ORIGINAL RESEARCH

Prevalence of most caries-susceptible area on individual primary tooth surface: an observational study

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Abstract

Due to multifactorial aetiology, tooth surfaces of primary dentition are more prone to dental caries and follow the specific pattern of dental caries which is difficult to control. The proper knowledge of caries-susceptible areas on individual primary teeth surfaces guides the clinician to take early preventive measures to stop the progression of dental caries. This study aims to find the prevalence of caries-susceptible areas on primary teeth surfaces in preschool children and the most commonly affected primary teeth. The study design adopted was a cross-sectional study. A total number of 3720 teeth of 186 preschool children were examined for initial pinpoint caries lesions using World Health Organization (WHO) caries detection criteria. 33 caries-susceptible areas were examined on individual primary tooth surfaces of preschool children who visited the Faculty of Dental Sciences. Each tooth surface was recorded separately and no radiographic examination was done. Obtained data was analysed keeping the level of significance at 5%. The overall prevalence of caries-susceptible area was found significantly higher in the maxillary teeth (Maxillary teeth: 41.7% *vs.* Mandible teeth: 30.7%; $p < 0.001$) and anterior teeth (Anterior teeth: 43.7% *vs.* Posterior teeth: 28.4%; $p < 0.001$). The prevalence of caries-susceptible area on primary teeth on the right side when compared to left counterparts was similar (Right side-38.6% and left side-38.4%; $p = 0.931$). Area 2 was the most prevalent area on primary teeth surfaces and primary canine was more prevalent in caries-susceptible areas.

Keywords

Caries-susceptible area; White spot lesion; Caries pattern; Dental caries

1. Introduction

Early childhood caries (ECC) is a major public health problem nowadays due to its high prevalence in preschool children with multifactorial aetiology. The clinically detectable stage of caries is the presence of white spot lesions (WSL) and the prevalence of WSL in primary teeth is around 14% which is increase with age [1]. In primary dentition it was the 10th most prevalent condition affecting 62.1 crore children with dental caries prevalence in 5-year-old children is 51.9% [2]. It is essential to diagnose the initial carious lesion or white spot lesion as soon as possible before the surface of the tooth is cavitated. It is of utmost importance for pediatric dentists to diagnose white spot lesions at the demineralization stage because at this stage of caries lesions can be reversed. Insufficient oral hygiene, poor plaque control and high sugar diet are driving oral micro-organisms like streptococcus mutans to cause early childhood caries in preschool children. Early childhood caries generally affects 48% of almost half of preschool children with different geographical variations [3]. Not all primary teeth and their surfaces are equally susceptible to dental caries. High

susceptibility to initial carious lesion may be due to at-will or nighttime bottle feeding, low socioeconomic status, improper hygiene or high cariogenic food consumption, *etc*. Increased consumption of sugar and reduced fluoride exposure is making primary anterior teeth prone to dental caries [4]. The host factors such as tooth position, tooth morphology and arch form play an important role in the site-specificity pattern of dental caries. The susceptibility of each primary tooth individually to dental caries varies as it follows a specific caries pattern or affects the specific tooth surface [5, 6]. The pattern of caries susceptibility varies on the tooth surfaces also. It is very important to know the prevalence of caries-susceptible area on the individual tooth surface during the progression of the initial carious lesion because it is a strong predictor of the carious lesion in permanent dentition. Most of the prevalence studies in the literature have been done on caries patterns or caries surfaces and the available literature shows a lack of studies assessing the prevalence of caries-susceptible areas on individual tooth surfaces. So, it is paramount to know the prevalence of most caries-susceptible areas or points

on individual primary tooth surfaces among Indian preschool children. Early detection of white spot lesions or initial caries lesions among preschool children can help in the prevention of the progression of ECC. So finding the prevalence of caries-susceptible areas can prevent the development of ECC. Therefore, the present study was designed to find the prevalence of caries-susceptible area on each primary tooth surface among preschool children in the spaced dentition.

2. Materials and methods

This study was followed according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2.1 Study design

This study adopted a cross-sectional study design.

2.2 Study setting and duration

The study was conducted at a dental institute in the Purvanchal region, India for a period of one year starting from February 2022 to January 2023.

2.3 Study population

A total number of 3720 teeth were examined in this study, out of which 106 were male and 80 were female (Table 1). Only the children in the age group of 3 to 5 years old with spaced dentition have been included in this study. Children with non-spaced dentition, suffering from any systemic disease and children with special health care needs were excluded from the study. The present study was done to evaluate the prevalence of caries-susceptible areas on the primary teeth surface of preschool children.

T A B L E 1. Distribution of gender according to age wise.

Age in year	Male (n = 106)	Female (n = 80)	Total (n = 186)
3	33 (64.70%)	18 (35.29%)	51 (27.41%)
4	39 (56.52%)	30 (43.47%)	69 (37.10%)
5	34 (51.51%)	32 (48.48%)	66 (35.49%)

The sample size was calculated using data obtained from the previous study conducted by Srivastava VK *et al.* [5]. The sample size calculated considering the prevalence of dental caries to be 90% as reported in the study. An absolute precision of 1% and a confidence interval of 95% have been kept. A minimum of 3456 teeth were needed as per the sample size calculated.

2.4 Data collection

Only the pinpoint size of the initial caries lesion (White spot lesion) which was already occurred on the primary tooth surface has been taken for examination, and the examination is done by a single trained and calibrated pediatric dentist under optimal daylight using WHO caries detection criteria 1997 [7]. Firstly, the caries was identified and a diagnosis of caries was made only when there is a pinpoint-sized white or brown spot lesion present with an intact or glossy surface and caries having detectable softened floor or undermined enamel. For caries examination on the approximal surface, we have selected only teeth having space in between them. Each tooth surface has been divided into 9 different caries susceptible areas. The recording of 33 caries-susceptible areas was examined on the 3720 individual tooth surfaces of children who visited the faculty of dental sciences (Fig. 1, Table 2). The data were recorded. Each tooth surface was recorded separately and no radiographic examination was done.

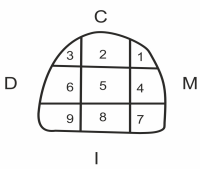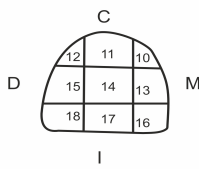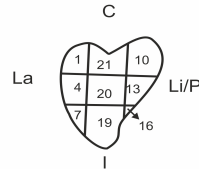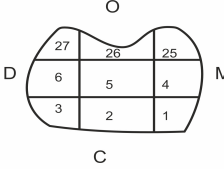### 2.5 Examiner training and calibration
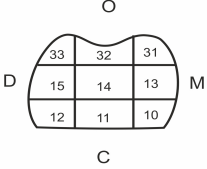
The primary examiner is trained under the supervision of a professor and head of the Department of Pediatric and preventive dentistry. Intra-examiner reliability was assessed using kappa statistics. Examinations were performed on 10 preschool children on two occasions, and the results showed nearly perfect agreement (Kappa = 0.84) [8].

2.6 Statistical analysis

Data was compiled using Microsoft Excel 2019 software (Microsoft, USA) and analyzed using SPSS v26 (IBM Corporation, Chicago, USA). The level of significance was kept at 5%. The prevalence of caries-susceptible areas was presented using frequency and perce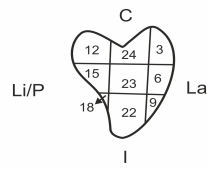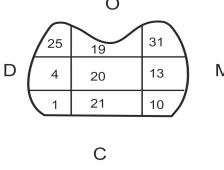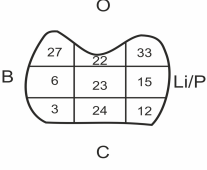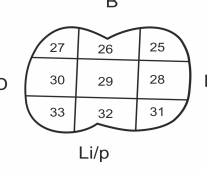ntage. The chi-square test was used to compare the data. Based on the susceptible area of caries coding for recording susceptible areas on primary tooth surfaces was made.

3. Result

A total of number 1453 caries-susceptible areas have been recorded on the primary teeth surface from 3720 teeth. Out of 33 caries-susceptible areas, Area 2 is the most prevalent area on the primary teeth surface followed by area 5, area 1 and the least prevalent is area 9, area 21, area 26 and area 33. The following caries-susceptible area were not have been found in this study, *i.e.*, area 12, area 13, area 14, area 15, area 16, area 17, area 18 and area 19. The most commonly affected teeth were primary maxillary canine of both sides, *i.e.*, (38.08% on the right side) (38.81% on the left side) and an overall prevalence rate is 38.44% and primary mandibular canine is 33.71% and least affected and minimum number of the caries-susceptible area has been found on primary maxillary 2nd molar of both sides. *i.e.*, (n = 3, 0.58% on the right and 0.59% left side) with an overall prevalence rate of 0.58%. The overall prevalence rate of individual teeth in the primary central incisor is 30.35%, the primary lateral incisor is 13.28%, the primary canine is 37.02%, the primary 1st molar is 15.41% and the primary 2nd molar is 3.92% (Table 3).

CODING OF CARIES SUSCEPTIBLE AREA ON PRIMARY TEETH SURFACE

F I G U R E 1. Diagrammatic representation of caries-susceptible area on primary teeth surfaces. La—Labial, Li—Lingual, P—Palatal, O—Occlusal, M—Mesial, D—Distal, I—Incisal, B—Buccal and C—Cervical.

T A B L E 2. Coding of the caries-susceptible area on primary teeth surfaces.

Number	Caries-susceptible area	Number	Caries-susceptible area
Area 1	Labio/bucco-mesio-cervical	Area 18	Linguo-disto-incisal
Area 2	Labio/bucco-mid-cervical	Area 19	Mesio-incisal/occlusal
Area 3	Labio/bucco-disto-cervical	Area 20	Mid-mesial
Area 4	Labio/bucco-mid-mesial	Area 21	Mesio-cervical
Area 5	Labio/bucco-central	Area 22	Disto-incisal/occlusal
Area 6	Labio/bucco-mid-distal	Area 23	Mid-distal
Area 7	Labio/mesio-incisal	Area 24	Disto-cervical
Area 8	Labio-mid-incisal	Area 25	Bucco-mesio-occlusal
Area 9	Labio-disto-incisal	Area 26	Bucco-mid-occlusal
Area 10	Linguo/palato-mesio-cervical	Area 27	Bucco-disto-occlusal
Area 11	Linguo/palato-mid-cervical	Area 28	Mid-mesio-occlusal
Area 12	Linguo/palato-disto-cervical	Area 29	Mid-occlusal
Area 13	Linguo/palato-mid-mesial	Area 30	Mid-disto-occlusal
Area 14	Linguo/palato-central	Area 31	Linguo/palato-mesio-occlusal
Area 15	Linguo/palato-mid-distal	Area 32	Linguo/palato-mid-occlusal
Area 16	Linguo-mesio-incisal	Area 33	Linguo/palato-disto-occlusal
Area 17	Linguo-mid-incisal		

T A B L E 3. Teeth specific prevalence of caries-susceptible area on primary teeth surfaces of preschool children.

	Maxillary Teeth (n = 1017, 69.99%)						Mandibular Teeth (n = 436, 30%)						All teeth (n = 1453, 100%)	
	Right Side (n = 512, 50.34%)		Left Side (n = 505, 49.65%)		Total number (n = 1017)		Right Side (n = 220, 50.45%)		Left Side (n = 216, 49.54%)		Total number (n = 436)		Total number (n = 1017 + 436)	
	Number	Total %	Number	Total %	Number	Total %	Number	Total %	Number	Total %	Number	Total %	Number	Total %
Central incisor	190	37.10%	187	37.09%	377	37.06%	31	14.09%	33	15.27%	64	14.67%	441	30.35%
Lateral incisor	81	15.82%	82	16.23%	163	16.02%	16	7.27%	14	6.48%	30	6.88%	193	13.28%
Canine	195	38.08%	196	38.81%	391	38.44%	71	32.27%	76	35.18%	147	33.71%	538	37.02%
1st Molar	43	8.39%	37	7.32%	80	7.86%	76	32.54%	68	31.48%	144	33.02%	224	15.41%
2nd Molar	3	0.58%	3	0.59%	6	0.58%	26	11.81%	25	11.57%	51	11.69%	57	3.92%

3.1 Prevalence of most caries-susceptible area according to maxillary and mandibular primary teeth (Tables 4 and 5)

The result of the study showed that the prevalence of susceptible areas for caries is more in the maxillary arch (n = 1017, 69.99%) compared to the mandible arch (n = 436, 30%). The most prevalent caries-susceptible area in primary dentition is area 2 on comparing both arches and statistically significant differences have been found ($p < 0.001$). In the maxillary arch, area 2 followed by area 5 is the most prevalent caries-susceptible area while the least prevalent caries-susceptible area is area 9 and area 11. In the mandibular arch, area 2 followed by area 5 is the most prevalent caries-susceptible area, while area 6, area 26 and area 33 are the least prevalent caries-susceptible areas.

T A B L E 4. The most prevalent caries-susceptible area on primary teeth surfaces of preschool children.

Seria no.	Region	Most prevalent caries-susceptible area	p value
1.			
	Maxillary arch	Area 2 (n = 424; 41.7%)	<0.001*
	Mandibular arch	Area 2 (n = 134; 30.7%)	
2.			
	Anterior teeth	Area 2 (n = 510; 43.7%)	<0.001*
	Posterior teeth	Area 28 (n = 81; 28.4%)	
3.			
	Right side of teeth	Area 2 (n = 280, 38.6%)	0.931
	Left side of teeth	Area 2 (n = 278, 38.4%)	
4.			
	Right anterior teeth	Area 2 (n = 254; 43.6%)	0.819
	Left anterior teeth	Area 2 (n = 256; 43.7%)	
5.			
	Right posterior teeth	Area 28 (n = 46; 30.7%)	0.599
	Left posterior teeth	Area 28 (n = 35; 25.7%)	
6.			
	Right anterior teeth	Area 2 (n = 254; 43.6%)	<0.001*
	Right posterior teeth	Area 28 (n = 46; 30.7%)	
7.			
	Left anterior teeth	Area 2 (n = 256; 43.7%)	<0.001*
	Left posterior teeth	Area 28 (n = 35; 25.7%)	

*: indicates a statistically significant difference at $p \leq 0.05$.

3.2 Prevalence of most caries-susceptible area according to anterior and posterior primary teeth (Tables 4 and 5)

The result of the study shows a statistically significant difference between anterior and posterior teeth ($p < 0.001$). Overall area 2 is the most prevalent area on primary teeth surfaces followed by area 5 and area 1. The least prevalent are area 9, area 21, area 26 and area 33. In anterior teeth, area 2 followed by area 5 is the most prevalent caries-susceptible area and area 9 is the least prevalent area. In posterior teeth, areas 28 and 29 are the most prevalent caries-susceptible areas and area 26, area 1 and area 33 are the least prevalent.

3.3 Prevalence of most caries-susceptible areas according to right and left side of primary teeth (Tables 4 and 5)

The result of the study showed that there was no statistically significant difference found between them ($p = 0.931$). Overall area 2 is the most prevalent area on primary teeth surfaces followed by area 5 and area 1. The least prevalent are Area 9, area 21, area 26 and area 33. Onto the right Side of the arch, area 2 and area 5 are the most prevalent caries-susceptible area and the least prevalent caries-susceptible area are area 6, area 21, area 23, area 26 and area 32. Onto the left side of the arch, Area 2 and Area 5 are the most caries-susceptible area and the least caries-susceptible are Area 9, Area 21 and Area 33.

3.4 Prevalence of most caries-susceptible area according to right anterior and left anterior of primary teeth (Tables 4 and 6)

The result of the study showed that there was no statistically significant difference found between them ($p = 0.984$). Overall area 2 and Area 5 are the most prevalent caries-susceptible areas and the least prevalent is area 9 on the right and left side of anterior teeth. Onto the right side of anterior teeth, area 2 and area 5 are the most prevalent caries-susceptible area and the least prevalent is area 6, area 21 and area 23. Onto the left side of anterior teeth, area 2 and area 5 are the most prevalent caries-susceptible area and area 9 and area 21 are the least prevalent caries-susceptible area.

3.5 Prevalence of most caries-susceptible area according to right posterior and left posterior of primary teeth (Tables 4 and 6)

The result of the study showed that there was no statistically significant difference found between them ($p = 0.516$). Overall, area 28 and area 29 are the most prevalent caries-susceptible areas and the least prevalent are area 1, area 4, area 26, and area 33 on the right and left side of posterior teeth. Onto the right side of posterior teeth, area 28 and area 2 are the most prevalent caries-susceptible area and the least prevalent is the area 1, area 26 and area 32. Onto the left side of posterior teeth, area 28 and area 29 are the most prevalent caries-susceptible area and the least prevalent is area 4 and area 33.

T A B L E 5. Prevalence of caries-susceptible area according to maxillary versus mandibular region, anterior versus posterior region and right and left region.

Area	Area name	Maxillary %	Mandibular %	Total %	Anterior %	Posterior %	Total %	Right %	Left %	Total %
Area 1	Labio/bucco-mesio-cervical	11.7%	8.9%	10.9%	13.4%	0.4%	10.9%	11.1%	10.7%	10.9%
Area 2	Labio/bucco-mid-cervical	41.7%	30.7%	38.4%	43.5%	16.8%	38.4%	38.3%	38.6%	38.4%
Area 3	Labio/bucco-disto-cervical	8.9%	6.4%	8.2%	10.2%	0%	8.2%	8.2%	8.2%	8.2%
Area 4	Labio/bucco-mid-mesial	2.8%	0%	1.9%	2.3%	0%	1.9%	1.9%	1.9%	1.9%
Area 5	Labio/bucco-central	24.9%	17.2%	22.6%	27.1%	4.3%	22.6%	22.4%	22.7%	22.6%
Area 6	Labio/bucco-mid-distal	0.3%	0.2%	0.3%	0.3%	0%	0.3%	0.1%	0.4%	0.3%
Area 7	Labio/mesio-incisal	0.8%	1.6%	1.0%	1.3%	0%	1.0%	1.1%	1.0%	1.0%
Area 8	Labio-mid-incisal	0.9%	0.7%	0.8%	1.0%	0%	0.8%	0.8%	0.8%	0.8%
Area 9	Labio-disto-incisal	0.1%	0%	0.1%	0.1%	0%	0.1%	0%	0.1%	0.1%
Area 11	Linguo/palato-mid-cervical	0.1%	0.7%	0.3%	0%	1.4%	0.3%	0%	0.6%	0.3%
Area 20	Mid-mesial	0.3%	0.5%	0.3%	0.4%	0%	0.3%	0.4%	0.3%	0.3%
Area 21	Mesio-cervical	0.2%	0%	0.1%	0.2%	0%	0.1%	0.1%	0.1%	0.1%
Area 23	Mid-distal	0.4%	0%	0.3%	0.3%	0%	0.3%	0.1%	0.4%	0.3%
Area 25	Bucco-mesio-occlusal	2.0%	5.3%	3.0%	0%	15.3%	3.0%	3.1%	2.8%	3.0%
Area 26	Bucco-mid-occlusal	0%	0.2%	0.1%	0%	0.4%	0.1%	0.1%	0%	0.1%
Area 27	Bucco-disto-occlusal	0.4%	0.9%	0.6%	0%	2.8%	0.6%	0.5%	0.6%	0.6%
Area 28	Mid-mesio-occlusal	3%	11.5%	5.6%	0%	28.4%	5.6%	6.3%	4.9%	5.6%
Area 29	Mid-occlusal	0.3%	10.6%	3.4%	0%	17.4%	3.4%	3.1%	3.6%	3.4%
Area 30	Mid-disto-occlusal	1.3%	3.7%	2%	0%	10.3%	2.0%	2.0%	1.9%	2.0%
Area 32	Linguo/palato-mid-occlusal	0%	0.7%	0.2%	0%	1.1%	0.2%	0.1%	0.3%	0.2%
Area 33	Linguo/palato-disto-occlusal	0%	0.2%	0.1%	0%	0.4%	0.1%	0%	0.1%	0.1%

T A B L E 6. Prevalence of caries-susceptible area according to right anterior versus left anterior region, right posterior versus left posterior region, right anterior versus right posterior region and left anterior versus left posterior region.

Area	Areaname	Right anterior %	Left anterior %	Total %	Right posterior %	Left posterior %	Total %	Right anterior %	Right posterior %	Total %	Left anterior %	Left posterior %	Total %
Area 1	Labio/bucco-mesio-cervical	13.7%	13.1%	13.4%	0.7%	0%	0.4%	13.7%	0.7%	11.1%	13.1%	0%	10.7%
Area 2	Labio/bucco-mid-cervical	43.5%	43.5%	43.5%	17.6%	16.5%	17.1%	43.5%	17.6%	38.3%	43.5%	16.5%	38.6%
Area 3	Labio/bucco-disto-cervical	10.3%	10.0%	10.2%	0%	0%	0%	10.3%	0%	8.2%	10.0%	0%	8.2%
Area 4	Labio/bucco-mid-mesial	2.4%	2.2%	2.3%	0%	0.8%	0.4%	2.4%	0%	1.9%	2.2%	0.8%	1.9%
Area 5	Labio/bucco-central	26.7%	27.2%	27.0%	5.4%	3.0%	4.3%	26.7%	5.4%	22.4%	27.2%	3.0%	22.7%
Area 6	Labio/bucco-mid-distal	0.2%	0.5%	0.3%	0%	0%	0%	0.2%	0%	0.1%	0.5%	0%	0.4%
Area 7	Labio/mesio-incisal	1.4%	1.2%	1.3%	0%	0%	0%	1.4%	0%	1.1%	1.2%	0%	1.0%
Area 8	Labio-mid-incisal	1.0%	1.0%	1.0%	0%	0%	0%	1.0%	0%	0.8%	1.0%	0%	0.8%
Area 9	Labio-disto-incisal	0%	0.2%	0.1%	0%	0%	0%	0%	0%	0%	0.2%	0%	0.1%
Area 11	Linguo/palato-mid-cervical	0%	0%	0%	0%	3.0%	1.4%	0%	0%	0%	0%	3.0%	0.6%
Area 20	Mid-mesial	0.5%	0.3%	0.4%	0%	0%	0%	0.5%	0%	0.4%	0.3%	0%	0.3%
Area 21	Mesio-cervical	0.2%	0.2%	0.2%	0%	0%	0%	0.2%	0%	0.1%	0.2%	0%	0.1%
Area 23	Mid-distal	0.2%	0.5%	0.3%	0%	0%	0%	0.2%	0%	0.1%	0.5%	0%	0.4%
Area 25	Bucco-mesio-occlusal	0%	0%	0%	15.5%	15.0%	15.3%	0%	15.5%	3.1%	0%	15.0%	2.8%
Area 26	Bucco-mid-occlusal	0%	0%	0%	0.7%	0%	0.4%	0%	0.7%	0.1%	0%	0%	0%
Area 27	Bucco-disto-occlusal	0%	0%	0%	2.7%	3.0%	2.8%	0%	2.7%	0.5%	0%	3.0%	0.6%
Area 28	Mid-mesio-occlusal	0%	0%	0%	31.1%	26.3%	28.8%	0%	31.1%	6.3%	0%	26.3%	4.9%
Area 29	Mid-occlusal	0%	0%	0%	15.5%	19.5%	17.4%	0%	15.5%	3.1%	0%	19.5%	3.6%
Area 30	Mid-disto-occlusal	0%	0%	0%	10.1%	10.5%	10.3%	0%	10.1%	2.0%	0%	10.5%	1.9%
Area 32	Linguo/palato-mid-occlusal	0%	0%	0%	0.7%	1.5%	1.1%	0%	0.7%	0.1%	0%	1.5%	0.3%
Area 33	Linguo/palato-disto-occlusal	0%	0%	0%	0%	0.8%	0.4%	0%	0%	0%	0%	0.8%	0.1%

3.6 Prevalence of most caries-susceptible area according to the right anterior and right posterior of primary teeth (Tables 4 and 6)

The result of the study showed that there was a statistically significant difference found between them ($p < 0.001$). Overall, area 2 and area 5 are the most prevalent caries-susceptible areas and the least prevalent is area 6, area 21, area 23, area 26 and area 32. Onto the right side of anterior teeth, area 2 and area 5 are the most prevalent caries-susceptible area and the least prevalent is area 6, area 21 and area 23. Onto the right side of posterior teeth, area 28 and area 2 are the most prevalent caries-susceptible area and the least prevalent is the area 1, area 26 and area 32.

3.7 Prevalence of most caries-susceptible area according to left anterior and left posterior of primary teeth (Tables 4 and 6)

The result of the study showed that there was a statistically significant difference found between them ($p < 0.001$). Overall, area 2 and area 5 are the most prevalent caries-susceptible areas and area 9, area 21 and area 33 are the least prevalent caries-susceptible area. Onto the left side of anterior teeth, area 2 and area 5 is the most prevalent caries-susceptible area and area 9 and area 21 are the least prevalent caries-susceptible area. Onto the left side of posterior teeth, area 28 and area 29 are the most prevalent caries-susceptible area and the least prevalent area 4 and area 33.

4. Discussion

The earliest sign which appears for the initial carious lesion is the appearance of a white spot lesion indicating the area of demineralization. This process of demineralisation cycle can be arrested or reversed at the initial caries stage. The overall prevalence of early childhood caries in India is 49.6%. The highest prevalence of ECC is found in Andra Pradesh state at 63% and Sikkim is having lowest prevalence of 41.92% [9]. Most studies in India done to find out the prevalence of ECC after tooth surface have been cavitated by finding the most commonly affected tooth surface. However, there is limited literature available on the prevalence of ECC using caries-susceptible areas or caries initiation points among Indian children particularly. In our study, the prevalence rate of the caries-susceptible area was found to be higher in the maxillary arch (69.99%) than in the mandibular arch (30%). This is due to the early appearance, typical localization, rapid destruction of hard tissue due to less mineral content and in addition to this saliva from minor salivary gland has been limited with less remineralising properties. Similar to a study done by Kashyap *et al*. [10] where the prevalence of white spot lesion is 31.8% in the Gujrat state. Ferro R *et al*. [11], Nomura *et al*. [12], Gudipaneni RK *et al*. [13] and Thakur J *et al*. [14] noted a higher prevalence rate of caries in the maxillary arch of primary dentition similar to our findings. The reason for the least resistance to caries in the mandibular arch is due to the protective mechanism offered by the tongue and adequate salivary flow due to the secretory mechanism of the Sublingual and Submandibular salivary gland duct near mandibular teeth. One recent study shows that children with a white spot or visible caries lesions are categorised into High-risk children [15]. Hence proper knowledge of diagnosing the white spot lesion and the prevalence of white spot lesions should be considered of prime importance. Leong *et al*. [16] also mentioned in their systematic review the importance of diagnosing the caries lesion at the early stage, so that it will reduce the cost of dental treatment in future and it helps in treatment planning as caries in primary dentition is known to be a strong predictor of caries in permanent dentition [17, 18]. At the age of 3 years, all primary teeth are fully erupted and as per WHO 2020 guidelines, 50% of children in the age group of 5 years should be caries-free [19]. Hence age groups of 3 to 5 years have been selected for the study. The established concept of caries-susceptible area for individual tooth surfaces is a prerequisite for pediatric dentists to formulate the treatment plan at the initial stage. Despite advances in preventive strategies, early childhood caries is still more common in developing countries [20, 21]. In our study, there was no gender predilection found in children for caries which is similar to studies done by other authors [22–24] Contrary, to this in the literature prevalence of ECC was found to be more in girls as compared to boys [25, 26]. The difference in ECC prevalence in males and females of other studies may be due to the difference in geographical variation, material and methods, Culture, religion and dietary pattern genetic variation. The negative attitude of parents towards the female child, early eruption of the teeth and prolonged retention of primary teeth in females might be possible causes of the higher prevalence of ECC [10, 27].

The right and left sides of the arches are equally prone to the development of dental caries and exhibit a bilateral phenomenon in this study corresponding to other authors' findings [27]. The reason for this is that the right and left sides of immature primary teeth are erupting at the same time and are exposed to oral environment hence chances of affecting teeth will be equal. It may be because the physical and cognitive development of children is yet to be completed and most of the activities like tooth brushing have to depend upon the parent's support. In other studies, the right side of the arch is more commonly affected than the left side of the arch. The reason for this is that many individuals are right-handed and easy to find brushes on the left side of their teeth and *vice versa* [5].

In the present study, the prevalence rate of the caries-susceptible area is more in the anterior region (80.6%) compared to the posterior region (19.33%) having a statistically significant difference which is similar to the study done by Gudipaneni RK *et al*. [13], Thakur J *et al*. [14] and Singh *et al*. [28]. The reason for the anterior teeth having a higher prevalence rate of caries because more dryness on the anterior teeth surface except for lower anterior teeth which are protected by the cleansing action of the tongue during the process of feeding and proximity to the submandibular gland salivary duct. The opposite result has been found in a study done by Chandan *et al*. [29], Gizani *et al*. [30] and Escobar *et al*. [31] which said that the posterior region is more affected than the anterior region. This is due to the topographical nature of primary molars and this study

focuses only on cavitated surfaces instead of initiation of caries lesion. In our study, Area 2 and Area 28 is the most prevalent caries-susceptible area found on the anterior and posterior teeth respectively indicating the mid-cervical region of the labial or buccal surface were most commonly affected caries-susceptible area. Since the mid surfaces of the tooth are convex and it has direct contact with the cheek and lip therefore oral clearance time of that convex area was less as compared to those surfaces which were not in direct contact with cheek and lip tissue. Among all anterior teeth, the Labial surface (Area 2) of primary teeth was most commonly affected by dental caries. Douglass *et al*. [32] and Psoter *et al*. [33] also reported in their study that the primary maxillary incisor teeth are the most commonly affected teeth. In the present study, among all anterior teeth, the Primary maxillary canine (38.44%) followed by the primary maxillary central incisor (37.06%) are the most affected teeth for the caries-susceptible area. This is due to the presence of labial ridge and cervical ridges which is present on the surface of primary maxillary canine teeth having more contact surface with cheek and lip soft tissue compared to the other teeth that will retain more amount of bacterial biofilm or substrate which require for caries initiation. This morphological variation may help in less oral clearance time of food particles or debris. The opposite findings have been seen in the study done by Nomura *et al*. [12] where the lowest prevalence is seen in primary maxillary canine because this study on done already on cavitated tooth surfaces not on initial carious lesion. Primary mandibular anterior teeth (6.88%) are least susceptible to dental caries in our study, these findings correlated with studies done by Gudipaneni *et al*. [13] and Thakur *et al*. [14]. In our study, the primary mandibular first molar (33.02%) had the most susceptible area for caries among preschool children because the primary mandibular first molar erupt earlier than the primary mandibular second molar. From the literature it is evident that the caries attack follows a specific caries pattern in which the primary maxillary incisor is affected first and lastly primary maxillary second molar similar to ECC. This is explained by the chronic and cumulative nature of dental caries from early childhood [26]. But in the present study, the prevalence of caries-susceptible area does not follow the ECC pattern and the primary maxillary canine was affected first and lastly primary maxillary second molar. This variation may be due to the age-related and other factors discussed above. The reason is due to the longer sugar exposure, improper oral hygiene practices, change in dietary patterns and number of teeth get affected by dental caries [26, 34]. The result of the study showed that early preventive intervention would benefit the population of high-risk children and it will reduce the economic burden of adult caries and improve the social and quality of life of children. The prevalence data will help the government of India in making policies and recommendations on the prevalence of ECC using the most common caries-susceptible area. The Limitation of the study is that author used WHO detection criteria for diagnosing caries instead of more accurate caries diagnostic methods such as International Caries Detection and Assessment System (ICDAS) and Nyvad. No radiographic examination has been done in this study. Therefore, further research should focus

on a variable which might influence caries development such as eating patterns, duration of breastfeeding, and oral hygiene practices.

5. Conclusions

Various caries-susceptible areas have been evaluated and the following conclusion has been advocated. Area 2 and area 5 of primary maxillary canine and area 28 and Area 29 of primary mandibular 1st molar were more susceptible to the initial carious lesion and the maxilla is more commonly affected than a mandibular arch.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study is available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

VKS and SB—conceived the idea of research and designed the research; performed the research. SB, AK, MC, VB and PG—carried out the literature search; contributed to the data collection. SS and SR—contributed to the data checking. MK—carried out the data analysis. SB and MK—prepared the initial draft of the manuscript. All the authors critically reviewed and revised the manuscript and gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical clearance was obtained from the ethical committee of Banaras Hindu University prior to the commencement of study (letter number: Dean/2021/EC/2971). Informed consent was obtained from all the participants and their legal guardian prior to controlling them in the study.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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