

Bilateral Symmetry of Number and Size of Dental Caries Lesions among Children

Nurit Dagon*/ Sigalit Blumer**/ Devora Liani***/ Benjamin Peretz ****/ Tal Ratson*****

Aim. To determine the bilateral occurrence of caries lesions in 5-12-year-old children, and to assess whether one bitewing photograph can predict caries size and occurrence in the homologous tooth on the other side of the mouth. **Study design.** The study was carried out on 222 medical files of children 5-12 years old who were first examined in the university dental clinic. The presence and size of the caries lesions in the first and second primary molars and first permanent molars were recorded. **Results.** No correlation was found when comparing the caries lesion distribution of each tooth's proximal surface. Seventy-one of the X-rays demonstrated a single caries lesion in a first or second primary molar or in a first permanent molar on one side of the mouth, of which 21.3% demonstrated a single caries lesion in the collateral side, 43.6% demonstrated 2 or more lesions, and 35.21% did not have any caries lesion on the collateral side of the mouth.

Conclusion. One bitewing cannot determine the presence and size of a caries lesion on the same site of the homologous tooth.

Keywords: Caries, Bitewings, X-ray, Pediatric dentistry

INTRODUCTION

In the early part of the last century, clinicians assumed that caries developed symmetrically in similar teeth on the right and left sides of the mouth. The corresponding teeth on either side of the dental arches are usually mirror images.¹ The development and eruption periods of homologous teeth are also closely related. Thus, exposure to extrinsic cariogenic factors could be expected to affect both teeth equally over a period of time.

Knowledge of caries patterns in a population assists in the prevention and diagnosis of dental caries. However, discerning such patterns may require a radiographic examination in addition to a clinical examination. Caries epidemiological studies have traditionally been based on clinical examination alone,² which resulted in detection of less than 50% of total approximal caries lesions found with both clinical and radiographic examination.¹⁻² It has also been reported that in the absence of radiographic examination, as many as 1.2-32.2% of the total number of dental lesions in occlusal surfaces of young teenagers may go undetected.³⁻⁷

Because the effects of radiation exposure accumulate over time, every effort must be made to minimize the patient's exposure. Therefore, radiographs should be taken only when there is an expectation that the diagnostic yield will affect patient care. The recommendations of the ADA/FDA guidelines for prescribing radiographs for children are subject to clinical judgment and may not apply to every patient. They are to be used by dentists only after reviewing the patient's health history and completing a clinical examination. Even

Department of pediatric dentistry, Maurice and Gabriela Goldschleger School of Dental Medicine, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel.

Main author and co-authors are DMD.

Corresponding author:

Nurit Dagon, Department of Pediatric Dentistry, The Maurice and Gabriela Goldschleger School of Dental Medicine, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel.

Phone: +972-54-4875140

Fax: +972-3-6409250

E-mail: Nurit.dagon@gmail.com

though radiation exposure from dental radiographs is low, once a decision to obtain radiographs is made, it is the dentist's responsibility to follow the "as low as reasonably achievable" (ALARA) principle to minimize the patient's exposure.⁸

The aim of this study was to investigate the pattern of dental caries among children 5-12-years-old, considering the bilateral symmetry, size, and number of caries lesions. The study also sought to determine whether caries lesion on a given surface predicts future caries on the corresponding surface on the other side of the mouth.

MATERIALS AND METHOD

Data was collected from 1000 medical files of children 5-12 years old who were treated in the pediatric dentistry department in the dental school of the researcher's university during the years 2008-2015. All of the individuals involved gave their informed consent. The study was approved by the ethical (Helsinki) committee of the university where the study was carried out, and it was conducted in full accordance with the World Medical Association Declaration of Helsinki.

The inclusion criteria of the study specified that the X-rays had to be of children who had never been treated prior to that examination. Children who had been treated before, were missing two bitewing X-rays, or had unclear X-rays were excluded from the study.

One investigator (D.L) examined 2 bitewing radiographs of each child using a magnifying glass connected to a plastic cone. This method was used to verify that the angle and distance from the X-ray photograph, which was viewed on a lightened viewer, remained uniform (the same) in all of the examinations. The size of the caries lesion in first and second primary molars and first permanent molars was classified using Mejare's classification:⁹

0. No visible radiolucency.
1. Radiolucency in the outer half of the enamel.
2. Radiolucency in the inner half of enamel-dentin border.
3. Radiolucency with a broken enamel-dentin border but no obvious progression in the dentin.
4. Radiolucency with obvious spread in the outer half of the dentin score.
5. Radiolucency in the inner half of the dentin.

The size of the lesions were later defined according to the clinical treatment considerations of the lesions as: "Small" (Mejare's classification 1-2), "Medium" (Mejare's classification 3), or "Large" (Mejare's classification 4-5).

The investigator examined the relation between a single caries cavity to caries cavities on the opposite side.

Statistical analysis

The descriptive variables were analyzed using the Statistical Package for the Social Sciences (SPSS Incorporated, Chicago, Illinois, Version 20.0, USA). T-test was used to evaluate caries incidence. The relation between caries bisymmetry on both sides of the mouth was evaluated by chi-Square test (p value =0.05).

RESULTS

Out of the 1000 files that were examined, a total of 222 met the inclusion criteria and were included in the analysis, 143 girls and 79 boys. The first age group (5-9 years old) included 138 children, and the second age group (9-12 years old) included 84. The caries prevalence was significantly higher in the first (younger) age group (p=0.001).

Seventy-one of the X-rays demonstrated a single caries lesion in a first or second primary molar or on a first permanent molar on one side of the mouth, of which 21.3% (15 teeth) demonstrated a single caries lesion on the collateral side, 43.6% (31 teeth) demonstrated 2 or more lesions, and 35.21% (25 teeth) did not have any caries lesions on the collateral side of the mouth (Figure 1).

In 25 of the 71 cases in which one lesion was detected in a bitewing, there were no caries lesions on the collateral side. Forty percent of the single caries lesions were categorized as "Small", 32% as "Medium", and the rest (28%) as 'Large' (Figure 2). In 31 of the 71 cases, there were more than two caries lesions on the collateral side. In 55% of the cases, a single caries lesion was categorized as "Large" (Figure 3).

Sixty children had no caries lesions in the first bitewing X-ray examined (27%). Twenty of them were also caries free in the collateral side of the mouth (9%), but 40 of them demonstrated at least one single caries lesion when the collateral bitewing was examined (18%).

In 60 cases, no caries lesions were found in the X-ray, and in a third of these cases, no caries lesions were present on the collateral side.

The distribution of caries lesions between the two sides of the mouth, considering the surface of the teeth involved, is presented in table 1. In general, no correlation was found when proximal tooth surfaces were compared (McNemar's test).

Figure 1. Prevalence of number of caries lesions present in a bitewing when a single caries lesion present on the collateral side.

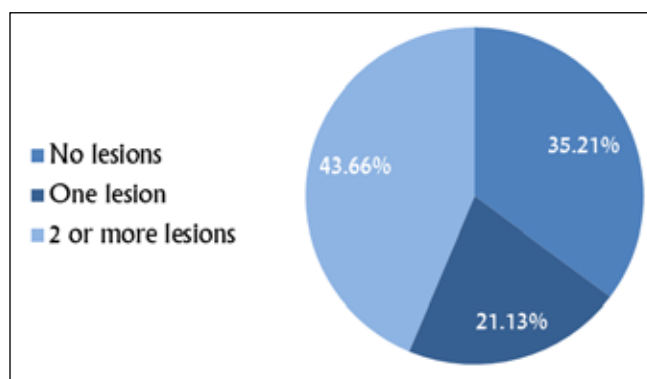


Figure 2. The prevalence of cases when a single caries lesion is present in a bitewing and no caries lesion is present on the collateral side, in relation to the caries lesion size.

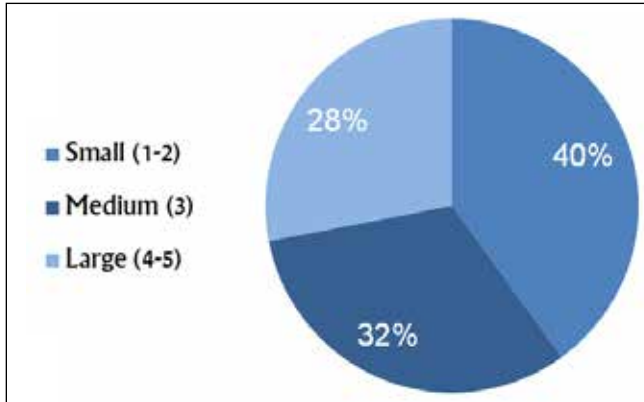


Figure 3. The prevalence of cases when a single caries lesion is present in a bitewing and two or more caries lesions are present on the collateral side, in relation to the caries lesion size.

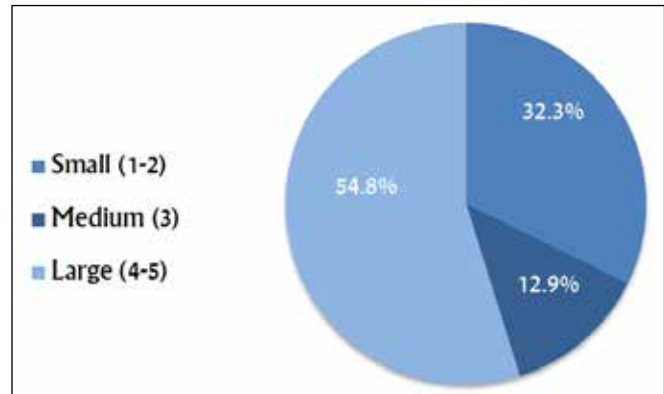


Table 1: The distribution of caries lesions between two sides of the mouth according to the surface of the teeth involved.

Tooth	Surface	Right side	Left side	Presence of caries lesions on both sides
Upper first Primary molar	Mesial	22/160 (13.8%)	7/160 (4.3%)	16/160 (10%)
	Distal	73/160 (45.6%)	72/160 (45%)	47 (29.4%)
Upper second Primary molar	Mesial	91/180 (50.5%)	79/180 (43.9%)	62/180 (34.4%)
	Distal	29/180 (16.1%)	22/180 (12.2%)	13/180 (7.2%)
Upper first Permanent molar	Mesial	16/201 (7.9%)	10/201 (4.9%)	6/201 (2.9%)
Lower first Primary molar	Mesial	19/154 (12.3%)	12/154 (7.8%)	7/154 (4.5%)
	Distal	96/154 (62.3%)	83/154 (53.9%)	67/154 (43.5%)
Lower second Primary molar	Mesial	67/184 (36.4%)	63/184 (34.2%)	37/184 (20.1%)
	Distal	48/184(26.1%)	39/184(21.2%)	23/184(12.5%)
Lower first Permanent molar	Mesial	13/195 (6.7%)	15/195 (7.7%)	6/195 (3.1%)

DISCUSSION

This study was retrospective, aimed at investigating the bilateral symmetry of caries lesions in primary and first permanent molars among children 5-12 years old who had not received any dental treatment before. Although bilateral symmetry was reported in other studies, our study did not find any evidence of such symmetry. Wyne *et al* found symmetry in caries occurrence in children’s mouths, especially in the mandibular second primary molars. Their research included 789 randomly selected pre-school children.¹⁰ Other studies also found bilateral symmetry in caries lesions in the first mandibular and maxillary permanent molars among 673 children 12-13 years old, and among 734 12-year-old children respectively.¹¹⁻¹² These studies demonstrated high rates of bilateral caries occurrence (50-91.6%), depending on the child’s age and on the tooth involved. It is important to remember that our study was limited by the sample size and diversity, since the data was collected from medical files of the pediatric dental clinic alone. These limitations may explain the differences between our results and those of the above-mentioned studies.

Although bilateral symmetry was found in some studies, the results of Vanobbergen *et al* resemble ours. They demonstrated that the hypothesis of left-right symmetry could not be rejected at the population level, but found that at the individual level, lesions tended to cluster on one side of the mouth.¹³ Another investigation using data on 5-16-year-old children in the UK did not show precise

symmetry between equivalent surfaces on the left and right sides of the mouth, but found that symmetry existed between groups of sites with similar susceptibility to caries.¹⁴ The results of the Wood *et al* study also confirm our finding that bilateral symmetry cannot be relied on between the right and left sides of the mouth in individual patients;¹⁵ they demonstrated that 44% of maxillary and 33% of mandibular pairs of occlusal surfaces of first permanent molars in 12 year old children showed caries experience on only one side of the mouth. The reason for the observed difference in bilateral caries lesions occurrence and size is not completely understood, but it suggests that similar sites may possess differing susceptibilities to caries. The differences may be partially explained by increased resistance of the unaffected tooth or structural defects in the attacked tooth.¹⁵ Jackson *et al* suggested that genetic factors determine which teeth or which sites on teeth are at risk of caries in a given environment.¹⁶

CONCLUSION

According to our findings, a bitewing of one side of the mouth is not sufficient to determine the presence and size of a caries lesion on the same site of the homologous tooth, and the dentist should prescribe radiographs according to the FDA/ADA recommendations.

Funding:

This research received no external funding.

Conflicts of Interest:

The authors declare no conflict of interest

REFERENCES

1. Pitts NB. The use of bitewing radiographs in the management of dental caries: scientific and practical considerations. *Dentomaxillofac Radiol*, 1996;25: 5-16.
2. Kidd EA, Pitts NB. A reappraisal of the value of the bitewing radiograph in the diagnosis of posterior approximal caries. *Br Dent J*, 1990; 169: 195-200.
3. Creanor SL, Russell JI, Strang DM, Stephen KW, Burchell CK. The prevalence of clinically undetected occlusal dentine caries in Scottish adolescents. *Br Dent J*, 1990; 169: 126-9.
4. Kidd EA, Naylor MN, Wilson RF. Prevalence of clinically undetected and untreated molar occlusal dentine caries in adolescents on the Isle of Wight. *Caries Res*, 1992; 26: 397-401.
5. Weerheijm KL, Groen HJ, Bast AJ, Kieft JA, Eijkman MA, van Amerongen WE. Clinically undetected occlusal dentine caries: a radiographic comparison. *Caries Res*, 1992; 26: 305-9.
6. Weerheijm KL, Gruythuysen RJ, van Amerongen WE. Prevalence of hidden caries. *ASDC J Dent Child*, 1992; 59: 408-12.
7. Hintze H, Wenzel A. Clinically undetected dental caries assessed by bitewing screening in children with little caries experience. *Dentomaxillofac Radiol*, 1994; 23: 19-23.
8. American Academy of Pediatric Dentistry (AAPD). Prescribing Dental Radiographs for Infants, Children, Adolescents, and Individuals with Special Health Care Needs. Reference Manual 2018-2019 40/6. <https://www.aapd.org/research/oral-health-policies—ecommendations/prescribing-dental-radiographs-for-infants-children-adolescents-and-individuals-with-special-health-care-needs/> (Accessed May 2021).
9. Mejäre I, Stenlund H, Zelezny-Holmlund C. Caries incidence and lesion progression from adolescence to young adulthood: a prospective 15-year cohort study in Sweden. *Caries Res*, 2004;38: 130-41.
10. Wyne AH, Chohan AN, Jastaniyah N, Al-Khalil R. Bilateral occurrence of dental caries and oral hygiene in preschool children of Riyadh, Saudi Arabia. *Odontostomatol Trop*, 2008; 31: 19-25.
11. Wyne AH. The bilateral occurrence of dental caries among 12-13 and 15-19 year old school children. *J Contemp Dent Pract*, 2004; 5: 42-52.
12. Sadeghi M. Prevalence and bilateral occurrence of first permanent molar caries in 12-year-old students. *J Dent Res Dent Clin Dent Prospects*, 2007; 1: 86-92.
13. Vanobbergen J, Lesaffre E, García-Zattera MJ, Jara A, Martens L, Declerck D. Caries patterns in primary dentition in 3-, 5- and 7-year-old children: spatial correlation and preventive consequences. *Caries Res*, 2007; 41: 16-25.
14. Batchelor PA, Sheiham A. Grouping of tooth surfaces by susceptibility to caries: a study in 5-16 year-old children. *BMC Oral Health*, 2004, 4: 2.
15. Wood PF. Asymmetry of caries attack on the occlusal surfaces of first permanent molar teeth. *Aust Dent J*, 1985; 30: 123-7.
16. Jackson D, Burch PR, Fairpo CG. Right/left asymmetry of caries at mesial and distal surfaces of permanent teeth. *Br Dent J*, 1979; 147: 237-40.