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RESTORING FUNCTION, AESTHETICS, AND CONFIDENCE: A MULTI-COUNTRY STUDY OF PEDIATRIC PROSTHETIC OUTCOMES AND DENTAL PRACTICE PATTERNS

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Abstract

Children who experience severe early tooth loss face serious clinical challenges that impact their oral health, facial development, and psychological well-being. Although prompt prosthetic intervention is crucial, there is a dearth of regional data regarding long-term results as well as the practices, attitudes, and knowledge of Middle Eastern clinicians handling these cases. The purpose of this study was to fill in these gaps. A cross-sectional, mixed-methods design was used. To assess the results of fixed and removable prosthetic appliances, a retrospective clinical audit of 368 patient records (aged 2–12 years) from various centres was carried out between 2015 and 2026. Second, 412 dental professionals in the Middle East completed an anonymous online Knowledge, Attitudes, and Practices (KAP) survey, yielding a 75% response rate. Descriptive and inferential statistics, such as logistic regression and chi-square tests, were used to analyse quantitative data. Removable partial dentures had the highest rate (42.6%) and required the most adjustments, according to the audit, which found an overall complication rate of 35.9%. Ectodermal dysplasia was associated with reduced discontinuation and improved compliance. Specialists' knowledge based on their own reporting varied from average to excellent, however knowledge of general dentists was significantly deficient, especially in the

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area of syndromic cases and growth considerations. Issues about the development of alveolar bone as well as irregular parental compliance were noted even though the attitude towards prosthetic care was generally positive. Different patterns of practice were displayed and the higher knowledge scores of the practitioners were associated with their working with dental technicians. Problems with prosthetics occur quite often, especially when removable appliances are used. Clinicians' knowledge, attitudes, and practices are not the same, which highlights the necessity of professional education with focused objectives and standardized regional guidelines. Achieving better permanent results for the children with severe early tooth loss in the Middle East involves solving the issue of compliance and incorporating care from different disciplines.

Key words: pediatric prosthodontics, early tooth loss, knowledge attitudes and practices, prosthetic complications

Introduction. Early tooth loss in children affects their oral function, facial growth, and psychological state severely [1]. Premature loss, especially of front teeth, leads to scratching, speech difficulties, and disruption of natural aesthetics, besides hindering the eruption of the permanent teeth and weakening the dental arch [2]. Apart from the physical consequences, children suffering from such problems usually show a lack of self-esteem and social uneasiness, which can be quite marked during schooling age when interaction with peers is at its peak. Unchecked, early tooth loss may cause misalignment or improper closing of teeth, decreased bone support in the jaw, and over the course of time, functioning at a much lower level than normal [3]. Hence, prosthetic restoration not only helps in recovering the lost function but also plays a part in making life more satisfactory. Nonetheless, children undergoing treatment are very different from adults: growth can still be expected in the craniofacial area, cooperation from the child is unpredictable, and the need for adjustments at different stages adds to the complexity of treatment and maintenance over the years [3]. While lots of prosthetic alternatives exist such as removable partial dentures, fixed appliances, and space maintainers, the information on their long-term reliability is mainly lacking, especially in areas where children suffer from severe early childhood caries, ectodermal dysplasia, and trauma [3]. Different levels of doctor expertise and ways of handling cases add to the situation of variable results. By looking into clinical results as well as dental professionals' knowledge, behaviour, and attitudes in three countries with different healthcare systems, this research seeks to fill the above-mentioned voids [4, 5].

Materials and methods. The study was designed in two separate parts that worked together. The first part was a retrospective audit – a review of patients' medical records to assess the prognoses for children who had received prosthetic treatment. The second part was a survey in which dentists were asked three questions regarding their knowledge, attitudes, and practices in their clinics. We got ethical approval from the review boards of Riyadh Elm University, Saudi

Arabia (FRP/2026/614) and made sure every step followed the standard ethical rules for research involving human subjects.

Auditing patient records. The records from several dental centres in Saudi Arabia, Malaysia, and Pakistan were reviewed covering the years 2015 to 2026. Dental records were reviewed for children between 2 and 12 years old who had received some kind of prosthetic replacement for teeth that were lost too early. In total, 368 records were reviewed based on the criterion. To be included, a record had to show that the child got either a removable or a fixed appliance, had at least six months of follow-up, clear notes about any complications and child or family compliance to followed instructions. The records were excluded where key details were missing – like whether the appliance broke, or whether the family showed up for follow-up visits. From each record, the child's age, sex, reason for teeth being lost (whether from cavities, ectodermal dysplasia, injury, or being born without those teeth), type of appliance used, problems like appliance breakage or loosening or gingival irritation, and the dentist's notes on whether the family was following the treatment plan well or poorly.

Survey on knowledge, attitudes, and practices. An anonymous online questionnaire was sent to 412 dental professionals across the same three countries. The group included pediatric dentists, prosthodontists, and general dentists. The questionnaire had four sections. The first section asked about their background – specialty, years of experience, and whether they worked in private practice or a university. The second section tested their knowledge with 15 questions. The third section explored their attitudes with 10 statements. The fourth section asked about their daily practices with another 10 statements. For each item, respondents picked an answer on a five-point scale from "Strongly Agree" to "Strongly Disagree". Before it was sent out, three experienced academic prosthodontists reviewed the questions under pilot study to evaluate whether the content made sense and covered the right topics. The internal consistency of the questionnaire was checked using Cronbach's alpha – a statistical way to see if the questions were measuring the same thing reliably. The alpha values were 0.87 for the knowledge section, 0.84 for attitudes, and 0.82 for practices; these are above average levels. Out of 412 professionals we contacted, 309 sent back completed surveys. That gave us a 75% response rate.

Results. ***Clinical audit findings.*** A total of 368 patient records were reviewed. From Saudi Arabia 128 cases, Malaysia 120, and Pakistan 120. The average age when children got their prosthetic appliances ranged from 5.4 to 5.8 years across the three countries, and there were no significant differences in the proportion of boys versus girls – the ρ-value was 0.58 as shown in Table 1a. The reasons why children lost their teeth varied a lot from one country to another, and that difference was statistically significant with a ρ-value under 0.001. In Saudi Arabia and Pakistan, early childhood cavities were the main cause – they accounted for 46.9% of cases in Saudi Arabia and 51.2% in Pakistan.

T a b l e 1

Consolidated demographic, clinical, prosthetic, and survey data across countries

Variable	Saudi Arabia	Malaysia	Pakistan	ρ-value
a) Demographic characteristics of pediatric patients audited				
Mean age (years ± SD)	5.6 ± 1.9	5.8 ± 2.1	5.4 ± 2.0	0.41
Male (%)	54.2	52.6	55.1	0.58
Female (%)	45.8	47.4	44.9	
Etiology of severe early tooth loss by country				
Early childhood caries (%)	46.9	36.2	51.2	< 0.001
Ectodermal dysplasia (%)	18.3	28.5	14.6	
Trauma (%)	20.4	20.0	19.1	
Hypodontia (%)	14.4	15.3	15.1	
Prosthetic appliance distribution and follow-up characteristics				
Removable partial denture (%)	49.2	60.3	66.1	< 0.001
Fixed metal appliance (%)	32.7	24.9	19.4	
Fixed resin appliance (%)	18.1	14.8	14.5	
Prosthetic complications during follow-up				
Any complication (%)	24.3	29.6	34.8	0.002
Fracture (%)	10.7	13.2	17.0	
Loosening (%)	7.6	9.3	10.2	
Soft tissue irritation (%)	6.0	7.1	7.6	
Compliance and continuation of appliance use				
Good compliance (%)	78.9	71.6	66.2	<0.01
Poor compliance (%)	21.1	28.4	33.8	
Premature discontinuation (%)	16.8	21.1	24.8	
b) Demographic and practice characteristics of survey respondents				
Pediatric dentists (%)	44.2	39.9	40.9	—
Prosthodontists (%)	24.8	22.1	22.8	—
General dentists (%)	31.0	38.0	36.3	—
< 10 years experience (%)	53.6	49.7	50.8	—
> 10 years experience (%)	46.4	50.3	49.2	—
Clinical practice (%)	64.6	60.6	60.3	—
University-based (%)	35.4	39.4	39.7	—

a) Demographic characteristics of the patients' records audit being displayed; b) demographic characteristics of the respondents involved in responding to the survey

In Malaysia though, ectodermal dysplasia was second more common, showing up in 28.5% of cases. As to the types of appliances dentists used, removable partial dentures were the most frequent choice overall, making up 42.6% of all appliances placed. They were especially popular in Pakistan, where 66.1% of children received them. In Saudi Arabia, fixed metal appliances were used more often – 32.7% of cases. Complications happened in just over a third of all cases, which came out to 35.9% overall. The rate was different across countries: 24.3% in Saudi Arabia, 29.6% in Malaysia, and 34.8% in Pakistan as shown in Table 1a. That difference was significant with a ρ-value of 0.002. The common complications were fractures nearing 13.7% of cases overall for three countries, loosening in 9.1%, and irritation of the soft tissues in 6.9% pediatric patients (Table 1a). Removable appliances caused trouble more often than fixed ones – 44.2% of removable cases had some kind of complication compared to 25.1% of fixed cases. Good compliance – meaning the child or family followed the dentist's recommendations reasonably well – was noted in 72.2% of cases overall. But again, this varied by country. Saudi Arabia had the highest rate of good compliance at 78.9%, followed by Malaysia at 71.6%, and Pakistan at 66.2%. That difference was significant with a ρ-value under 0.01. When we ran the logistic regression, two factors stood out as strong predictors of complications. Poor compliance raised the odds of complications by more than three times – the odds ratio was 3.42 with a confidence interval from 2.15 to 5.44 and a ρ-value under 0.001. Using a removable appliance instead of a fixed one nearly doubled the odds ratio. The odds ratio was 2.31 with a confidence interval from 1.48 to 3.60 and a ρ-value under 0.001. On the other hand, children with ectodermal dysplasia were less likely to stop treatment early – the odds ratio was 0.48 with a confidence interval from 0.29 to 0.79 and a ρ-value of 0.004.

KAP survey findings. Of the 412 specialists to whom the questionnaire was sent, 309 completed it, resulting in a response rate of 75%. Table 1b presents the demographic characteristics of the study participants.

Knowledge domain. Clinicians demonstrated varying levels of knowledge across different regions; overall, doctors from Saudi Arabia ranked first in the results, followed by those from Malaysia and Pakistan. Figure 1 shows that respondents are well-informed about the functional and psychosocial consequences, but there are still some areas where their knowledge is not entirely accurate, such as the management of syndromes and the selection of materials.

Attitude domain. Clinicians recognize the benefits of early prosthetic treatment in children. It contributes to mental health and family harmony. In some cases, however, bone growth over time is a greater cause for concern. The specialists' main concern, however, is whether they will be able to maintain patient compliance in the long term. The risk associated with alveolar bone development is particularly pronounced in certain areas (Fig. 2).

Practice domain. Clinical practices varied significantly across countries, with Saudi clinicians reporting more comprehensive treatment approaches and

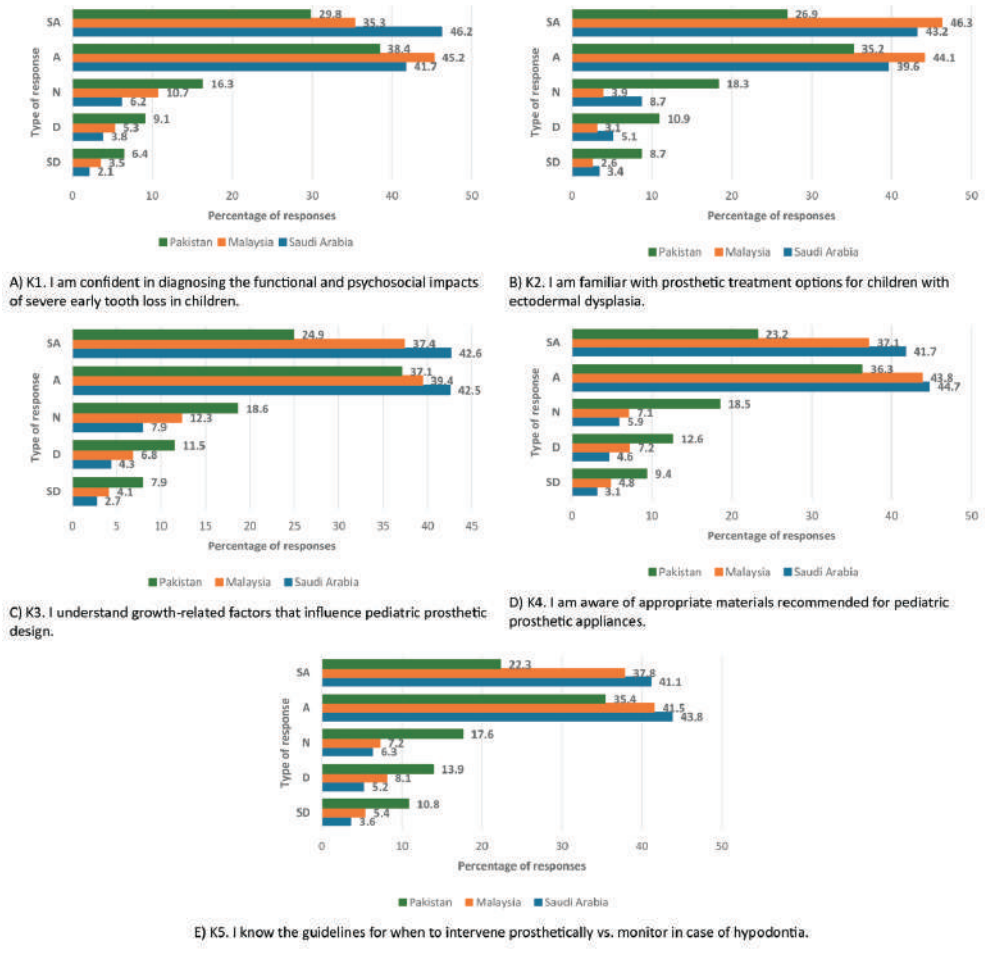


Fig. 1. Knowledge of respondents towards prosthetic intervention for early tooth loss. (Strongly agree (SA); Agree (A); Neutral (N); Disagree (D); Strongly disagree (SD))

structured follow-up protocols, whereas Pakistani practitioners showed greater reliance on removable appliances. Across all regions, lack of patient or parental compliance was consistently identified as the primary cause of treatment failure (Fig. 3).

A positive correlation was observed between knowledge and both attitudes and practices, indicating that improved understanding was associated with better clinical implementation.

Discussion. The aim of this study was to evaluate the outcomes of pediatric prosthodontics in Saudi Arabia, Malaysia, and Pakistan, thereby filling a gap in the existing literature. The study assessed the efficacy and effectiveness of various prosthetic devices used in early childhood (space maintainers, removable/fixed appliances with metal or resin-based bases). It also evaluated the perception

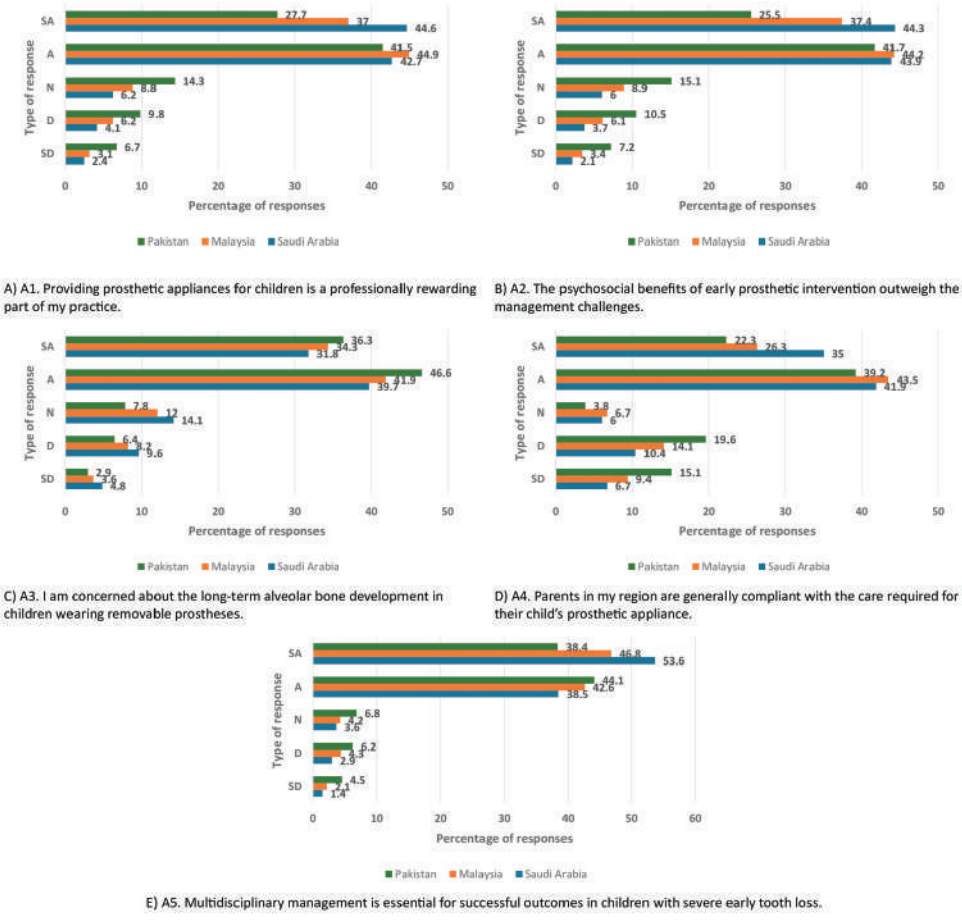


Fig. 2. Attitude of the respondents on Likert Scale towards prosthetic intervention for early tooth loss. (Strongly agree (SA); Agree (A); Neutral (N); Disagree (D); Strongly disagree (SD))

of the dentists involved in pediatric dentistry among the three countries while managing the early tooth loss.

The results of this research play a key role in mapping the geographical differences and similarities in children's dental care, pinpointing areas where proper educational programmes or changes in policies could substantially improve the health of the patients [6]. The study also revealed a significant discrepancy between high scores on knowledge and those on practice, which are not equally high, indicating that there are some hidden challenges that hinder the application of knowledge and that these challenges need to be identified [7]. Examples of this include the fact that pediatricians may have sufficient knowledge of oral health, but in reality, their practice may lag behind due to various factors, such as time constraints and lack of knowledge of dental procedures [8]. This discrepancy between

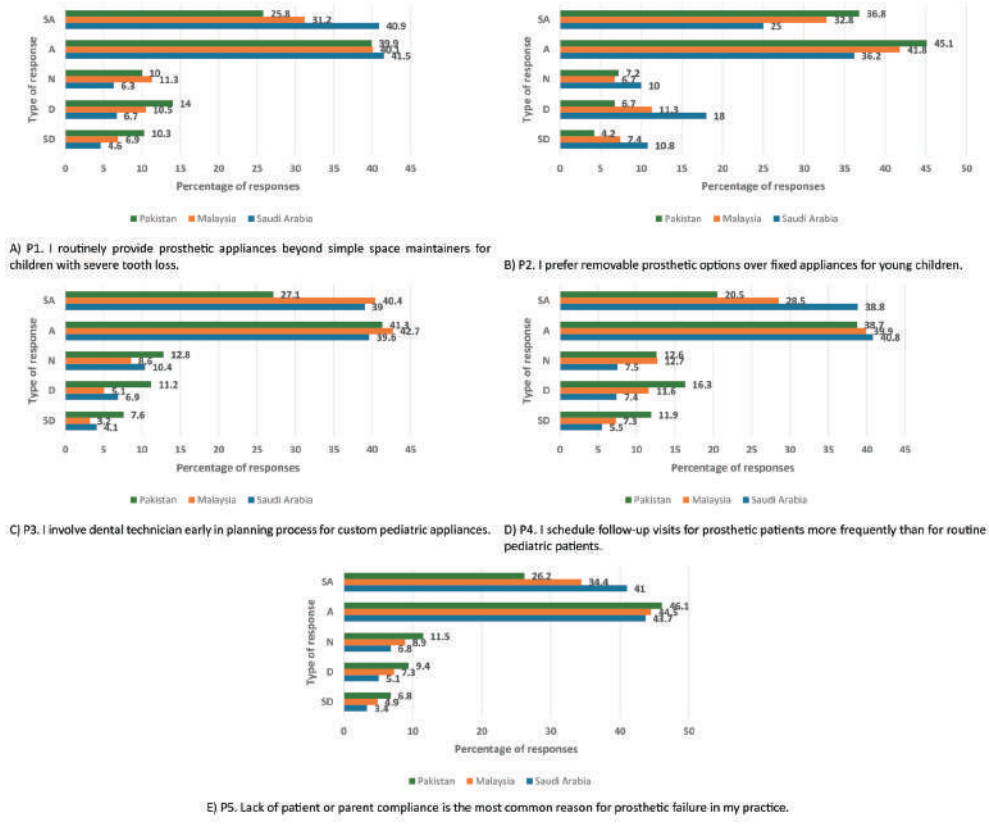


Fig. 3. Attitude of the respondents on Likert Scale towards prosthetic intervention for early tooth loss. (Strongly agree (SA); Agree (A); Neutral (N); Disagree (D); Strongly disagree (SD))

knowledge and practice signals that there is a necessity for training programmes that are aimed at cooperation among different professions, as well as the education of the translation of knowledge into actual clinical actions in areas that have different healthcare systems and availability of resources [7]. Examples of such measures include providing continuing professional development opportunities for general dentists, through which they can learn about the most up-to-date approaches to treating deep carious lesions in primary teeth and the most effective methods for providing prosthetic care [9].

Limitations. There are several limitations to this study that should be taken into account in future research. First, the retrospective nature of the clinical audit was limited to paper-based data, and documentation practices may vary across different centres and cultures; the results represent conclusions drawn from the interpretation of these responses. Second, the questionnaire relies on the accuracy of the self-reports provided by the respondents; responses may be influenced by

social desirability bias. Another aspect to consider is that the present study is limited to three countries, and its results do not necessarily reflect the situation in the rest of the Middle East or Asia. Despite these limitations, we believe that the multinational design, combining both clinical data and a questionnaire, provides a useful and comprehensive picture of pediatric prosthetic care in this part of the world.

Conclusions. In summary, this multi-country research has identified the pediatric prosthetic care scenario in Saudi Arabia, Malaysia, and Pakistan. Study findings not only pointed to similarities but also differences among regions in terms of professional behaviour and patient outcomes. Clearly, the research has underscored the urgent demand for relevant educational measures and policy changes to improve the quality and availability of pediatric prosthetic services in these regions. Closing the gaps between knowledge and practice as well as making higher levels of prosthetic designs and more comprehensive follow-up protocols more readily accessible will certainly be the focus for enhancing children's oral health in the long run.

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