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OXIS contacts and approximal caries in preschool children- A prospective cohort study

M Kirthiga[#a], **M S Muthu**[#a], **G Kayalvizhi**[b], **Vijay Prakash Mathur**[c], **Naveenkumar Jayakumar**[d], **R Praveen**[e]

[a]Centre for Early Childhood Caries Research (CECCRe), Department of Pediatric and Preventive Dentistry, Sri Ramachandra Faculty of Dental Sciences, Sri Ramachandra Institute of Higher Education & Research (SRIHER), Chennai, Tamilnadu, India

[a]Centre for Early Childhood Caries Research (CECCRe), Department of Pediatric and Preventive Dentistry, Sri Ramachandra Faculty of Dental Sciences, SRIHER, Chennai, Tamilnadu, India

[b]Department of Pedodontics and Preventive Dentistry, Syamala Reddy Dental College, Bangalore, India

[c]Division of Pedodontics and Preventive Dentistry, Centre for Dental Education and Research, All India Institute of Medical Sciences, New Delhi, India

[d]Department of Oral and Maxillofacial Surgery, Sri Ramachandra Faculty of Dental Sciences, SRIHER, Chennai, Tamilnadu, India

[e]Department of Conservative Dentistry and Endodontics, Indira Gandhi Institute of Dental Sciences, Puducherry, India

[#] These authors contributed equally to this work.

Abstract

The present prospective cohort study was conducted to evaluate the susceptibility of OXIS contact areas namely O (open type), X (point type), I (straight type) and S (curved type) in

Correspondence to: M S Muthu.

Corresponding Author M.S. Muthu MDS., Ph.D., MFDS RCPS (Glasg), Head, Centre for Early Childhood Caries and Research, Department of Pediatric and Preventive Dentistry, Sri Ramachandra Faculty of Dental Sciences, Sri Ramachandra Institute of Higher Education and Research (SRIHER), Sri Ramachandra Nagar, Porur, Chennai, Tamil Nadu 600116 (India), Tel: +91 9444045094, muthumurugan@gmail.com.

Statement of Ethics
This study protocol was reviewed and approved by the Institutional Ethics Committee, Sri Ramachandra University of Higher Education & Research, IEC-NI/16/AUG/55/54. A written informed consent was obtained from parents of the included children for participation and examination of the child for the presence of dental caries.

Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Author Contributions
M Kirthiga contributed to conception, design, data acquisition, analysis and interpretation, and drafted and critically revised the manuscript. M S Muthu contributed to conception, design, data acquisition, analysis and interpretation, and drafted and critically revised the manuscript. G Kayalvizhi contributed to conception, design, analysis and interpretation, and critically revised the manuscript. Vijay Prakash Mathur contributed to conception, design, analysis and interpretation, and critically revised the manuscript. Naveenkumar Jayakumar contributed to conception, design, analysis and interpretation, and critically revised the manuscript. R Praveen contributed to data acquisition, analysis and interpretation, and critically revised the manuscript. All authors gave their final approval and agree to be accountable for all aspects of the work.

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the development of approximal caries. We conducted this study among 953 school children with 3812 contacts in Puducherry, India. At baseline, the contacts were assessed in accordance with OXIS criteria. At the end of 12 months, two calibrated dentists measured dental caries following the International Caries Detection and Assessment (ICDAS) criteria. Information about feeding practices, diet, and oral hygiene was collected by means of a structured questionnaire from each child's parent. Data were analyzed by unadjusted and adjusted Poisson regression analysis with a multilevel approach. The two levels of analysis were tooth and child. Of 3,812 contacts observed during the follow-up, 127 (3.3%) were observed as carious. Poisson regression analysis revealed a significant association between type of contact and caries prevalence ($p < 0.05$). The risk ratios for the development of approximal caries in X contacts were 2.4 (0.3-17.2), p value 0.38; in I contacts - 4.9 (1.2-19.9), p value 0.027; and in S contacts 8.2 (1.9-34.2), p value 0.004, when compared with the O contacts. Among the child variables, male gender (RR=2.1; 95%CI-1.3,3.5), parental supervision while toothbrushing (RR=1.6; 95%CI-1.1,2.4) and the use of toothpaste (RR=1.9; 95%CI-1.3,3.1) were found to be associated with approximal caries after adjustment for the other variables. Among the OXIS contacts, the S type was most susceptible to approximal caries due to its complex morphology, followed by I, X, and O.

Keywords

Approximal Caries; OXIS Contact areas; Pre school children; Primary molars

Introduction

In the primary dentition, the occlusal lesions are more common than the approximal lesions. However, as soon as the proximal contacts form, the prevalence of the approximal lesions increases which occurs at three years. This pattern continues in the mixed and permanent dentitions. Therefore understanding the variations of contacts is crucial in understanding the progression of the disease [Kennedy., 1986]. Proximal caries detection in primary teeth is of great importance because of the rapid rate of caries progression and the difficulty in determining the presence or absence of a lesion. This could be explained by some of the characteristics of primary teeth, such as the thinner enamel and dentin layers, lower degree of mineralization, wider dentinal tubules in comparison with permanent teeth, and broad area of contact allowing greater biofilm accumulation [Virajsilp V., 2005]. The OXIS classification of interproximal contact areas of primary molars was first described in 2018. It consists of four types of contact areas, namely, the open type, denoted as O; the point contact type, denoted as X; the straight contact type, denoted as I; and the curved contact type, denoted as S [Kirthiga et al., 2018]. Subsequently, studies have been performed to evaluate the prevalence of OXIS contacts in various geographic locations, namely, Puducherry [Muthu et al., 2020], Seoul (South Korea) [Kirthiga et al., 2021], and Ajman (UAE) [Walia et al., 2021].

Previous studies in this area evaluated the association of two types of contacts (open and closed) with approximal caries and concluded that the risk for approximal caries in the posterior primary dentition is increased if contact points are closed rather than open [Allison and Schwartz, 2003; Warren et al., 2003; Subramaniam et al., 2012]. A

prospective study concluded that the risk for approximal caries development was higher when the approximal surfaces were concave when compared with other combinations, namely, concave-concave, concave-convex, convex-concave, and convex-convex [Cortes et al., 2018]. A recent investigation was performed to assess the influence of OXIS contact areas on approximal caries in a retrospective cohort study design. This study used existing Cone Beam Computed Tomography (CBCT images) and clinical photographs and concluded that a significant association exists between OXIS contacts and approximal caries. Another significant conclusion from this study was that the S contact had the maximum risk for approximal caries development in primary molars, followed by I, X, and O contacts [Muthu et al., 2021].

Although evidence exists regarding OXIS contacts as a risk factor for approximal caries, the role of the confounding factors in the prevalence of approximal caries has not been measured. A well-designed prospective cohort study is necessary to understand the association of OXIS contacts with approximal caries. The aim of the present study was to evaluate, prospectively, the susceptibility of OXIS contact areas in the development of approximal caries, in a group of pre-schoolers aged 3-4 years. The hypothesis tested in the present study was that the broad contact areas (S & I) would be more susceptible to approximal caries development in children when compared with the narrow or open contact areas (X & O).

Materials and Methods

Ethical Considerations and Permissions

The study protocol was reviewed and approved by the Institutional Review Board (IECNI/16/AUG/55/54). Prior to commencement of the study, permissions were obtained from the Chief Educational Officer, Puducherry, and Principals of the respective schools. After the purpose of the study was explained, a written informed consent was obtained from parents of the included children, allowing for their participation and examination for the presence of dental caries.

Study Design and Participants

This study was the longitudinal portion of a previous published study [Muthu et al., 2020] performed in preschool children aged 3-5 years who had an ancestral nativity to Puducherry, a Union Territory in India. A two-stage simple random sampling methodology was used to select schools and children, respectively. The total number of schools included for the present study was 34. Finally, a cohort of 1,119 children (with 4,476 contacts) aged 3–4 years was recruited at baseline. The calculation of the sample is based on a previously conducted study [Allison and Schwartz, 2003] to estimate the prevalence of open contacts of primary molars. Thus, the sample size was calculated with an expected prevalence of 30% percent and a z-value of 1.96. A minimum sample size of 933 children was determined. Furthermore, the sample size was increased to 1119 to compensate for 20% of additional losses. The baseline examinations were performed between November 2018 and January 2019, and the 12-month follow-up examinations were performed between November 2019

and January 2020. The selection criteria and the sample selection were described in a previously published study [Muthu et al., 2020].

Assessment of Baseline Data (November 2018 - January 2019)

A single paediatric dentist (KM) was extensively trained and calibrated under the supervision of an expert to clinically evaluate the contact areas over two months duration. The calibration process consisted of a 10 hour session conduced in two stages. The first stage included power point slide presentations with clinical photographs of the OXIS classification of contact areas to be observed clinically. In the second stage, a clinical exercise using 100 study models of 25 children was performed to provide a learning environment of previously acquired theoretical information. For the calculation of intra examiner reproducibility, 25 caries free children (with 100 contacts) were examined and reexamined clinically after a period of two weeks. The intra-examiner Cohen's Kappa coefficient was 0.96. Clinical examinations were performed among 4,476 contacts of the 1,119 caries-free children (ICDAS=0) for the type of contact between the distal surface of the first primary molar and the mesial surface of the second primary molar according to OXIS criteria [Kirthiga et al., 2018]. Sectional maxillary and mandibular impressions were made on the day of clinical examination, for future record purposes. All the recruited children were provided with oral hygiene instructions regarding frequency and method of brushing.

Calibration of the Examiners

Prior to the commencement of the study, two examiners (BR & SP), pediatric dentists, were trained to diagnose dental caries clinically and radiographically using ICDAS. The method of training was carried out according to the recommendations for examiner training of the 2014 ICDAS criteria manual. For the calculation of inter-examiner reproducibility, 25 children were analyzed by both the examiners. The inter examiner kappa coefficients was 0.94. The intra examiner kappa coefficients of the examiners (BR, SP) was observed to be 0.92 and 0.89 respectively.

Assessment of the Outcome by Clinical and Radiographic Examination at 12 Months (November 2019 - January 2020)

The dependent outcome was the clinical or radiographic presence of caries in the approximal surfaces (the distal surface of the first primary molar and/or the mesial surface of the second primary molar) at the 12-month follow-up examination. The outcome assessment was performed independently by two trained and calibrated examiners who were blinded to the baseline data.

Clinical Examinations

Clinical examinations at the 12-month follow-up were performed in a suitable classroom by means of a mouth mirror, under natural light (Type III examination)[Peter., 2017]. Cotton rolls were used to clean the teeth of food debris and to dry them. The selected children were examined for dental caries according to the International Caries Detection and Assessment System (ICDAS II) criteria [Ismail et al., 2007] by examiners who were blinded to the

baseline data. Teeth were initially assessed wet and then air-dried by means of a portable device providing compressed air. The examiners assessed the buccal, lingual, mesial, distal, and occlusal surfaces of each tooth and recorded the findings on a custom-made assessment form. However, only the presence of caries in the approximal surfaces (the distal surface of the first primary molar or the medial surface of the second primary molar) was considered for the assessment. A CPITN probe was used for the assessment of enamel breakdown, if required.

Radiographic Examination

In addition to clinical examination, bitewing radiographs were taken when visual inspection of approximal surfaces was impossible (in accordance with the AAPD guidelines) or when the ICDAS score was 4 (underlying dark shadow from dentin). The radiographs were taken by means of a portable dental X-ray unit (Vatech EZRay Air Plus Portable X-Ray Machine, Vatech, New Delhi, India) and a digital scanner (SOREDEX™ DIGORA™ Optime, Brea, CA, USA) which were brought to the schools where the examinations took place. In addition, a ring holder was used to ensure standardization. All radiographs were read in a view box by both investigators on different occasions. The mesial surfaces of the second primary molars and the distal surfaces of the first primary molars were examined for dental caries. According to radiographic appearance, a code, as per ICDAS scoring, was assigned to the designated surface as follows: 0, No radiolucency; RA 1, Lesion in the external half of the enamel; RA 2, Lesion in the internal half of the enamel; RA 3, Lesion in the external third of the dentin; RB 4, Lesion in the middle third of the dentin; RC 5, Lesion in the internal third of the dentin, clinically cavitated; and RC 6, Radiolucency into the pulp, clinically cavitated. Missing (m) or filled (f) surfaces, if any, were coded separately. Although the ICDAS scores were used for the clinical and radiographic assessment of dental caries, the final outcome was determined as the absence or presence of approximal caries lesions (cavitated or non-cavitated). Data were recorded on a custom-made data sheet.

Questionnaire Data and Diet Chart Assessment

To ascertain the effects of independent variables related to feeding, oral hygiene, diet, and caries prevention, each child was given a validated questionnaire [Folayan MO et al., 2015] to take home on the day of the clinical examination. The parents' socio-economic status was categorized by the modified Kuppuswamy scale as upper, upper middle, lower middle, upper lower, or lower class. The questionnaire was given to the classroom teachers, who communicated with the parents regarding its completion and return by the child within 24-48 hours. The parents were advised to contact the teachers (who were sensitized by the primary investigator) in case of any queries/doubts which may arise during questionnaire completion. The completed questionnaires were collected from the teachers of the recruited children after the stipulated time period. Due to the peak COVID situation and the travel restrictions during this period, the collection of questionnaires from all schools was not possible. Hence, in these situations, questionnaire data collection was performed via telephone interview by a trained investigator (KM).

Statistical Analysis

Demographic data were analyzed with descriptive statistics expressed as frequencies and percentages. The number of approximal caries was considered as count data. Data were entered in Excel and analyzed by STATA 16 software. The data had a hierarchy level which was tooth (level 1) and child (level 2). The data were analyzed by unadjusted and adjusted Poisson regression analysis with a multilevel approach (teeth [level 1, on which outcome was measured] and child [level 2]), since both dental variables and child characteristics could exert an influence on the outcome. The incidence of approximal caries in primary teeth was calculated as relative risk (RR) and respective 95% confidence intervals (CI). A p value of less than 0.05 was considered statistically significant. The stepwise method was used to select variables for the final model, maintaining only those dental variables that remained significant ($p < 0.05$) after the adjustments. For the child variables, those that remained significant ($p < 0.05$) after being controlled for the other variables were maintained in the final model. The goodness-of-fit of the model was analyzed using deviance (–2 log likelihood).

Results

Characteristics of the Participants

Of the 1,119 children (with 4,476 contacts) who were recruited at baseline, 166 children (with 664 contacts) were lost to follow-up at 1 year, corresponding to a response rate of 85.2%. The drop-outs were primarily because they migrated from their schools or were not present on the day of the follow-up examination or did not complete the questionnaire. Finally, 953 (85.2%) subjects with 3,812 contacts remained in the study after completion of both clinical examinations and questionnaires. There were 759 questionnaires collected from schools. For the remaining 194 parents, questionnaire data collection was performed by means of a telephone interview. The gender distribution of the cohort present at one-year follow-up consisted of 478 (50.2%) female and 475 (49.8%) male children. At the final examination, the children were between 4 and 5 years of age (501 were 4 years old, 452 were 5 years old).

Evaluation of the Questionnaires

Supplementary file 1 denotes all the characteristics of the included participants based on the demographics and information collected from the questionnaire. Of the included children, 67.8% brushed once daily, 57.6% of the children had never visited a dentist before, and only 4% had received professional topical fluoride application. According to their parents, 78.2% of the children ate snacks at a frequency of 1-2 times per day. With respect to the knowledge-related questions on caries prevention, 52.7% of the parents/caregivers strongly disagreed that toothpaste containing fluoride has a role in caries prevention. With respect to frequency of snacking as a risk factor of dental caries, 61% of the parents agreed. According to the parents, 65.5% agreed that mouthrinsing after snacking is beneficial in the prevention of dental caries.

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Prevalence and Frequency of Contacts at Baseline

Of the 4,476 contacts, the observed prevalence of O, X, I, and S types was 261 (5.8%), 148 (3.3%), 3,381 (75.5%), and 686 (15.3%), respectively. The most common contact observed was I, followed by S, O, and X.

Assessment of the Outcome

Among the 3,812 contacts, 127 contacts (3.3%) were found to be carious at the approximal surfaces (the distal surface of the first primary molar and/or the mesial surface of the second primary molar) during the follow-up visit. The remaining 3,685 caries lesions were sound. There were no restored or missing teeth identified. Among the 127 caries-affected contacts, 102 were cavitated lesions and 25 were non-cavitated lesions. Of the caries-affected contacts, 25 contacts on both approximal surfaces were caries-affected (the mesial surface of the primary second molar and the distal surface of the primary first molar). In the other 77 caries-affected contacts, 26 were mesial (primary second molar) and 51 were distal surfaces (primary first molar) showing the presence of approximal caries. Seventy-six lesions required a bitewing radiograph for confirmation of approximal caries. Among them, 32 lesions were found to be cavitated and 44 were sound. All the parents of the caries-affected children were contacted and informed regarding the child's dental health status. They were offered free dental treatment at a private dental center. Of the 121 parents, 83 gave consent for the treatment. Therefore, 64 restorations with glass-ionomer cement and 19 stainless steel crowns were provided for the children with caries-affected contacts.

Univariate and Multivariate Poisson Regression Analysis

Supplementary file 2 displays the results of the univariate analysis by Poisson regression with a multilevel approach for the incidence of approximal caries and the independent variables. Among the tooth variables, the type of arch and type of contact were significantly associated with the incidence of dental caries. Among the contact types the S contact has an increased risk of development of approximal caries (RR-7.3;CI,1.9-32.0). With respect to type of arch the left upper (RR-0.5), left lower (RR-0.4) and right upper (RR-0.3) quadrants showed decreased risk of approximal caries development when compared to right lower quadrant respectively. The incidence of approximal caries among S type and I type contacts was 31.5 % and 65.4%, respectively. Considering the child variables, male gender (RR-3.4), upper middle (RR-2.8) and lower middle category (RR-4.5) of socio-economic status were statistically significant. Further, toothbrushing by parent alone (RR-1.8), the absence of use of toothpaste (RR-1.8), and the frequency of toothbrushing once (RR-2.5) and twice daily (RR-2.5) were also found to be statistically significant. Table 1 displays the multilevel adjusted Poisson regression models with a multilevel approach after adjustment for the cluster effect at tooth and child levels. Model 1 represents the naive model, model 2 represents multilevel Poisson regression with dental variables (level 1), and model 3 represents multilevel Poisson regression with dental (level 1) and child variables (level 2). Model 2 indicates that the "S" type of contact showed a more than 7.7 times incidence of approximal caries as compared with the "O" type of contact (RR=7.7, 95% CI=1.9-32.0; *p* value - 0.005). Further, the contacts in the maxillary right quadrant showed a more than 3.5 times incidence of approximal caries as compared with contacts in the right

lower quadrant (*p* value - < 0.001). Model 3 suggests that the type of contact and type of quadrant had a significant association with approximal caries. The risk ratio for the development of approximal caries was significant for S contact (RR=8.2;CI:1.9-34.2) and I contact (RR=4.9;CI:1.2-19.9) when compared to O contact. Further, right upper quadrant (RR=3.3;CI:1.9-5.7) was observed to have a significant association with approximal caries when compared to the right lower quadrant. Among the child variables, male gender (RR-2.1), toothbrushing by sometimes child, sometimes parent (RR-1.6), absence of use of a toothpaste (RR-1.9) and upper lower category of socioeconomic status (RR-2.2) were found to have an increased risk with approximal caries after adjustment for the other variables. The schematic representation of OXIS types of contacts at baseline and after 12 months, respectively, is shown in Figure 1.

Discussion

The aim of the present prospective longitudinal study was to determine whether OXIS contacts are a risk factor for the development of approximal caries in the primary teeth. The focus was on the types of contacts categorized as OXIS, and there was a possibility that more than one type of contact could exist in the same child. The research question of interest was in knowing whether a tooth with a broad contact (I or S) was at greater risk of developing dental caries compared with a tooth with an O or X type of contact, while also considering variables related to the child. Therefore, a multilevel analysis was adopted The findings of the present study confirm the hypothesis that the presence of a broad contact (I or S) poses a greater risk towards approximal caries development when compared to a narrow or open contact. To the best of our knowledge, this is the first longitudinal study to investigate the association between individual OXIS contacts and approximal caries with the tooth and child as the units of analysis in a multilevel approach.

At the end of 12 months, 14.8% of the entire sample had dropped out, which was well within the acceptable range. Of the total number of carious contacts, the contributions of I and S contacts were 65.4% and 31.5%, respectively, which equals 96.9% [Muthu et al., 2021]. This result was in correlation with that of another study where the contributions of I and S contacts were 68% and 30.9%, respectively, which equals 98.9%. From the above findings, it is clear that the maximum number of ap caries lesions in the primary molars occur where a broad contact area (I or S) is present.

Of the 127 carious contacts, 25 contacts were carious on both ap surfaces (mesial surfaces of primary second molars and distal surfaces of primary first molars). In the other 77 carious contacts, there were 51 distal surfaces (primary first molars) and 26 mesial surfaces (primary second molars) showing the presence of approximal caries. This result was in agreement with those of other studies where the distal surfaces of primary first molars were most commonly affected compared with other surfaces [Cortes et al., 2018; Fan et al., 2019]. A possible explanation for this finding could be the early eruption of primary first molar compared to the second molar. Further the distal contact of primary first molar is established before the mesial contact of the primary second molar.

The final model (model 3) revealed that type of contact, type of quadrant, gender gender, parental supervision during toothbrushing and absence of use of toothpaste were found to be associated with the development of approximal caries. Among the type of contacts, the S type of contacts (RR = 8.2; 95% CI, 1.9-34.2) had an eightfold greater risk and I contact had a nearly fivefold greater risk of exhibiting approximal caries when compared to teeth with O type of contacts. Therefore, the S type (RR = 8.2; 95% CI, 1.9-34.2) was most susceptible to approximal caries among the OXIS contacts, due to its complex concave-convex morphology. This was followed by the I contact (RR = 4.9; 95% CI, 1.2–19.9) when compared with the O type of contact. This result was in agreement with that of a previous retrospective cohort study conducted in this area. Also, the broad contact areas (I and S) were observed to be more susceptible to approximal caries than the narrow contact areas (O and X) [Muthu et al., 2021]. This result was in agreement with that of another study where the morphology of the approximal surfaces in the primary molar teeth, if both surfaces were concave, significantly influenced the risk of the individual developing approximal caries. The concave-concave surface can be considered synonymous with the S type among OXIS contacts [Cortes et al., 2018]. A logical explanation would be that this type of contact would lead to maximum plaque retention between the primary molars, since maintenance of oral hygiene by routine mechanical cleansing methods would be difficult in these areas, given their complex ‘concave followed by convex’ design. Another variable that was found to be significant in the adjusted model was the type of quadrant. The right upper quadrant was found to be most prone to approximal caries. Previous studies have observed that the right side is more prone to develop dental caries, since it is the dominant side of mastication when compared with the left side of the oral cavity [Demirci M., 2020].

In the present study, gender (male), parental supervision during toothbrushing (sometimes child, sometimes parent), and absence of the use of toothpaste were found to be associated with approximal caries. The girls exhibited fewer teeth with dental caries when compared with boys. This finding suggests that girls may have followed oral hygiene measures to a greater degree than did boys. Although numerous variables with respect to the child relative to feeding habits, oral hygiene, and diet were assessed, none of the other factors was found to have an association with approximal caries.

Being a prospective cohort study including children who were 3 and 4 years old at baseline, the findings provide concrete evidence on whether OXIS contacts are a risk factor for approximal caries. Further, the use of the ICDAS system for diagnosis of non-cavitated lesions and the bitewing radiographs for hidden lesions could have prevented the underestimation of dental caries. One limitation of the study was that clinical examination of the children under natural light and in the upright position may have made it difficult to inspect and diagnose dental caries in the posterior teeth. Further, the COVID situation during the data collection period made it impossible to complete the questionnaire collection from the schools.

The association of OXIS contacts with approximal caries by means of a prospective cohort design and a standardized methodology should be studied in different ethnic populations. This could help us understand whether OXIS contacts are a potential risk factor for approximal caries after consideration of confounding variables.

Conclusion

The present study confirms that the variations in OXIS contacts is a potential risk factor for approximal caries. Among the four contact types, S contact type was the most susceptible followed by I type.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

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Data Availability Statement

All data generated or analysed during this study are included in this article or available as supplementary files. Further enquiries may be directed to the corresponding author.

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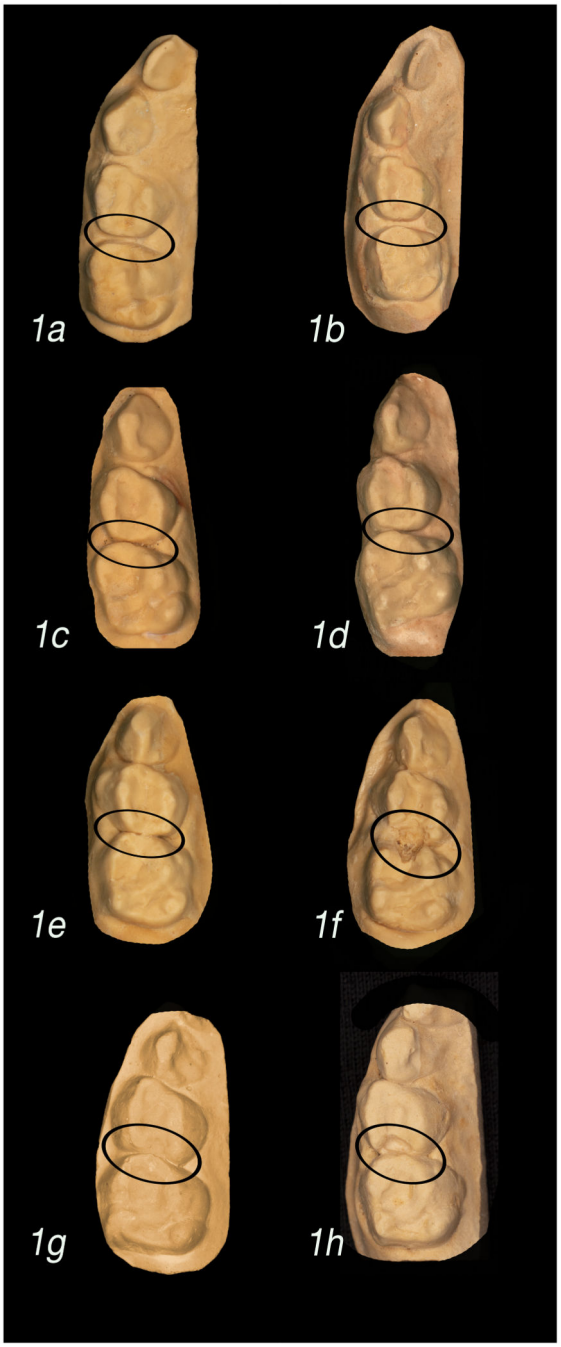

Figure 1.
Schematic representation of OXIS types of contacts at baseline and after 12 months, respectively. (a,b) O types of contacts. (c,d) X types of contacts. (e,f) I types of contacts. (g,h) S types of contacts

Table 1

Multilevel adjusted Poisson regression analysis of incidence of proximal caries on primary teeth considering child and tooth variables

Variable	Model1: Naive model	Model 2 RR (95%CI)	p value	Model 3 RR (95%CI)	P value
Intercept	0.3(0.2,0.4)	0.004 (0.001,0.018)		0.0006 (0.0001,0.0034)	
Type of contact					
O		1		1	
I		3.8(0.9,15.5)	0.062	4.9(1.2,19.9)	0.027
S		7.7(1.9,32.0)	0.005	8.2(1.9,34.2)	0.004
X		1.9(0.3,13.7)	0.513	2.4(0.3,17.2)	0.38
Type of quadrant					
Right lower		1		1	
Right upper		3.5(1.9,6.1)	<0.001	3.3(1.9,5.7)	<0.001
Left upper		1.8(0.9,3.4)	0.05	1.7(0.9,3.2)	0.078
Left lower		1.4(0.8,2.7)	0.269	1.4(0.7,2.6)	0.336
Gender					
Female		1		1	
Male				2.1(1.3,3.5)	0.003
Parental supervision while tooth toothbrushing					
Child alone		1		1	
Parent alone				1.0(0.5,1.9)	0.989
Sometimes child, sometimes parent				1.6(1.1,2.4)	0.029
Use of toothpaste					
Yes		1		1	
No				1.9(1.3,3.1)	0.002
Don’t know				1.1(0.4,3.0)	0.907
Frequency of tooth brushing					
Every meal		1			
Twice daily				1.3(0.5,2.9)	0.598
Once				1.5(0.8,3.2)	0.234
Occasionally				2.3(0.7,7.2)	0.15
Never				2.3(0.5,11.3)	0.321
Don’t know				1.18e-08(0,)	0.999
SES					
Upper middle		1		1	
Lower middle				2.0(0.9,4.5)	0.1
Upper lower				2.2(0.9,4.9)	0.058
log likelihood(ll)	-558.919	-533.2311		-500.9509	
Deviance (-2 log likelihood)	1117.837	1066.4622		1001.9018	

CI: Confidence Interval; RR: Relative Risk