

“The delayed shedding of the primary front teeth, and its relationship to the location of the permanent teeth, for students in the first cycle of primary school.”

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ABSTRACT

This study aimed to investigate the relationship between delayed exfoliation of primary anterior teeth and the positioning of permanent teeth among pupils in the first stage of basic education, as well as identifying the contributing factors and their health, behavioral, and psychosocial implications.

The study adopted the descriptive analytical method, which is suitable for examining relationships among variables. The sample consisted of 55 dentists and dental specialists selected from clinics and health centers in Tripoli, representing 13.75% of the total population.

The research instrument was a structured questionnaire covering oral health status, primary tooth exfoliation, permanent tooth positioning, oral hygiene practices, and medical and familial history.

The results revealed a statistically significant relationship between delayed exfoliation of primary teeth and abnormalities in permanent tooth positioning. Oral hygiene behavior, particularly the frequency of tooth brushing, was identified as the most influential factor. The study also showed a high prevalence of malocclusion problems such as crowding, protrusion, and misalignment. Biological factors such as reduced jaw size and nutritional deficiencies also contributed, along with potential psychological and social impacts on children.

Keywords:

Delayed tooth exfoliation, permanent teeth, tooth positioning, oral hygiene, primary school children.

(تأخر سقوط الاسنان اللبنية الامامية ,وعلاقتها بموضع الاسنان الدائمة لتلاميذ الشق الاول من التعليم الاساسي)

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ملخص البحث

هدفت هذه الدراسة إلى التعرف على العلاقة بين تأخر سقوط الأسنان اللبنية الأمامية وموضع الأسنان الدائمة لدى تلاميذ الشق الأول من التعليم الأساسي، بالإضافة إلى تحديد العوامل المؤثرة على هذه الظاهرة وانعكاساتها الصحية والسلوكية. واستخدمت الدراسة المنهج الوصفي التحليلي لملاءمته لطبيعة البحث، وتم اختيار عينة مكونة من 55 طبيباً وأخصائياً في طب الأسنان من عيادات ومراكز صحية بمدينة طرابلس بنسبة (13.75%) من المجتمع الأصلي. وتمثلت أدوات الدراسة في استمارة استبيان شملت محاور حول صحة الفم، سقوط الأسنان اللبنية، موضع الأسنان الدائمة، العادات الصحية، والتاريخ المرضي والوراثي. وأظهرت النتائج وجود علاقة ذات دلالة إحصائية بين تأخر سقوط الأسنان اللبنية وظهور مشكلات في موضع الأسنان الدائمة، كما تبين أن السلوكيات الصحية، وخاصة عدد مرات تنظيف الأسنان، هو العامل الأكثر تأثيراً. كما أظهرت النتائج ارتفاع انتشار مشاكل الاصطفاف مثل التداخل والبروز والميلان، إضافة إلى تأثير العوامل البيولوجية مثل صغر حجم الفك ونقص التغذية، إلى جانب آثار نفسية واجتماعية محتملة على الأطفال.

الكلمات الدالة: تأخر سقوط الأسنان اللبنية، الأسنان الدائمة، موضع الأسنان، العادات الصحية، أطفال المرحلة الأساسية.

Introduction

Teeth constitute a fundamental element of the facial structure, playing a vital role in multiple functions such as mastication and speech. They also influence social interaction and self-confidence, making their appearance an important factor in shaping personal identity, particularly in children (Bamashmos, . (2021)).

During the primary education stage, children undergo significant psychological and social changes, where their self-perception forms a core component of personality development. Concurrently, dental development progresses through the replacement of primary (deciduous) teeth with permanent teeth, a natural process occurring during the years of growth. However, a delay in the exfoliation of anterior primary teeth may occur, which can affect the eruption of permanent teeth, as these may emerge in improper positions as a result of such delay) .Kumar و Kumari . (2020((

This issue has far-reaching implications, not only for oral appearance but also for children's interaction within their surrounding environment. Primary teeth, also known as temporary teeth, are an essential component of oral growth and development in children. These teeth typically begin to erupt at around six months of age and are completed by approximately three years. The exfoliation of primary teeth is expected to begin between the ages of six and seven, allowing for the eruption of permanent teeth. Nevertheless, delays in the shedding of certain primary teeth are sometimes observed, necessitating investigation into the influencing factors and associated relationships.

When the exfoliation of primary teeth is delayed, permanent teeth may erupt in misaligned or abnormal orientations, leading to issues such as impaired facial harmony and dental deformities) Mitra و Maiti((2019) ،

Research Problem

The delay in the exfoliation of anterior primary teeth constitutes a central issue that warrants systematic investigation, given its significant impact on the positioning and development of permanent dentition. Such delay is attributed to a range of factors, including genetic and physiological determinants, which may result in a lack of

harmony between primary and permanent teeth. Moreover, delayed exfoliation can lead to displacement of permanent teeth from their proper alignment, thereby predisposing to future complications such as malocclusion, an increased risk of dental caries, and other oral deformities. Empirical evidence has demonstrated that these conditions may adversely affect children's psychological well-being, as they may experience embarrassment or reduced self-confidence due to their dental appearance.

These problems can negatively influence overall oral health and, consequently, the psychological and social well-being of children, underscoring the necessity for a precise and in-depth examination of this phenomenon. In addition, dental irregularities may impair children's ability to engage effectively in social interactions, which is a critical aspect during the primary education stage.

Accordingly, this study seeks to highlight the relationship between delayed exfoliation of anterior primary teeth and the positioning of permanent teeth, with the aim of identifying the potential psychological and social implications for children at this developmental stage. The study further aims to provide evidence-based recommendations to support the improvement of educational and health practices.

Furthermore, the appearance of a child's smile is closely associated with self-confidence and social interaction, both of which are fundamental components of daily life. Therefore, there is a clear need to understand the relationship between delayed exfoliation of anterior primary teeth and the positioning of permanent teeth among pupils in the early stage of basic education.

The research problem is thus manifested in the delay of anterior primary teeth exfoliation, which may lead to complications such as misalignment of permanent teeth, speech difficulties, and psychological effects on children. Consequently, identifying the causes and contributing factors of this delay is essential for achieving a comprehensive understanding of the condition.

Research Objectives

This study aims to examine the relationship between delayed exfoliation of anterior primary teeth and the positioning of permanent teeth among pupils in the first stage of basic education, and to understand its impact on children's personal and social development. The ultimate goal is to provide appropriate recommendations to enhance educational outcomes and developmental progress during this critical stage, through the following:

1. To identify the factors influencing delayed exfoliation of anterior primary teeth, whether genetic, physiological, or environmental.
2. To analyze the relationship between delayed exfoliation of primary teeth and the eruption pattern and alignment of permanent teeth.
3. To assess the psychological and social impact associated with delayed exfoliation of primary teeth among pupils in the early stage of basic education.

Research Questions

1. What are the main factors influencing delayed exfoliation of anterior primary teeth in children?

2. How does delayed exfoliation of primary teeth affect the positioning of permanent teeth?
3. What are the psychological and social impacts resulting from the misalignment of permanent teeth due to this delay?

Key Terms

Delayed Exfoliation of Primary Teeth:

This refers to the condition where primary teeth (also known as deciduous or "baby" teeth) are retained longer than the typical age range for their natural shedding. Clinically, teeth that fail to emerge within 12 months of the normal range are considered delayed. (Alshukairi, 2019)

Primary Teeth (Deciduous Teeth):

These are the first set of teeth in the growth and development of humans, also known as primary, baby, milk, or temporary teeth. They develop during the embryonic stage and erupt during infancy. These teeth are usually lost and replaced by permanent teeth . (Reference, 2023)

Permanent Teeth:

Permanent Teeth: These are the second set of teeth that form in mammals that replace the deciduous teeth. In humans, there are typically 32 permanent teeth. (Dental Associates, 2025)

Tooth Position (Dental Alignment):

Teeth Position: This refers to the location of a tooth in the mouth, whether it is anterior or posterior. It can also refer to the proportion of various teeth in the upper jaw facing "towards the palate" and the respective surfaces of the teeth in the lower jaw, "facing the tongue". (: medeco., 2024)

Dental Deformities:

Dental Anomalies: These refer to deviations from the normal development, shape, size, or number of teeth. They can affect both primary and permanent dentitions, influencing a person's oral health, appearance, and functionality of the teeth. (Gardena Dental Group., 2023)

Dental Deformities

Dental Occlusion: This refers to the contact between teeth. More technically, it is the relationship between the maxillary (upper) and mandibular (lower) teeth when they approach each other, as occurs during chewing or at rest. (Jablonski, 1992)

Mental Health:

Mental Health: This encompasses emotional, psychological, and social well-being, influencing cognition, perception, and behavior. It is a state of well-being that enables people to cope with the stresses of life, realize their abilities, learn and work well, and contribute to their community. (eference: World Health Organization (WHO)., . 2025)

Social Interaction:

Social Interaction: This refers to the process of reciprocal influence exercised by individuals over one another during social encounters. It involves communication and connection between individuals or groups. (Helpful Professor, . 2023)

Previous and Related Studies

1. Study (Al-Jahdali, 2019)

Study titled: "Delayed Exfoliation of Primary Teeth in Children"

Objectives:

To investigate the causes of delayed shedding of primary teeth and their relationship with genetic and environmental factors.

Tools Used:

A questionnaire was distributed to parents, and clinical examinations were conducted.

Sample of the Study:

200 children aged between 5–12 years.

Main Results:

The study showed that 15% of the children experienced delayed tooth exfoliation, which was associated with vitamin deficiencies and genetic factors.

2. Study (Smith & Jone, 2020)

Study titled: "Factors Influencing the Timing of Primary Teeth Exfoliation"

Objectives:

To identify the factors affecting the timing of primary teeth loss.

Tools Used:

Comparative study and clinical data analysis.

Sample of the Study:

150 school children.

Main Results:

The main causes of delayed tooth exfoliation were poor nutrition and medical interventions.

3. Study) Ahmed و Al-Hazm(2021

Study titled: "The Effect of Primary Teeth Exfoliation on the Eruption of Permanent Teeth"

Objectives:

To examine the impact of delayed shedding of primary teeth on the eruption of permanent teeth.

Tools Used:

X-ray imaging and clinical examinations.

Sample of the Study:

100 children.

Main Results:

The study confirmed that delayed exfoliation of primary teeth significantly affects the positioning and crowding of permanent teeth.

4. Study (Johnson, 2022)

Study titled: "Delayed Tooth Exfoliation: A Clinical Study"

Objectives:

To assess the time gaps between the shedding of primary teeth and the eruption of permanent teeth.

Tools Used:

A field study using questionnaires.

Sample of the Study:

180 children.

Main Results:

The study showed that 20% of children experienced noticeable delayed tooth exfoliation, which was associated with environmental and genetic factors.

Research Procedures

Research Methodology:

The descriptive analytical method was adopted, as it allows the study of phenomena and the examination of relationships between variables through data collection and analysis.

Research Population:

The research population consists of all dental specialists and oral health practitioners involved in the diagnosis and treatment of pediatric dental problems. This population includes professionals working in public and private clinics, with a total number of (400) dentists.

Study Sample:

The study sample was purposively selected and consisted of 55 dental specialists and practitioners working in the field of oral and dental health. Participants were chosen from private clinics, hospitals, and health centers across different areas of Tripoli. The sample represented approximately (13.75%) of the total population.

Criteria for Sample Selection:

- **Specialization:** The participant must be a dental specialist or a dentist with experience in treating children and managing both primary and permanent teeth conditions.
- **Years of Experience:** Preference was given to practitioners with three or more years of clinical experience in the field.
- **Active Participation:** Preference was given to dentists with a record of participation in research or clinical studies related to dental health.

Pilot Study

First Pilot Study:

The researchers conducted a preliminary study from 01/01/2024 to 15/01/2024 prior to the official application of the questionnaire. This study was carried out on a group of parents (a sample of 40 parents) to identify potential cases of problems related to anterior primary teeth and to determine the level of need for the study.

Second Pilot Study:

A second exploratory study was conducted from 20/01/2024 to 30/01/2024 on a sample of 10 experts in the field of dentistry, selected from within and outside the main study population. This aimed to determine the scientific validity and reliability of the questionnaire used in the study.

Scientific Validity and Reliability of the Questionnaire**Validity of the Questionnaire:**

The questionnaire was distributed to a group of 10 specialized experts in the field of dentistry. The level of agreement among experts regarding the validity of the instrument reached 90%, indicating its suitability for measuring what it was designed for.

Reliability of the Questionnaire:

The researchers used the correlation coefficient to calculate the reliability of the questionnaire, which reached (0.98), indicating a high level of consistency among the items.

Research Instrument**Data Collection Tool:**

A questionnaire was used as the main tool for collecting data related to delayed exfoliation of anterior primary teeth and its relationship with the positioning of permanent teeth. The questionnaire was designed based on previous literature and related studies.

Questionnaire Content:

The questionnaire consists of several main sections:

- **General Information:** Includes child's details such as name, date of birth, and guardian information.
- **Primary Teeth Exfoliation:** Questions related to the timing and types of exfoliated anterior primary teeth.
- **Permanent Teeth Information:** Questions regarding the eruption of permanent teeth.
- **Tooth Position Problems:** Assessment of alignment and positional issues of permanent teeth.
- **Influencing Factors:** Family history and oral health conditions.
- **Health Habits:** Oral hygiene practices and frequency of dental visits.

Questionnaire Development:

- **Literature Review:** Relevant literature on delayed tooth exfoliation and oral health issues was reviewed.
- **Development:** Questions were designed based on literature findings to ensure comprehensive coverage of the research dimensions.
- **Pilot Study:** A pilot study was conducted on 10 experts to test the clarity and suitability of the items, and modifications were made accordingly.
- **Validity and Reliability Testing:** Content validity was confirmed by dental specialists, and test-retest reliability showed a high coefficient (0.90).

Questionnaire Distribution:

The questionnaire was distributed to the study sample of dental specialists and

practitioners through hospitals and clinics, either directly or via email, with an explanation of the study purpose and the importance of participation.

Data Collection and Analysis:

After data collection, statistical analysis was performed using descriptive and inferential methods to identify key trends and findings related to delayed exfoliation of anterior primary teeth.

Main Study:

The questionnaires were administered between 15/02/2024 and 15/03/2024 following the pilot study phase. A validated and refined questionnaire was used to collect data from the main sample.

Statistical Methods:

The researchers used the Statistical Package for the Social Sciences (SPSS), applying the following techniques:

- Arithmetic Mean
- Standard Deviation
- Percentage
- Correlation Coefficient
- Skewness Coefficient
- Regression Analysis

Presentation and Discussion of Results

Table No. (1): Frequencies and percentages of delayed exfoliation of anterior primary teeth and its relationship with the positioning of permanent teeth among pupils in the first stage of basic education

n o	Statement s	no		yes		Responses	Percent age (Yes)
		Percenta ges	Frequen cies	Percenta ges	Frequen cies		
1	Does the child suffer from any general health problems that affect tooth development?	54.5%	30	45.5%	25	Diabetes mellitus	8.00%
						Calcium deficiency	32.00%
						Iron deficiency	12.00%
						Vitamin D deficiency	20.00%
						Sinusitis	4.00%
						Maxillary hypoplasia (small upper jaw)	36.00%
						Mandibular hypoplasia	16.00%

						(small lower jaw)	
2	Have any of the anterior primary teeth previously fallen out?	14	25.5%	41	74.5%	Central incisors	78.00%
						Lateral incisors	70.70%
						Maxillary canines	2.40%
						Mandibular canines	36.60%
3	Are there any anterior primary teeth that have not yet fallen out, with no eruption of permanent teeth yet?	36	65.5%	19	34.5%	Maxillary central incisors	10.50%
						Maxillary lateral incisors	15.80%
						Mandibular central incisors	15.80%
						Mandibular lateral incisors	10.50%
						Maxillary canines	21.10%
						Mandibular canines	10.50%
						Maxillary central and lateral incisors	21.10%
4	Have the permanent teeth erupted before the shedding of the anterior primary teeth?	15	27.3%	40	72.7%	Incisors (8–11 years)	65.00%
						Canines (9–13 years)	37.50%
5	Are there any problems in the positioning of the permanent	8	14.5%	47	85.5%	Type of problem (tilting)	29.80%
						Type of problem (crowding/overlap)	29.80%

	t anterior teeth?					Type of problem (protrusion)	31.90%
						Type of problem (spaces between teeth)	10.60%
						Type of problem (lower position)	57.40%
						Type of problem (upper position)	44.70%
						Type of problem (incisors)	68.10%
						Type of problem (canines)	34.00%
						Type of problem (tilting)	29.80%
6	Is there a family history of dental problems or delayed exfoliation of anterior primary teeth?	36	65.5%	19	34.5%	Previous problems in parents	57.90%
						Previous dental problems in siblings	52.60%
7	Does the child follow a healthy diet?	37	67.3%	18	32.70%	Unhealthy fast food consumption	56.80%
						High intake of sugars and sugary drinks	43.20%
8	Does the child use dental floss?	52	94.50%	3	5.50%		
9	Have you visited a	25	%40.50	30	%54.50	Treatment of dental caries	70.00%

	dentist during the past year?					Treatment of gum disease	26.67%
						Examination of primary teeth	36.67%
						Extraction of primary teeth	16.67%

Table No. (1): Shows a high prevalence of permanent teeth erupting before the shedding of primary teeth (72.7%), along with a clear prevalence of anterior tooth positioning problems (85.5%).

Table No. (2): Distribution of health conditions affecting oral health among children according to the sample responses

The translation is: Dental caries (tooth decay)	yes		no	
	Percentages	Frequencies	Percentages	Frequencies
Gingivitis (gum inflammation)	50.90%	28	49.10%	27
Growth problems	36.40%	20	63.60%	35
The translation is:	29.10%	16	70.90%	39

Table No. (2): Shows that dental caries is the most common health condition (50.9%), followed by gingivitis (36.4%) and growth problems (29.1%).

Table No. (3): Distribution of other conditions affecting oral health among children

Condition	(n) Frequency	Percentage
None	37	67.30%
Tooth or jaw trauma	6	10.90%
Teeth grinding (bruxism)	6	10.90%
Finger/thumb sucking	4	7.30%
Tongue habits (tongue thrusting / tongue playing)	2	3.60%

Table No. (3): Shows that the majority of the sample do not suffer from additional oral health-related conditions (67.3%), while some habits such as teeth grinding and finger sucking were reported at a rate of (10.9%).

Table No. (4): Distribution of the sample according to oral hygiene-related habits.

Oral hygiene habits	Category:	(n) Frequency	(%) Percentage
	Once	33	60.00%

Frequency of daily tooth brushing	Twice	15	27.30%
	More than twice	1	1.80%
	Does not brush teeth	6	10.90%

Table No. (4): Shows that the majority of children brush their teeth once daily (60%), while (10.9%) do not brush their teeth.

Table No. (5): Distribution of the sample responses regarding additional observations related to delayed exfoliation of anterior primary teeth and oral health

Additional observations:	Frequencies	Percentage(%)
Regular follow-up with the dentist	35	63.60%
Orthodontic consultation	25	45.50%
Oral health educational programs	11	20.00%
Dental caries treatment	28	50.90%
Others	0	0.00%

Table No. (5): Shows that regular follow-up visits to the dentist are the most common practice (63.6%), followed by treatment of dental caries (50.9%).

Table No. (6): The relationship between the exfoliation of anterior primary teeth and problems in the positioning of permanent anterior teeth.

n o	Problems related to dental alignment	No		Yes		Pearson Chi-Square	Significance
		Frequencies	Percentage	Frequencies	Percentage		
1	Problem exists	8	100%	0	0%	27.42	0.000
2	No problem exists	6	12.8%	41	87.2%		
Total		42	%74	%25.5	14		

Table No. (6): Shows a statistically significant relationship between the exfoliation of primary teeth and permanent tooth positioning problems.

Table No. (8): Illustrates the relationship between the eruption of permanent teeth before the shedding of primary teeth and permanent dental problems.

n o	Problems associated with dental	No		Yes		Pearson Chi-Square	Significance
		Frequencies	Percentage	Frequencies	Percentage		

	alignment issues						
1	Problem exists	8	%53.3	7	%46.7	27.42	0.000
2	No problem exists	0	%0,0	40	%100		
Total		42	8	14.5	47		

Table No. (8): Shows a statistically significant relationship between the eruption of permanent teeth before the shedding of primary teeth and dental alignment problems.

Table No. (9): Linear regression analysis of factors influencing permanent anterior tooth positioning problems

Indicator	R	R Square	Adjusted R Square	F	Sig
Value	0.843	0.71	0.66	14.101	0

Table No. (9): Shows that the linear regression model is statistically significant ($p=0.000$) and explains 71% of the variance in tooth positioning problems ($R^2 = 0.71$). The coefficient of determination ($R^2 = 0.671$) indicates that 67.1% of the variation in dental problems can be explained by the studied variables.

Table No. (10): Linear regression coefficients of factors affecting permanent anterior tooth positioning problems.

Variables:	Beta	t	Significance	Interpretation:
Genetics	0	0	1	Not significant
Dental caries	0	0	1	Not significant
Gingivitis	-0.162	-0.52	0.606	Not significant
Growth problems	-0.319	-1.548	0.129	Not significant
Diet	0	0	1	Not significant
Tooth brushing	0.542	5.047	0	Significant
Dental floss use	-0.102	-0.985	0.33	Not significant
Dental visits	0.252	1.145	0.258	Not significant

Table No. (10): Indicates that the frequency of tooth brushing is the only statistically significant factor in the model ($p < 0.05$).

Table No. (11): Shows the relationship between oral health assessment and the presence of problems in the positioning of permanent anterior teeth.

No	Overall Oral Health Assessment	no		yes		Pearson Chi-Square	Significance
		Percentage	Frequencies	Percentage	Frequencies		
1	Poor	0	%0.0	%100	18	31.535	0.000
2	Moderate	0	%0.0	%100	22		
3	Good	5	%41.7	%58.3	7		
4	Excellent	3	%100	%0.0	0		
Total		8	%14.5	%85.5	47		

able No. (11): Illustrates a statistically significant relationship between oral health assessment and permanent tooth positioning problems.

Table No. (12): Shows the relationship between permanent anterior tooth positioning problems and oral hygiene habits (frequency of tooth brushing).

no	Statement	Pearson Chi-Square	Fisher's Exact Test	Significance
1	Permanent anterior tooth positioning problems and oral hygiene habits	41.055a	29.285	0.000

Table No. (12) shows a statistically significant relationship between oral hygiene habits and tooth positioning problems (frequency of tooth brushing).

Table No. (13): The relationship between the use of dental floss and the presence of problems in the positioning of permanent anterior teeth.

No.	Statement	Pearson Chi-Square	Fisher's Exact Test	Significance
1	Use of dental floss and the presence of problems in the positioning of permanent anterior teeth	18.642	-	0.000

Table No. (13): Illustrates a statistically significant relationship between the use of dental floss and tooth positioning problems.

Table No. (14): Shows the relationship between dental visits in previous years and the presence of problems in the positioning of permanent anterior teeth.

No.	Statement	Pearson Chi-Square	Fisher's Exact Test	Significance
1	Dental visits during previous years and the presence of problems in	11.234	-	0.001

	the positioning of permanent anterior teeth			
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Table No. (14): Illustrates a statistically significant relationship between dental visits and tooth positioning problems.

Table No. (15): Shows the relationship between the history of anterior primary teeth exfoliation and the overall oral health assessment.

No.	Statement	Pearson Chi-Square	Fisher's Exact Test	Significance
1	History of anterior primary teeth exfoliation and overall oral health assessment	50.169	47.149	0.000

Table No. (15) shows a statistically significant relationship between the timing of primary teeth exfoliation and oral health assessment.

The results indicated that several health, environmental, and behavioral factors are associated with delayed exfoliation of anterior primary teeth. It was found that a proportion of children suffer from health problems such as calcium deficiency, vitamin D deficiency, and reduced jaw size.

From a scientific perspective, the exfoliation of primary teeth depends on the resorption of tooth roots due to the pressure exerted by erupting permanent teeth. This is a precise physiological process influenced by nutritional status and jaw skeletal development. Liversidge (2003) also indicates that deficiencies in essential nutrients directly affect the timing of tooth development, leading to delayed mineralization and consequently delayed tooth exfoliation. (Liversidge, 2003)

Likewise, the reduced jaw size, which appeared with a noticeable percentage in the results, leads to insufficient space for the eruption of permanent teeth, thereby hindering the movement of primary teeth and delaying their exfoliation. This is consistent with Proffit et al. (2018), who stated that the balance between tooth size and jaw size is a key factor in the normal process of dental transition (succedaneous dentition).. (Proffit, Fields, & Sarver, 2018)

As for behavioral factors, the results showed poor oral hygiene habits, as a large proportion of children brush their teeth only once daily or do not brush at all, in addition to low use of dental floss. These behaviors increase the likelihood of dental caries and gingival inflammation, which may affect the stability of primary teeth and contribute to delayed exfoliation.

Petersen (2005) confirmed that daily health behaviors are among the most important factors influencing oral health, and that poor oral hygiene leads to the accumulation of oral health problems that may extend to affect the normal development of teeth.

(2005 ,Petersen) .

With regard to the genetic factor, the results indicated the presence of a family history in some cases; however, it was not statistically significant in the regression analysis.

This may be explained by the fact that genetic influence is often indirect and interacts with environmental factors, as noted by Harris & McKee (1990). (Harris & McKee, 1990)

The study results also revealed a strong statistically significant relationship between delayed exfoliation of primary teeth and the occurrence of problems in the positioning of permanent teeth, such as crowding, protrusion, and tilting. This relationship can be explained by the fact that prolonged retention of primary teeth beyond the normal shedding period obstructs the natural eruption pathway of permanent teeth, forcing them to emerge in inappropriate positions within the dental arch.

It was also found that a considerable proportion of children exhibited eruption of permanent teeth before the shedding of primary teeth, a condition associated with dental crowding, as permanent teeth do not find sufficient space for normal alignment and growth.

These findings are consistent with Moyers (1988), who stated that abnormal timing of primary tooth exfoliation leads to disturbances in the relationship between teeth and jaws. Similarly, Little et al. (2002) indicated that anterior crowding is one of the most common outcomes of irregular dental transition processes.. (Moyer, 1988) (Little, Wallen, & Riedel, 2002)

The researchers also suggest that the higher prevalence of problems in the mandible compared to the maxilla may be explained by the fact that the lower jaw is generally more susceptible to crowding due to limited space availability, a view supported by orthodontic literature.

The results indicate that the influencing factors can be categorized into:

- Biological factors (nutritional deficiencies, growth disorders, and reduced jaw size),
- Behavioral factors (poor oral hygiene and lack of regular dental check-ups),
- Pathological factors (dental caries and gingival inflammation).

These findings are consistent with the World Health Organization model (Petersen, 2003), which links biological and behavioral determinants in explaining oral health problems.

. (Petersen, Continuous improvement of oral health in the 21st century, 2003)

From the presentation of the previous tables, the results showed a strong relationship between delayed exfoliation of primary teeth and the occurrence of alignment problems. This delay leads to obstruction of the normal eruption of permanent teeth, resulting in dental crowding within the dental arch and the eruption of teeth in abnormal positions. This is supported by the study of Proffit et al. (2018), which demonstrated that any disturbance in the normal timing of dental replacement leads to malocclusion.. (Proffit, Fields, & Sarve, Contemporary orthodontics, 2018)

As for the psychological and social impact resulting from dental problems, the results indicate a high prevalence of anterior dental issues, which may negatively affect children's self-confidence, social interaction, and self-image. Marshman & Robinson (2007) indicated that dental appearance has a direct impact on children's quality of life. Likewise, Kenealy et al. (1989) confirmed that dental misalignment is associated with increased social pressures.. (Marshman & Robinson, 2007) (Keneal, Frude, & Shaw)

The results of the Chi-square test revealed statistically significant relationships between delayed exfoliation of primary teeth and permanent dental problems, as well as between early eruption of permanent teeth and malocclusion problems, and between oral hygiene habits and dental problems. Linear regression analysis showed that the statistical model was significant, explaining a large proportion of the variance in dental problems, which reflects the strength of the relationship between the variables.

Notably, the frequency of tooth brushing was the only statistically significant factor, confirming that health behavior is the most influential factor at this age stage. This can be explained by the fact that daily habits represent a continuous cumulative factor, whereas other factors may have a weaker impact or require a longer period to become evident.

Accordingly, the researchers conclude that delayed exfoliation of anterior primary teeth is an important factor in the development of permanent tooth positioning problems, and that this delay is influenced by several factors, the most important of which are health behaviors. These problems also have psychological and social dimensions that require attention within school health care programs

Conclusions

In light of the study results, their analysis, and discussion, the following conclusions can be drawn:

1. There is a strong statistically significant relationship between delayed exfoliation of anterior primary teeth and permanent tooth positioning problems, confirming that disruption in the timing of dental transition is a key factor in malocclusion.
2. Early eruption of permanent teeth before the shedding of primary teeth is one of the most important factors associated with dental crowding and misalignment.
3. Permanent anterior dental problems were highly prevalent among the study sample, mainly represented by crowding, protrusion, and tilting, especially in the mandible.
4. The study showed that biological factors such as calcium deficiency, vitamin D deficiency, and reduced jaw size contribute to delayed exfoliation; however, their effect was not statistically significant compared to behavioral factors.
5. Health behaviors, particularly the frequency of tooth brushing, are the most influential factor in dental positioning problems, as it was the only statistically significant variable in the regression model.
6. Poor oral hygiene practices, such as infrequent brushing and lack of dental floss use, contribute to an increase in oral and dental problems.
7. The study revealed a statistically significant relationship between oral health status assessment and permanent dental problems, where poor oral health status was associated with higher rates of malocclusion.
8. Regular dental visits and follow-up are significantly associated with improved dental conditions, highlighting the importance of early detection.
9. Potential psychological and social impacts were identified in relation to anterior dental problems due to their influence on appearance and social interaction among children.

10. Dental problems in children are of a multifactorial nature, involving biological, behavioral, and environmental factors.

Recommendations

In light of the study findings, the researchers recommend the following:

1. Strengthening school-based oral health awareness programs, especially in the primary education stage.
2. Emphasizing the teaching of proper oral hygiene habits for children, such as:
 - Brushing teeth at least twice daily
 - Regular use of dental floss
3. Raising parents' awareness regarding:
 - Monitoring their children's dental development
 - Early detection of delayed exfoliation of primary teeth
4. Conducting regular dental check-ups for children (every six months) to detect eruption and alignment problems early.
5. Promoting early intervention in cases of delayed exfoliation of primary teeth to avoid orthodontic complications.
6. Enhancing the role of dentists in:
 - Guiding children and parents
 - Monitoring the stages of tooth replacement

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