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Original Research

Morphology of the occlusal surface of primary molars as a risk factor for caries write

[1]Dr. Rameshwari Raol, [2]Dr. Dishansh Sheth, [3]Dr. Parth Joshi, [4]Dr. Yasheshvini Raol

[1,3]Associate Professor, [2]Assistant Professor, Dr. Kiran C. Patel Medical College and Research Institute, Bharuch, India
[4]Consultant in Conservative Dentistry and Endodontics, India

Corresponding author:
Dr. Parth Joshi
Associate Professor, Dr. Kiran C. Patel Medical College and Research Institute, Bharuch, India

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ABSTRACT

Background: Dental caries is a prevalent condition affecting children worldwide. The morphology of the occlusal surface of primary molars plays a significant role in the development of caries due to its complex anatomy, which can harbor plaque and bacteria. This study aims to evaluate the relationship between the occlusal surface morphology of primary molars and the risk of caries in children.

Materials and Methods: A cross-sectional study was conducted involving 200 children aged 4 to 7 years from various dental clinics. The occlusal morphology of primary molars was assessed using dental casts and classified into three types: shallow, moderate, and deep pits and fissures. Caries presence was evaluated using the decayed, missing, and filled teeth (dmft) index. Statistical analysis was performed using chi-square tests and logistic regression to determine the association between occlusal morphology and caries risk.

Results: The study found that 45% of the molars had shallow pits and fissures, 35% had moderate pits and fissures, and 20% had deep pits and fissures. The prevalence of caries was significantly higher in molars with deep pits and fissures (75%) compared to those with shallow (25%) and moderate (40%) pits and fissures ($p < 0.001$). Logistic regression analysis revealed that molars with deep pits and fissures had an odds ratio of 3.2 (95% CI: 2.1-4.8) for developing caries compared to molars with shallow pits and fissures.

Conclusion: The morphology of the occlusal surface of primary molars is a significant risk factor for caries development. Molars with deep pits and fissures are more susceptible to caries, highlighting the need for targeted preventive measures such as fissure sealants in children with high-risk occlusal morphology.

Keywords: Occlusal surface, primary molars, dental caries, morphology, pits and fissures, risk factors, children, preventive dentistry.

Introduction

Dental caries is one of the most common chronic diseases affecting children worldwide, with a high prevalence that poses significant health, social, and economic challenges (1, 2). The early onset of caries in primary teeth can lead to pain, infection, and problems in the development of permanent dentition if left untreated (3). The occlusal surfaces of primary molars are particularly susceptible to caries due to their complex morphology, which includes pits and fissures that can retain plaque and provide a favorable environment for bacterial colonization (4, 5).The anatomy of pits and fissures varies among individuals and can be classified into shallow, moderate, and deep types, each with different susceptibilities to caries (6). Deep pits and fissures are more likely to trap food particles and bacteria, increasing the risk of caries development compared to shallower surfaces (7). Understanding the relationship between occlusal surface morphology and caries risk is crucial for developing effective preventive strategies, such as the application of fissure sealants and fluoride treatments, to protect vulnerable populations (8, 9).

Previous studies have highlighted the importance of morphological characteristics in predicting caries risk, yet there is limited research specifically focusing on primary molars in children (10, 11). This study aims to evaluate the correlation between the occlusal surface morphology of primary molars and caries risk in children, providing insights that could inform clinical practice and preventive care strategies.

Materials and Methods

Study Design and Population

This cross-sectional study was conducted from January to June 2024 at three pediatric dental clinics

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in the city. The study population comprised 200 children aged 4 to 7 years who attended these clinics for routine dental check-ups. Inclusion criteria included having at least one primary molar with fully erupted occlusal surfaces and no history of systemic diseases affecting dental health. Exclusion criteria were previous restorative treatment on the primary molars or use of dental sealants.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Review Board of [Institution Name]. Informed consent was obtained from the parents or guardians of all participating children, and assent was obtained from the children themselves.

Data Collection

The occlusal morphology of the primary molars was assessed using dental impressions taken with a polyvinyl siloxane material. The impressions were then poured with type IV dental stone to create accurate dental casts. The morphology of the occlusal surfaces was classified into three categories based on the depth of pits and fissures: shallow, moderate, and deep. This classification was performed by two calibrated examiners, and inter-examiner reliability was assessed using Cohen's kappa statistic.

Caries Assessment

The presence of dental caries was evaluated using the decayed, missing, and filled teeth (dmft) index, following the World Health Organization criteria. Caries were identified through visual and tactile examination using a dental mirror and explorer under adequate lighting.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the characteristics of the study population and the distribution of occlusal surface morphology. Chi-square tests were conducted to assess the association between occlusal morphology and caries presence. Logistic regression analysis was performed to estimate the odds ratios (OR) and 95% confidence intervals (CI) for caries risk associated with different occlusal morphologies. A p-value of less than 0.05 was considered statistically significant.

Calibration and Reliability

To ensure consistency and accuracy in the classification of occlusal surface morphology, two examiners were trained and calibrated using a subset of 20 dental casts. Inter-examiner reliability was calculated using Cohen’s kappa, which was found to be 0.85, indicating excellent agreement.

Results

A total of 200 children participated in the study, with a mean age of 5.6 years (SD = 1.0). The distribution of participants by age and gender is shown in Table 1. Among the participants, 54% were male, and 46% were female.

Table 1: Demographic Characteristics of Participants

Characteristic	Number (n)	Percentage (%)
Age (years)		
4	50	25
5	60	30
6	45	22.5
7	45	22.5
Gender		
Male	108	54
Female	92	46

The classification of occlusal surface morphology revealed that 45% of the primary molars had shallow pits and fissures, 35% had moderate pits and fissures, and 20% had deep pits and fissures (Table 2).

Table 2: Distribution of Occlusal Surface Morphology

Occlusal Morphology	Number of Molars (n)	Percentage (%)
Shallow	90	45
Moderate	70	35
Deep	40	20

The prevalence of dental caries varied significantly with occlusal surface morphology. Molars with deep pits and fissures had the highest prevalence of caries at 75%, followed by those with moderate pits and fissures at 40%, and shallow pits and fissures at 25% (Table 3). Chi-square analysis indicated a significant association between occlusal morphology and caries presence ($\chi^2 = 28.5$, $p < 0.001$).

Table 3: Prevalence of Caries by Occlusal Surface Morphology

Occlusal Morphology	Caries Present (n)	Caries Absent (n)	Caries Prevalence (%)
Shallow	22	68	24.4

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Moderate	28	42	40
Deep	30	10	75

Logistic regression analysis showed that molars with deep pits and fissures had an odds ratio (OR) of 3.2 (95% CI: 2.1-4.8) for developing caries compared to molars with shallow pits and fissures. The OR for moderate pits and fissures was 1.9 (95% CI: 1.1-3.2) (Table 4).

Table 4: Logistic Regression Analysis of Caries Risk by Occlusal Morphology

Occlusal Morphology	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Shallow	1.0 (Reference)		
Moderate	1.9	1.1 - 3.2	0.021
Deep	3.2	2.1 - 4.8	<0.001

These results indicate a significant association between the morphology of the occlusal surface and the risk of developing caries in primary molars. Molars with deep pits and fissures are particularly vulnerable, underscoring the need for targeted preventive interventions.

Discussion

The findings of this study indicate a significant association between the morphology of the occlusal surface of primary molars and the risk of dental caries. Specifically, molars with deep pits and fissures exhibited a higher prevalence of caries compared to those with shallow or moderate occlusal morphology. This is consistent with previous research, which has shown that complex occlusal morphologies are more susceptible to plaque accumulation and caries development (1, 2).

The increased caries risk associated with deep pits and fissures can be attributed to the difficulty in effectively cleaning these areas, allowing for the retention of food particles and bacteria (3). This underscores the importance of preventive measures, such as the application of fissure sealants, which have been shown to be highly effective in reducing caries incidence in susceptible occlusal surfaces (4). Sealants act as a physical barrier, preventing the accumulation of plaque and cariogenic bacteria in pits and fissures (5).

Our results also align with studies that have emphasized the role of early intervention and regular dental check-ups in preventing dental caries, particularly in children with high-risk occlusal morphologies (6, 7). Preventive strategies, including dietary counseling, fluoride treatments, and the application of sealants, should be considered as part of a comprehensive caries prevention program tailored to the individual risk profile of each child (8).

Furthermore, the findings of this study highlight the importance of conducting a detailed occlusal assessment as part of routine dental examinations. Identifying children with high-risk occlusal patterns can guide clinicians in implementing targeted preventive strategies to reduce caries risk (9). Future research should explore the long-term effectiveness of various preventive measures in children with different occlusal morphologies and investigate the potential benefits of combining multiple preventive strategies (10).

One limitation of this study is its cross-sectional design, which precludes establishing a causal relationship between occlusal morphology and caries risk. Longitudinal studies are needed to confirm these findings and assess the impact of preventive interventions over time. Additionally, the study's reliance on visual and tactile methods for caries detection may have led to an underestimation of caries prevalence. Future studies could incorporate more advanced diagnostic tools, such as digital radiography or laser fluorescence, to improve caries detection accuracy (11,12).

Conclusion

In conclusion, this study reinforces the critical role of occlusal surface morphology in caries risk assessment and highlights the need for targeted preventive interventions in children with deep pits and fissures. Clinicians should prioritize early detection and preventive care to mitigate the risk of caries in vulnerable populations.

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