stearate were added as wetting agent and glidant. All the excipients were blended to reduce particle size. This blend was passed through a sieve. Following this, cassia extract, sodium bicarbonate, citric acid, sodium carbonate, methylparaben, propylparaben, SLS, and primogel were blended and wetted with ethanol (99.9%). The mixture was again passed through a sieve and the extruded particles were desiccated in a dry oven (Sanfa, DHG-9101A 108L) at 37°C for 6 hours.¹² Magnesium stearate was then mixed with the dried granules which were compressed in a single-stroke punch machine (Rogen Pharma, Rawat, Pakistan) to achieve the final form of tablets.

Evaluation of Dispersible Tablets:

Tablets were assessed for mass, width, disintegration, rigidity, and friability. Twenty, randomly selected tablets were individually weighed using an analytical balance (Shimadzu ATX224).¹³ Six randomly selected tablets were examined for thickness using a vernier caliper while another six were tested for fragmentation period. Distilled water was used as a fragmentation mode and they were placed inside six chambers of the disintegration apparatus, as recommended by United States Pharmacopoc (USP). The average breakdown time was then calculated utilizing the disintegration machine. Also, another six randomly selected tablets were tested

for hardness using a Monsanto hardness tester. Friability testing was done using a Roche friabilator. Ten tablets were assessed and exposed to a mutual effect of attrition and shock in a plastic compartment. The friabilator was functioned for 100 revolutions and the tablets were then cleaned and reweighed.

Preparation of Teflon Moulds and Heat Cure Acrylic Disks:

Teflon moulds were fabricated according to ISO 1567:1999 with 25.4 mm thickness, 4 mm depth, and 32 mm diameter. Moulds were then flaked with type II gypsum. Heat cure acrylic powder (Meadway Heatcure Supercure) was weighed on a digital weighing scale with an accuracy of 0.1 mg (UniBloc Analytical Balances ATY 224, Shimadzu, Japan). Methyl-methacrylate monomer (Meadway Universal Heatcure) was gauged with a pipette (370710-10, PYREX VISTA, USA). The heat cure fluid was then positioned into a blending container and the powder was scattered on top of the liquid for 30 seconds. The mix was packed at a doughy stage into Teflon moulds. The containers were then placed in a hydraulic bench press (Dental Hydraulic Flask Press, BISON, Intensive Industries, India) at 80 bars of compression for 25 minutes. The containers were then submerged in water (enveloped by 7 cm of water) and treated employing an electrically regulated water bath. After curing, finishing of the acrylic disks was done with an acrylic trimmer. Polishing was completed with pumice slurry atop a lathe polishing buff.¹⁴

Antifungal Activity of Dispersible Tablets on Heat Cure Acrylic Resin Specimens:

Three acrylic discs were disinfected in an autoclave (SA 230 Taiwan) at 121°C for 15 minutes.

The discs were inoculated with candida which was adjusted to 0.5% McFarland standard as per WHO recommendations, and were incubated for 1 hour at 37°C in an incubator (Model B-53).¹⁵ The discs were then rinsed with distilled water for 15-30 seconds. Three different discs were prepared:

Disc 1: Immersed in placebo tablet overnight (negative control).

Disc 2: Immersed in herbal tablet overnight.

Disc 3: Immersed in a commercial tablet (Poligrip) overnight (positive control).

The discs were removed from tablet solutions the next day and inoculated into a specific media, sabouraud dextrose agar (Oxoid, England), and incubated for 24 hours at 37°C in an incubator (Model B-53 Rmeco). The experiment was conducted in triplicate to confirm the results. Colony forming units (CFU) were measured for all tablets using a CFU counter.

RESULTS

Post Formulation Studies:

For the weight variation test, the mean mass was determined. The mean mass of the tablets remained 380.03 ± 0.81 mg, the mean thickness was found to be 6.65 ± 0.51 mm, the mean time for tablets to disintegrate was found to be four minutes and the mean hardness was found to be 8.25 ± 0.52 kg/cm². The friability was calculated to be 0.7% which lies within the official limits, which is less than 1% according to USP standards.

Antifungal Activity of Dispersible Tablets on Heat Cure Acrylic Resin Specimens:

Three different tablets were tested for antifungal activity. The negative control presented a CFU greater than 600 while the positive control exhibited no CFU. In comparison to the commercial tablets, the herbal tablets were spot zero showing no microbial growth as well. Consequently, no CFU was found on the agar plate after an incubation period of 24 hours at 28°C (Figure-1). The procedure was repeated three times to confirm the results.

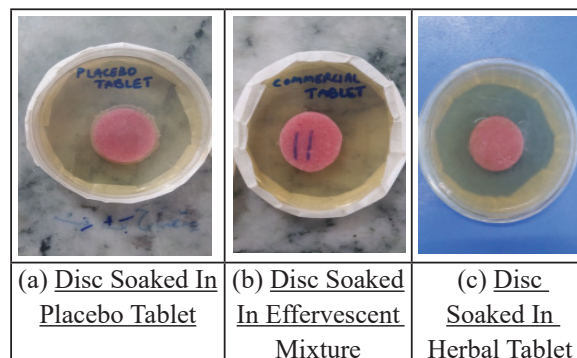


Figure 1: Antifungal Activity of (a) Placebo Primogel tablet; (b) Effervescent mixture and (c) Herbal tablet

DISCUSSION

Removable acrylic dentures act as reservoirs for the growth of oral microflora.¹ Lack of denture hygiene measures precedes the development of a microbial biofilm atop the fitting side. This biofilm acquires nutrients from human saliva and proliferates as well as matures while enhancing its adherence with the rough denture surfaces.^{1,16} Furthermore, as the denture exterior maintains a proximal connection through the mucosa, the biofilm proliferation leads to inflammation of the mucosa, which is a characteristic feature of DRS.¹⁶ The main etiological agent in dental plaque that leads to DRS is *candida*.¹⁷ Increased microbial load leads to various denture-related problems for patients. Consequently, it is of paramount importance for the patient to maintain the hygiene of the denture to minimize the incidence of DRS.¹⁸

The use of tablets is a highly widespread method of cleaning dentures in technologically advanced countries.¹⁹ Nevertheless, denture cleaning tablets are associated with a high cost if they are to be used regularly. In a developing country like Pakistan, with a significant proportion of the country living below the poverty line, such a cost is not economically feasible for the general population. A systematic survey also reported using toothpaste as the most recommended method of cleaning dentures in developing countries. However, it must be noted that regular use of this method of denture cleaning leads to disruption of the physical properties of the denture surface.⁴ For elderly patients, amount and effortless accessibility are significant features when choosing a denture cleaner. The elderly denture-wearing population with financial dependence on others finds it hard to afford denture cleaners so there is a dire need to explore economical denture cleaning tablets, which also have a reduced influence on the physical properties of dentures.²⁰

The leaf extract of *cassia* has antiseptic, antifungal, and anti-inflammatory properties in addition to having no reported side effects.²¹⁻²³ It has also been used to treat several bacterial and fungal diseases and is cost-effective to prepare tablets using it. Hexane, ethyl acetate, chloroform, methanol, and water extracts of *cassia* flowers have been evaluated for their antifungal and antibacterial activities with significant results for all the extracts.²⁴⁻²⁶ In a study by Bhalodia et al., it was

reported that *cassia* extract exhibited an extraordinary restraint of bacterial growth against *Staphylococcus Aureus*, *Streptococcus Pyogenes*, *Escherichia Coli*, and *Pseudomonas Aeruginosa*. They also reported significant antifungal results against *Aspergillus Niger*, *Aspergillus Clavatus*, and *Candida Albicans*.²⁴

The present study identified the antibacterial and antifungal properties of tablets formulated from *cassia* leaf extract with the capability to disinfect and maintain the hygiene of heat-cured acrylic dentures. The active component responsible for antibacterial and antifungal activity was not investigated due to restraint of time. Nonetheless, these antimicrobial characteristics are because of the existence of tannins, terpenoids, glycosides, and alkaloids.²⁴ Both the *cassia* herbal tablet and the commercial tablet were found to have equally effective antifungal properties in the present study with the herbal tablet having no allergic or toxic effects. The commercial tablet weighed 2.72 gm, in comparison to 0.38 gm of the herbal tablet demonstrating that the commercial tablet weighed seven times more than the herbal one. In the present study, only four tablets were used to obtain the desired results, illustrating the strong antifungal properties of the herbal *cassia* extract.

Consistent with Felton et al., an ultimate denture cleaner must be bactericidal, fungicidal, as well as cost-effective which was found to be in the formulated herbal tablet used in the present study.¹⁸ The non-toxic characteristics of the tablet were not examined in the current analysis which was seen by Jothy et al., who found no side effects when a solitary amount of 5000 mg/kg of methanolic extract of *cassia* was dispensed in mice.²⁷ Hence, it may be safely anticipated that the tablets have no toxic effects. Several other formulations of natural-based denture cleansers have also been reported; Saraya et al. formulated an herbal denture cleansing solution containing four medicinal plants which also demonstrated an anti-candidal effect.²⁸ Similarly, Pooja et al. used cashew leaf and aloe vera for denture cleansing and compared it with commercial denture cleansing tablets demonstrating a statistically significant reduction in the candidal count for both the tablets.²⁹ Conversely, in an analysis piloted by Khan et al. comparing the effectiveness of two herbal extracts and two commercially obtainable denture cleaners hostile to *candida*, the commercial denture cleaning

tablet was reported to be the most effective.³⁰

The CFU count was only after the acrylic plates had been soaked in the tablets. Future studies should be done with CFU measurements taken before and after disinfection. Clinical trials are recommended for optimizing tablet performance and to show evidence of biocompatibility, which should eventually lead to the introduction of the plant-based denture cleansing tablet.

CONCLUSION

This study showed that formulated tablets from ethanolic extracts of cassia fistula leaves have strong antifungal activity. Consequently, this plant can be considered a biological medicinal basis for treating various oral infectious states. The formulated tablet can additionally also be used as a prophylactic measure to enhance denture hygiene, consequently reducing the chances of DRS as it was as useful as the commercially available denture cleaning tablet.

DISCLAIMER

None.

CONFLICT OF INTEREST

None to declare.

ETHICAL STATEMENT

The ethical approval is provided by the Ethical Review Committee of Islamic International Dental College (IIDC), Riphah International University, Islamabad, Pakistan vide letter: IIDC/IRC/2016/001/011.

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Frequency of Autoimmune Disorders in Patients of Alopecia Areata: A Cross-sectional Survey

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ABSTRACT

Objective: To evaluate the frequency of autoimmune disorders in alopecia areata patients.

Materials and Methods: The study enrolled 200 patients diagnosed with alopecia areata, ranging in age from 18 to 65 years. Each participant was evaluated for the presence of autoimmune conditions—such as autoimmune thyroid disorders, vitiligo, systemic lupus erythematosus (SLE), and psoriasis—using both clinical examination and relevant laboratory investigations.

Results: Out of the 200 patients of alopecia areata, autoimmune disorders were identified in 25% (n=50). The most frequent disorder was hypothyroidism, observed in 30 patients (15%). Other disorders included vitiligo in 11 patients (5.5%), systemic lupus erythematosus (SLE) in 5 patients (2.5%), hyperthyroidism in 4 patients (2%) and psoriasis in 3 patients (1.5%).

Conclusion: Alopecia areata is commonly linked with various autoimmune conditions, with hypothyroidism being the most prevalent. These findings underscore the importance of screening alopecia areata patients for autoimmune comorbidities, particularly thyroid disorders.

Keywords: Alopecia Areata, Hypothyroidism, Lupus Erythematosus, Systemic, Psoriasis, Vitiligo

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INTRODUCTION

Hair loss is referred to as alopecia in medical literature, irrespective of the underlying etiology. It is not simply limited to the scalp but may also be present elsewhere on the body. The average person has more than 500,000 hairs on their head when they are born. Anagen phase (the phase of growth), catagen phase (the period of rest), and telogen phase (the phase of shedding) are the three distinct phases of hair cycle.¹ Alopecia can either be scarring or non-scarring. Amongst the non-scarring type, alopecia areata is one of the commonly encountered conditions in the dermatology outpatient department.² Alopecia areata is commonly characterized by well-demarcated patches of hair loss on the scalp and other hair-bearing areas, frequently accompanied by characteristic exclamation mark hairs. If left untreated, alopecia areata may progress to “alopecia totalis”, involving complete scalp hair loss, or “alopecia universalis”, characterized by total loss of body hair.^{3,4} It has been reported that this condition has potentially life-threatening psychological impacts on the patient and such individuals have a high risk of committing suicide.⁵

Alopecia areata can manifest at any stage of life, from infancy to late adulthood, with peak incidence occurring between 15 and 29 years of age. Approximately 44% of individuals with alopecia areata experience disease onset before the age of 20. Fewer than 30% of alopecia areata cases have an onset after the age of 40.²

Although the exact pathogenesis of alopecia areata remains unclear, it is widely recognized as a T-cell-mediated autoimmune disorder that predominantly occurs in genetically susceptible individuals.³ The immune response targets an unidentified autoantigen within the hair follicle. The peribulbar inflammatory infiltrate is mainly composed of oligoclonal, autoreactive T lymphocytes.⁴

Studies have shown that there is some association of autoimmune disorders with alopecia areata.⁶ However, previous studies have reported a wide variation in the incidence of autoimmune disorders among alopecia areata patients. For instance, one study reported the frequency to be 55.8% out of which the frequency of vitiligo and autoimmune thyroid disease was 4.2% each.⁷ Contrary to this, another study reported a frequency of only 12.4%, with autoimmune thyroid disease (6.8%) being majorly

associated autoimmune condition along with SLE (2%).⁸ Another study reported a 2.5% prevalence of psoriasis among individuals with alopecia areata.⁹

There is limited data on autoimmune diseases within the Pakistani population, and even fewer studies have explored their association with alopecia areata. Therefore, the objective of our study was to assess the prevalence of autoimmune disorders among patients with alopecia areata in a Pakistani cohort. The findings aim to assist dermatologists in making informed decisions regarding routine screening for autoimmune conditions in alopecia areata patients, particularly in resource-constrained settings.

MATERIALS AND METHODS

A cross-sectional survey was performed at the Department of Dermatology, Fauji Foundation Hospital Rawalpindi. A total of 200 patients were enrolled in the study using non-probability consecutive sampling technique. The study duration was 6 months. Sample size was calculated considering an estimated prevalence of 55.8%, absolute precision of 7% and 95% confidence level.⁷ The study included patients of either gender, aged 18 to 65 years who had been clinically diagnosed with alopecia areata by a senior consultant. Patients with scarring alopecia, androgenetic alopecia, those having any signs of inflammation, and patients on systemic or local medication for alopecia areata in the past 4 weeks were excluded.

Each participant was provided with a detailed explanation of the study, and written informed consent was subsequently obtained. Demographic characteristics, detailed history and clinical examination were performed. Outcome variables were recorded including SLE, vitiligo, hypothyroidism, hyperthyroidism and psoriasis. Diagnosis of cutaneous disorders was made based on history and clinical examination, while laboratory investigations like thyroid function tests, serum ANA levels, ds-DNA levels and skin biopsy were done where necessary.

Data was analyzed using SPSS software version 22. The numeric variables (age and duration of alopecia) were expressed as mean \pm standard deviation. The categorical variables (gender, family history of alopecia, presence of autoimmune disease and type of autoimmune disease)

were represented as frequency and percentages. Data was stratified based on age, gender, family history of alopecia areata, and disease duration to control for potential effect modifiers. Chi-square test was applied post-stratification to assess statistical significance, with a p-value of ≤ 0.05 considered statistically significant.

RESULTS

Out of the 200 enrolled patients, 64% were females (n=128) and 36% were males (n=72). The mean age of the participants was 35.95 ± 12.71 years, and mean disease duration was 5.47 ± 5.25 weeks. Regarding disease duration, 66% of the patients (n=132) had the condition for less than six weeks, while 34% (n=68) reported a duration of six weeks or more. Age group analysis revealed that 77.5% of the patients were aged between 18-45 years, while 22.5% were aged 46-65 years. Family history was positive in 20% patients of alopecia areata (n=40). These results are shown in the following table.

Table No: 1 Demographic Characteristics of Patients

Parameter		Value
Mean Age (years)		35.95 ± 12.71
Mean Disease Duration (weeks)		5.47 ± 5.25
Gender Distribution	Males (n)	72
	Females (n)	128
Positive Family History (n)		40

In terms of autoimmune comorbidities, hypothyroidism was the most common, found in 15% (n=30), followed by vitiligo in 5.5% (n=11), SLE in 2.5% (n=5), hyperthyroidism in 2% (n=4), and psoriasis in 1.5% (n=3) as shown in the bar graph below

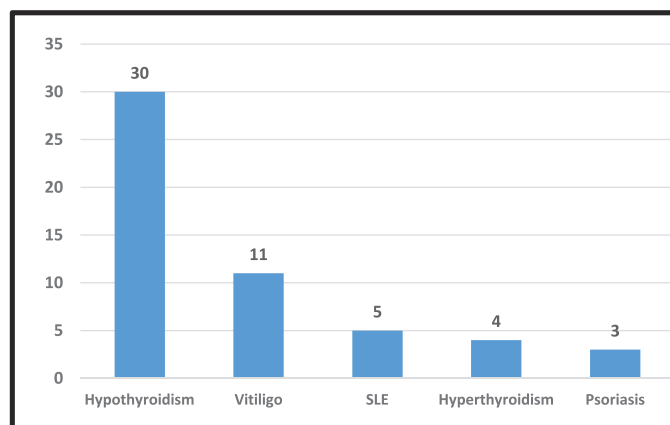


Figure No 1: Graphical Representation of Disease Distribution

The relationship between autoimmune disease presence and factors such as gender, age group, disease duration, and family history of alopecia areata was also examined. A total of 74% of females and 26% of males had autoimmune diseases; however, this difference did not reach statistical significance (p=0.089). 72% of patients with autoimmune diseases were aged 18–45, while 28% were aged 46–65, with a non-significant p-value of 0.282. The duration of alopecia areata (<6 weeks or ≥ 6 weeks) was found not show a statistically significant relationship with autoimmune disease (p=0.168). However, a statistically significant relationship was observed between positive family history of alopecia areata and the occurrence of autoimmune disorders, with 48% of patients having both a family history and autoimmune disease, compared to only 10.7% without a family history, resulting in a statistically significant p-value of 0.000.

DISCUSSION

Alopecia areata is a prevalent type of non-cicatricial hair loss that can manifest in various patterns. It can present as a solitary, self-limited episode or recur intermittently over several years. The precise origin of the disease process remains unclear, however substantial evidence supports an autoimmune etiology involving a T-cell-mediated response targeting an unidentified autoantigen within the hair follicle.¹⁰ It is frequently associated with autoimmune conditions, including vitiligo, morphea, systemic lupus erythematosus, lichen planus, Hashimoto’s thyroiditis, atopic dermatitis, endemic goiter, Addison’s disease and diabetes mellitus.

Our study identified coexisting autoimmune conditions in 25% of patients, with hypothyroidism being the most frequent, affecting 30 patients (15%). In contrast, one study demonstrated that 55.8% patients diagnosed with alopecia areata also had autoimmune disorders.⁷ While another study reported a lower frequency of 12.4%, with autoimmune thyroid disease (6.8%) being the most commonly associated condition, followed by SLE (2%).⁸ Additionally, another study found the prevalence of psoriasis to be 2.5% in alopecia areata patients.⁹

The majority of enrolled subjects in our study presented with mild alopecia areata, followed by moderate and severe forms, with alopecia totalis being the least frequent. Similar findings were reported by Ahmed et al, who also observed that the mild form was the most

common clinical presentation.¹¹ A similar distribution was also identified by Jameel et al and Ejaz et al.^{12, 13}

Puavilai et al. reported a relatively low prevalence of thyroid disease (7.2%) among alopecia areata (AA) patients.¹⁴ However multiple studies, including our study, have demonstrated a stronger association between thyroid dysfunction and AA. The link between hypothyroidism and hair changes is well established, though the exact mechanisms remain unclear. Clinical signs such as altered hair texture and hair loss from the eyebrows, scalp and other body areas are common in myxedema. Supporting this, Vrijman et al. identified subclinical hypothyroidism in 16% of 50 AA patients, with anti-thyroglobulin (anti-TG) and thyroid peroxidase antibodies (TPO-Ab) detected in 46% and 48% of patients, respectively.¹⁵ Similarly, Gönül et al. found thyroid function abnormalities in 10% and thyroid autoantibodies in 14.7% of 110 AA patients, indicating a noteworthy relationship between AA duration and autoantibody levels.¹⁶ In another retrospective study, Doğan et al. observed Hashimoto's thyroiditis in 5.6% of 89 euthyroid AA patients, with 27% showing abnormal thyroid function tests—although nearly a quarter of these were clinically insignificant. They also detected anti-TPO antibodies in 9% and elevated anti-TG levels in 3.3% of euthyroid cases.¹⁷ Based on these findings, routine monitoring of thyroid function and autoantibodies is recommended in AA patients, particularly children, even if initial thyroid assessments appear normal.

This study has some limitations. Firstly, it was carried out at a single tertiary care institute, which may restrict the applicability of its findings to the general population. Secondly, the absence of a control group makes it difficult to compare the prevalence of autoimmune conditions in AA patients versus the general population.

Future research should aim to incorporate multi-center participation across diverse geographic and ethnic populations to enhance generalizability. Incorporating a control group would allow for more robust comparisons and better understanding of the relative risk of autoimmune diseases in AA patients.

CONCLUSION

Alopecia areata is frequently associated with autoimmune

disorders, with hypothyroidism being the most common. A significant association of a family history of alopecia areata with autoimmune disorders indicates a potential genetic predisposition. These findings underscore the importance of comprehensive screening for autoimmune diseases in individuals with alopecia areata, which could lead to more targeted and effective treatment approaches for managing this disease.

DISCLAIMER:

None.

CONFLICT OF INTEREST

None to declare.

ETHICAL STATEMENT

An ethical clearance letter was obtained from the Ethical Review Board of Fauji foundation Hospital, RWP. Ref no: 728/RC/FFH/RWP.

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Comparative Analysis of Post-Dental Surgery Outcomes: Focus on Dry Socket and Mouthwash Practices

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ABSTRACT

Objective: Dry socket, alveolar osteitis, or alveolitis also called fibrinolytic alveolitis is a common complication subsequent to tooth extractions, leading towards significant post-operative pain. While its particular cause remains indistinct, factors such as bacterial contamination and infection, smoking, traumatic extractions, and fibrinolytic activity contribute to its incidence. In this study it is intended to assess the effectiveness of 0.12% chlorhexidine mouthwash in pre-op extraction is effective in reducing the incidence of dry socket and post-extraction pain.

Materials and Methods: A total of 200 patients which required tooth extraction were included in study, with 102 assigned to the test group (mouthwash users) and 98 to the control group (non-mouthwash users). The test group rinsed with 10 mL of 0.12% chlorhexidine mouthwash 2x, twice daily for four weeks before the procedure of extraction. Pain was measured/ evaluated using the Visual Analogue Scale (VAS) at 72 hours post-extraction. Chi-square tests were used for statistical analysis ($\alpha=0.05$).

Results: Dry socket frequency was significantly reduced/ lower in the mouthwash group by (13.7%) compared to the control group (71.4%) ($p=0.001$). Pain levels were also reduced, with approximately 53.9% of mouthwash users pre-op extraction were reporting no pain (VAS=0) versus 13.3% in the control group. Smoking and spitting were significantly associated with dry sockets ($p=0.001$), but there was no correlation found with respect to gender, age, extraction site, or extraction type.

Conclusion: Chlorhexidine mouthwash usage suggestively and significantly reduces alveolar osteitis/dry socket and therefore post-extraction pain. Smoking remains a chief risk factor, accentuating the importance of patient education on discarding smoking and usage of antiseptic mouthwash for improved healing.

Keywords: Alveolar Osteitis, Chlorhexidine, Mouthwashes, Pain, Postoperative, Tooth Extraction, Smoking

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INTRODUCTION

Dry socket is the most common complication that arises after tooth extractions and is also accompanied by a pain of a rather intense nature which starts after the tooth has been removed.¹ Dry socket, also known as alveolar osteitis, was initially identified in 1896 as a gradual healing process characterized by moderate to intense pain, occurring with no indication of infection, typically 2 to 4 days following the extraction of a tooth, most commonly an impacted mandibular third molar.² A clinical evaluation shows an empty socket lacking a blood clot or containing a compromised clot and exposed bone, resulting in a dull, throbbing pain that may radiate to the ears, neck, and temporal areas.³ Furthermore, signs including marginal gingivitis, localized lymphadenopathy, necrotic tissue, foul breath, and an unpleasant taste in the mouth may also be noticed.⁴ To sum it up “Postoperative pain that increases between the first day and third day following the extraction and is accompanied by a dissolving blood clot in the alveolar socket, whether halitosis is present or not” is the most recent definition of Alveolar Otitis.⁵

The pathogenesis of dry socket involves multiple pathogenic factors although no clear etiology has been proposed. Nonetheless, high oral bacterial load before and after surgery, smoking, gender, use of oral contraceptives, pericoronitis, inadequate irrigation, tooth location and operator ability and experience are considered to be risk factors. Another theory is that bacteria either cause or prolong dry socket lesions.^{6,7} Dry socket lesions are more common after traumatic extractions, where strong luxation and forceps forces are needed to extract teeth¹. According to observations, one of the primary etiological factors in the development of dry socket is fibrinolytic activity. An increase in fibrinolytic activity following extraction may result in an early loss of intra-alveolar blood clot.⁸ Fibrinolysis occurs when the plasminogen pathway is activated, which can be accomplished by substances that are physiologically (directly) or non-physiologically (indirectly) activated.⁹ Direct activators are released by alveolar bone cells following trauma, whereas indirect activators are released by bacteria. Despite playing a crucial part in fibrinolytic processes, the precise cause of dry socket is still unknown.¹⁰

Finding a reliable method of lowering the prevalence of dry socket has always been a challenge. In comparison to use of antifibrinolytic drugs, antibacterial

strategies (antibiotics, topical gels, mouthwashes) have generally proven a greater promise.^{11,12} The current study was inspired by the desire to prevent dry socket in general practice after extraction. Post operative mouth wash use is a common practice, however the use of mouth wash prior to the surgery for a minimum of one month to create an aseptic oral environment is undetermined and hence the focus of the present study.

MATERIALS AND METHOD

The study is Quasi-experimental study and was carried at Foundation University College of Dentistry & Hospital for a period of 1 month. It included 200 patients (Corresponding to the sample size calculator on calculator.net) who required teeth extraction due to decay or other reasons. Out of, 39(19.5%) were male and 161(80.5%) were female patients. Patients who declined to take part in the study, females who were pregnant or on oral contraceptives, patients with any underlying disease, and children were not taken into the study. Patients were randomly allocated to control (98) and test groups (102). Test groups were asked to do 10 ml (0.12% chlorhexidine) rinse twice daily after brushing for 60 seconds, 4 weeks before the extraction. Data entry was done to Statistical Package for the Social Sciences (SPSS, IBM, IL, USA) and statistical analysis ($\alpha=0.05$) was done using chi-square test.

Visual Analogue score of patients who underwent extractions was determined. The level of pain patients experienced was significantly reduced in the test groups (mouthwash users) when compared with control group (non-mouthwash users) pain was evaluated using VAS score. Patients were assessed at office on the third post-operative day(72h) after the tooth extraction. The VAS was converted into a scale for measuring pain intensity, possessing 10 distances of equal length, each starting from 0 to 9 (score 0: no pain, score 10: intolerable pain).¹³

VAS Score Range	Pain Intensity	Description

The VAS scale is categorized into four distinct levels of pain intensity for easier assessment:

- **No pain (0):** The individual experiences no pain.
- **Mild pain (1-3):** Pain is very mild or barely noticeable.
- **Moderate pain (4-7):** Pain is noticeable, and it might interfere with some activities.

Severe pain (8-10): Pain is intense and can be incapacitating

RESULTS

Table No 1: Visual Analogue Score of Pain

visual analogue score of pain	0 (no pain)	1-3 (mild)	4-7 (moderate)	8-10 (severe)	Total
mouthwash users	55(53.9%)	33(32.4%)	1(1%)	13(12.7%)	102(100%)
non-mouthwash users	13(13.3%)	15(15.3%)	22(22.4%)	48(49%)	98(100%)

The association between incidence of dry socket and extraction site as shown in table 2 was not significant ($p=0.06$) after the surgery. According to Chi-Square testing no significant difference ($p=0.55$) was observed between the genders.

Table No 2: Dry Socket With Regards Extraction Site

Extraction site	incisors	canine	first premolar	Second premolar	First Molar	Second Molar	Third Molar	Total
With Dry socket	2(1%)	4(2%)	2(1%)	9(4.5%)	28(14%)	8(4%)	31(15.5%)	84(42%)

The Age range of the patients was from 20 to 60 years old and there was not a significant effect ($p=0.89$) on the patients having dry socket, it was more prevalent in the ages above 30 years.

No significant correlation was found between the types of extraction methods used ($p=0.297$). There was no significant difference in the surgically extracted and the simple extractions. Dry socket occurred 84 patients 12 men (46.2% of total men), and 49 women (41% of total women) as indicated in table3.

Table No 3: Dry Socket With Regards Gender, Age, Type of Extraction

Patients	Total	Gender		Age			Type Of Extraction	
		Male	Female	20-33	34-47	48-60	simple	surgical
With Dry Socket	84	12 (46.2%)	49 (41%)	26 (40.6%)	31 (44.3%)	27 (40.9%)	35 (38%)	49 (45.4%)
Without Dry socket	116	27 (53.8%)	112 (59%)	38 (59.4%)	39 (55.7%)	39 (59.1%)	57 (62%)	59 (54.6%)
TOTAL	200 (100%)	39 (19.5%)	161 (80.5%)	64 (32%)	70 (35%)	66 (33%)	84 (46%)	116 (54%)

There was a total of 84 patients who had dry socket out of which 66(36.5% within the non-smokers) were non-smokers and 18 (94.7% of total smokers) were smokers it was statistically significant ($P=0.001$) as shown in the table 4.

Table No 4: Dry Socket with Regards Smoker And Non-Smoker

Patients	Smokers	Non-Smokers	Total
With Dry Socket	18 (94.7%)	66 (36.5%)	84 (42.0 %)

The prevalence of dry socket was much lower in the test group than in the control group, and the p value was statistically significant in mouthwash users ($P=0.001$).

There was a statistically significant correlation between test (mouthwash users) and control groups (non-mouthwash users) ($P=0.001$) with the prevalence of dry socket in the test group being significantly lower than the control group.

Table No 5: Dry Socket with Regards Mouth Wash Users and Non Users.

Patients	Test Group (Mouthwash Users)	Control Group (Non-Mouthwash Users)	Total
With Dry Socket	14 (13.7%)	70 (71.4%)	84 (42.0 %)
Without Dry socket	88 (75.9%)	28 (28.6 %)	116 (58.0 %)

DISCUSSION

According to the study's findings, using mouthwash considerably lowers the risk of developing dry socket after dental extractions. Mouthwash users had a significantly lower visual analogue score (VAS) of pain, with a greater percentage reporting no pain (53.9%) than non-mouth wash users (13.3%). Furthermore, compared to mouthwash users (12.7%), non-mouth wash users (49%) had a substantially higher prevalence of severe pain (VAS score 8–10). This implies that mouthwash's antibacterial qualities could aid in better post-extraction healing and decreased inflammation.¹⁴

Additionally, 42% of the total patient population had dry sockets, according to the findings. Nevertheless, no statistically significant association was there between the extraction site and the occurrence of dry socket ($p=0.06$). In line with earlier research showing that posterior teeth, especially molars, are more vulnerable because of anatomical and procedural variables¹⁵, the highest frequency of dry socket was linked to the extraction of third molars (15.5%) and first molars (14%).

Likewise, there were no discernible variations in the occurrence of dry socket between patients who were male and those who were female ($p=0.55$). This difference was not statistically significant, even though males had a slightly larger percentage of dry socket instances (46.2%) than women (41%). Similarly, the incidence of dry socket was not significantly impacted by age ($p=0.89$), however the prevalence was somewhat higher in patients over 30.¹⁶

In terms of extraction type, there was no obvious difference in the occurrence of dry socket between basic and surgical extractions ($p=0.297$), suggesting that process complexity does not always affect the risk.¹⁷ This data raises the possibility that other elements, like post-operative care and patient-related variables, may be more important in the development of dry socket.¹⁸

Smoking and the occurrence of dry sockets were found

to be significantly correlated ($p=0.001$). The well-established link between smoking and delayed wound healing was further supported by the fact that 94.7% of the patients who developed dry socket were smokers.^{19,20} Because smoking is known to decrease blood flow, hinder the development of clots, and bring toxic substances into the healing region, smokers are more likely to experience dry socket.²¹

Most significantly, there was a statistically significant relationship ($p=0.001$) between the occurrence of dry socket and mouthwash use. The incidence of dry socket was significantly lower in the test group of patients who used mouthwash (13.7%) than in the control group of patients who did not use mouthwash (71.4%). This research emphasizes how using mouthwash before planning an extraction can play a valuable contribution as part of post-extraction preventive measure to reduce issues like dry socket. The evaluation of pain and dry socket incidence was limited to 72 hours post-extraction. Late-onset complications or prolonged healing responses were not assessed. Self-Patient adherence to the prescribed chlorhexidine mouthwash regimen (twice daily for four weeks) was based on self-reporting, which may introduce bias and affect the reliability of outcomes. The study was conducted at a single institution, limiting the generalizability of the findings to other populations or settings with different clinical protocols. Pain was measured using the Visual Analogue Scale (VAS), which, while commonly used, is inherently subjective and may vary with individual pain thresholds and psychological factors.

CONCLUSION

The results of the study support the use of mouthwash in post-operative treatment by indicating that it greatly lowers the likelihood of dry socket and post-extraction pain. Furthermore, smoking is still a significant risk factor for dry socket, which emphasizes the necessity of patient education and guidance on quitting smoking before having dental extractions. The overall findings

emphasize the significance of preventive measures such as using antiseptic mouthwash and quitting smoking to enhance post-extraction outcomes, even if extraction site, gender, age, and extraction type were not significantly linked to dry socket.

DISCLAIMER

None.

CONFLICT OF INTEREST

None to declare.

ETHICAL STATEMENT

An ethical clearance letter was obtained from the Ethical Review committee of Foundation University School of Health sciences Ref no: FF/FUMC/216-618Phy/25

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Evaluating the Competency of Dental Students and House Officers in Inferior Alveolar Nerve Block with Clinical Training Reinforcement

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ABSTRACT

Objective: This study aims to assess the competency of dental students and house officers in performing the inferior alveolar nerve block, focusing on the impact of reinforced clinical training.

Materials and Methods: A cross-sectional study was conducted using non-probability consecutive sampling. A total of 90 dental students and house officers were evaluated before and after clinical reinforcement to assess their proficiency in performing inferior alveolar nerve block (IANB). Data analysis was conducted using SPSS version 25.

Results: The results revealed a significant improvement in the participants' ability to correctly identify anatomical landmarks after clinical reinforcement, which contributed to more effective IANB administration.

Conclusion: Focused clinical reinforcement significantly enhances the competency of dental practitioners in performing the IANB, leading to improved outcomes for both practitioners and their patients.

Keywords: Anatomical landmarks, Clinical reinforcement, Inferior alveolar nerve block, Local anesthesia

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INTRODUCTION

The inferior alveolar nerve block (IANB) is one of the most widely used techniques in dentistry for anesthetising the lower jaw.¹ Dental students, house officers, general dentists, and postgraduates commonly perform this block for procedures such as lower tooth extractions, root canal treatments, and other procedures confined to the lower jaw. It is a cornerstone of pain-free dentistry, bridging the gap between the procedure and the patient's comfort. To perform an effective IANB, dentists must possess a solid understanding of the anatomical landmarks involved. The mandible exhibits considerable anatomical variability, making a detailed understanding crucial for successful anaesthesia.² Improper anaesthesia may lead to patient discomfort, failed procedures, and heightened stress for both patients and practitioners. Mastery of the IANB technique is an indicator of professional skill, building patient trust and enhancing overall clinical outcomes. A strong understanding of the inferior alveolar nerve, its landmarks, and variations allows dentists to provide effective, safe, and painless care. Successful execution of the IANB depends heavily on the clinician's ability to identify anatomical variations. Less experienced clinicians may struggle to adapt to altered landmarks, resulting in decreased success rates. The efficacy of IANB is known to improve with increased clinical experience.³

Clinical reinforcement strengthens medical education by combining theoretical knowledge with hands-on experience, thereby improving retention, critical thinking, and practical skills.^{7,9} It enhances confidence, adaptability, and professionalism, preparing students for real-world challenges and improving patient care outcomes. Todashaki et al. found that dental students achieved a success rate of over 70%, while professors and postgraduate students in the Department of Oral and Maxillofacial Surgery showed a success rate of 90%, illustrating a significant difference in competency.⁴ Similar research by Ghavimi et al. indicated success rates of 93.5% and 71% for IANB with and without panoramic radiographic guidance, respectively.⁵ Mohamed et al. demonstrated that different teaching methods could improve IANB effectiveness among students.⁶ Alhindi et al. reported a decrease in failure rates of IANB when both theoretical and hands-on practices were provided.⁷ Furthermore, dental anxiety and other patient conditions can influence the success of the IANB.⁸

MATERIALS AND METHODS

A cross-sectional analytical study was conducted at the University College of Dentistry (UCD), The University of Lahore, with ethical approval from the UCD review board. SPSS version 25 was utilized for data analysis. Non-probability consecutive sampling was used, and a pre-validated questionnaire assessed the effectiveness of the IANB technique before and after clinical reinforcement. Medically fit adult patients requiring IANB for simple or complex extractions and root canal treatments were randomly assigned to dental students or house officers under supervision. A visual analogue scale (VAS) was used to assess the severity of pain during the procedure, ranging from 0 (no pain) to 10 (worst pain). Dental students from the first, second, and third years, as well as patients with neurological conditions, were excluded from the study.

Before clinical reinforcement, supervisors filled out a questionnaire evaluating the participants' skills. Clinical reinforcement focused on the correct identification of anatomical landmarks and the proper technique for administering IANB. Afterwards, participants were re-evaluated on the same criteria, showing a marked improvement in IANB effectiveness.

RESULTS

The responses of participants are summarized in figure 1 and figure 2. According to Figure 1, 16 house officers correctly identified the pterygomandibular raphe and coronoid notch before clinical reinforcement, which increased to 19 after reinforcement. Similarly, 14 house officers correctly identified the pterygomandibular space before reinforcement, which rose to 19 after clinical intervention. The mandibular ramus was identified by 16 house officers before reinforcement, increasing to 20 after clinical reinforcement.

Figure 2 presents data for final-year students, where 9 students identified the pterygomandibular raphe and coronoid notch initially, which doubled after clinical reinforcement. The pterygomandibular space was identified by 8 students before clinical intervention, increasing to 19 afterwards. The mandibular ramus was identified by 11 students, increasing to 18 after clinical reinforcement.

Figure No 1: Identification Of Anatomical Landmarks(House Officers)

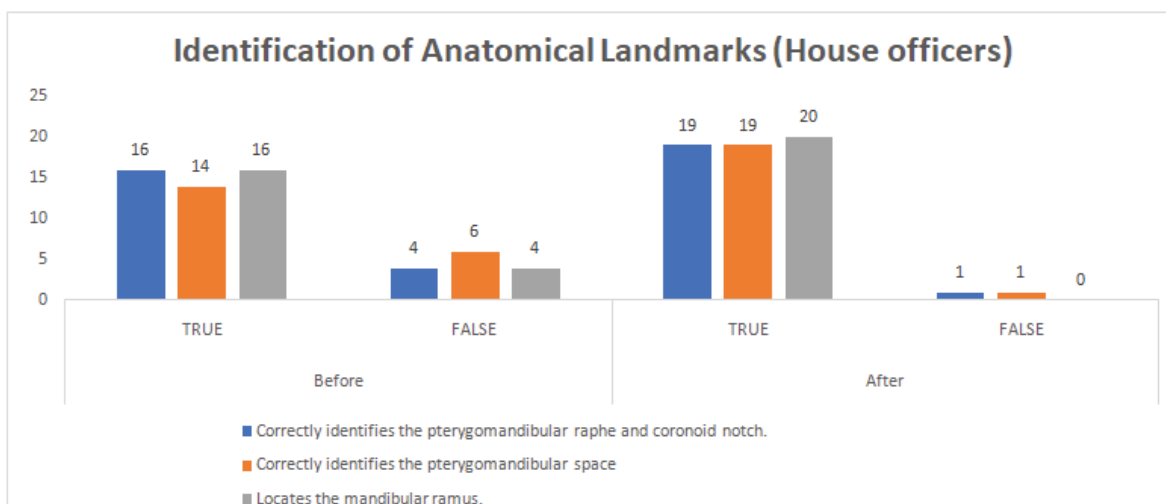
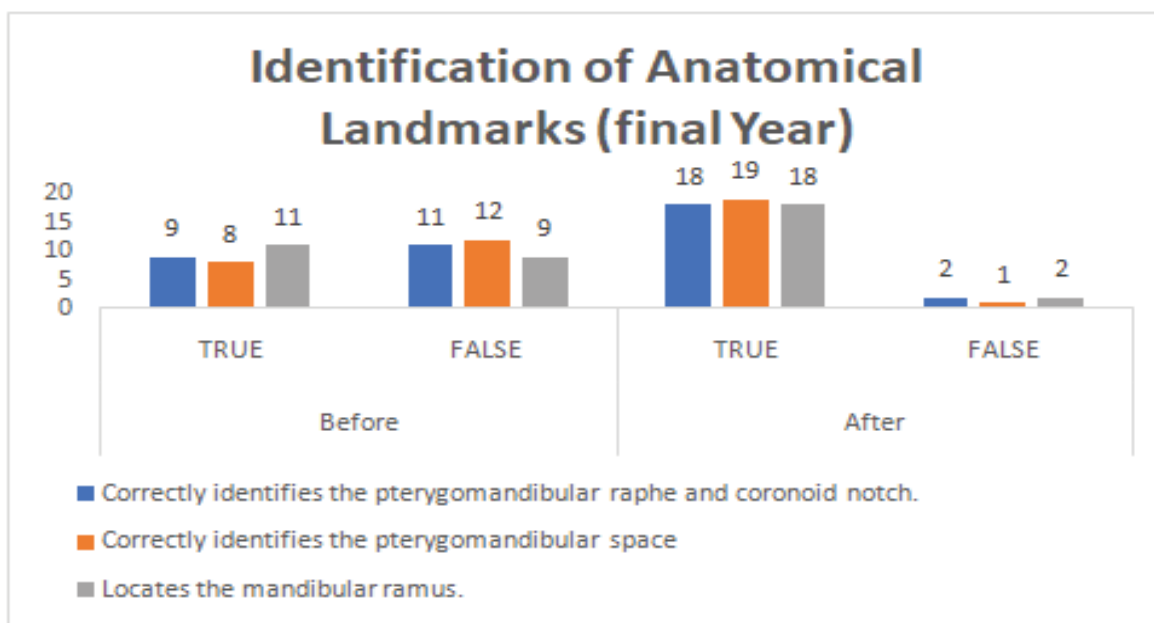


Figure No 1: Identification Of Anatomical Landmarks(Final Year)



DISCUSSION

In Pakistan, while most dental professionals are familiar with the IANB technique, there is often difficulty in correctly identifying the anatomical landmarks and the appropriate penetration sites.⁹ In my opinion, theoretical knowledge and clinical knowledge are two different domains and are equally important to understand to get effective Inferior alveolar Nerve Block. However, anatomy varies from patient to patient but still knowledge and practice help achieve the results of IANB. Correct identification of anatomical landmarks is quite important in order to hit the exact penetration site and to avoid complications. IANB can cause serious complications if not accurately administered. Improper technique, incorrect

identification of landmarks and needle misplacement can lead to trismus, hematoma, facial nerve paralysis, needle breakage and inadequate anaesthesia. Hence, both clinical and theoretical knowledge is important to achieve results. The IANB is not limited to tooth extractions but is also used for procedures such as root canal treatments, dental implants, periodontal surgeries, and biopsies. The primary aim of the IANB is to provide a pain-free environment for patients, contributing to better treatment outcomes.¹⁰

Unfortunately, many students and house officers possess strong theoretical knowledge of anatomical landmarks but struggle with their correct identification in clinical settings. To provide high-quality care and ensure patient

comfort, practitioners must master the IANB technique. The struggle to achieve effective local anaesthesia can be enhanced by giving clinical reinforcement, and with practice, they can master it.

Ameerally et al. emphasised the need for better education systems to ensure that dental and medical practitioners have a comprehensive understanding of their specialty, ensuring the best outcomes for patients.¹ Both practical and theoretical knowledge play an important role in achieving the results of choice. If the practical training is carried out with focused reinforcement of the theoretical knowledge, then results could be achieved better the chances of failure will be reduced. Positive or negative reinforcement also play a role in the outcome.¹¹

Todashaki et al. found that dental students had a success rate of over 70%, which increased to 90% among professors and postgraduate students, highlighting that both dental students and house officers increased to over 90% after clinical reinforcement.¹² It is hence proved that with the clinical exposure and reinforcement, the chances of failure of IANB are reduced. In the comparative study, the results were increased, showing that with experience, the chances of failure are reduced.

Ghavimi et al. reported success rates of 93.5% and 71% for IANB with and without panoramic radiography, respectively.⁵ In contrast, our study showed an increase in success rates to over 90% without radiographic guidance. With radiographic guidelines, the participants get the clue of IANB, and the success rate is increased. In our study no radiographic guidelines were used, but the participants were assessed after giving clinical reinforcement. The results were increased immensely, and the complications and failures were reduced.

Mohamed et al. demonstrated that various teaching methods improve IANB effectiveness, which aligns with our findings that clinical intervention significantly enhanced the IANB competency of both house officers and dental students. The results show that after the clinical reinforcement, the chances of failure of IANB were reduced.^{13,14}

Alhindi et al. showed that both theoretical education and hands-on training could reduce failure rates in IANB.¹⁵

Our study produced similar results, emphasising that clinical reinforcement improves the success of the inferior alveolar nerve block. With the clinical reinforcement, the participants increased the efficiency of IANB and the less failures of IANB were experienced.

CONCLUSION

The competency of dental practitioners in performing the inferior alveolar nerve block can be substantially improved through focused clinical reinforcement, ultimately leading to better clinical outcomes for both practitioners and patients.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

None whatsoever

FUNDING DISCLOSURE

None

ETHICAL APPROVAL

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AUTHORS CONTRIBUTION

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An abstract (no longer than 250 words) and 3-6 relevant keywords (in alphabetical order) are required for the following article categories: Original Articles, Narrative Reviews, Systematic Reviews and Meta-analysis. For Case Reports and Short Communications, an abstract should be no longer than 150 words and 3-6 relevant keywords.

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