OXIS Contact Area Variations In Primary Molars Among Three To Five Year Aged Preschool Children

Dr. Surabhi Kumari[1], Dr. Arun Sharma[2], Dr. Karuna Sharma[3], Dr. Charanjeet Singh[4]

[1]Post Graduate Student, Department of Pediatric and Preventive Dentistry, Rama Dental College Hospital and Research Centre, Kanpur, Uttar Pradesh, India

[2]Professor and Head, Department of Pediatric and Preventive Dentistry, Rama Dental College Hospital and Research Centre, Kanpur, Uttar Pradesh, India

[3]Reader, Department of Pediatric and Preventive Dentistry, Rama Dental College Hospital and Research Centre, Kanpur, Uttar Pradesh, India

[4]Reader, Department of Pediatric and Preventive Dentistry, Rama Dental College Hospital and Research Centre, Kanpur, Uttar Pradesh, India

Corresponding Author: Dr. Surabhi Kumari
Email: drsurabhi4@gmail.com

Abstract

Aim: The purpose of the present study is to determine the contact area variations in primary molars among three to five year aged preschool children.

Materials and Method: The sample for this study consisted of 75 children of age group 3-5 years whose impression were taken casts were poured and die models were made to assess the types of contact areas between primary molars as seen from the occlusal view. The contacts were scored using OXIS classification. Data was statistically analysed.

Results: Among the different types of contacts, the most common contact in maxilla was observed as I (41%), followed by O (29%) ,X (28%) and S (3%). In the mandible, the most common contact type was I (47%), followed by X (29%), O (16%) and S (9%) when the total prevalence of maxillary and mandibular arch was compared there was no statistically significant difference observed.

Conclusion: In the present study four different types of interproximal contact areas were observed as per OXIS classification that is O type of contact, X type of contact, I type of contact and S type of contact in three to five year aged preschool children.

Keywords: Contact Areas, Preschool Children, Primary Molars, OXIS Classification

Introduction

The absence of interdental spaces in the primary dentition may increase the risk of dental caries. The word contact area refers to the joining of proximal tooth surface from the mesial and distal side. The proximal convexity of teeth formed an area of contact connecting opposing teeth within the same arch. An definite located contact is also vital to support the stability and integrity of the dental arches and the health of underlying structures.. The key requirement for the prevention of proximal caries is

well-established contact area that prevents food impaction. This process could be credit to the reduction of the mechanical cleaning activity due to the restricted movement between adjacent teeth, causes to greater plaque aggregation . Studies by Allison and Schwartz[1] and Subramaniam et al.,[2] concluded that the chance for proximal caries in the posterior primary dentition is higher if contact points are closed rather than open . Warren et al.,[3] indicated that the absence of interdental spaces is weakly associated with increased carious experience in the primary dentition. The type of interproximal contact areas of primary molars were first represented in a cross-sectional study (2018), which described four different types of contact areas: open (O); point (X); straight (I); and curved (S)[4]. A current retrospective cross-sectional study [4]was conducted to evaluate the different types of interproximal contact areas of primary molars as viewed from the occlusion. This was executed on 74 contracts from 28 existing cone beam computed tomography (CBCT) images of children aged from 3 to 14- year-olds and explain four different types of contact areas between the primary molars (maxillary and mandibular): types O, X, I, and S, based on the shapes noticed. Figures 1 show the criteria for the types of interproximal primary molar contacts. The OXIS classification for the contact area was based on the patterns observed in the study.[5]

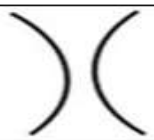
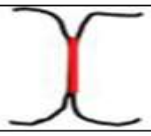
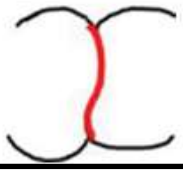
S. No	Diagrammatic representation	Criteria	Type Of Contact
1		When there is no contact between the primary molars	Open contact
2		When there is a point of contact (</=1.5mm) between the primary molars	X-shaped contact
3		When there is a straight contact (>/=1.5mm) between the primary molars	I-shaped contact
4		When there is a curved contact between the primary molars	S-shaped contact

Figure 1: Scoring criteria for the types of interproximal contact of primary molars

There is a definite need to understand the prevalence of the OXIS contacts in a population, because this could be an indicator of potential risk for proximal caries. The contact area were examined to scored in the form of O (open contact), X (point contact), I (straight contact), and S (curved contact) as seen from an occlusal surface . In a Danish study from 2005 on 4–6 year-old children, it was concluded that plaque aggregation, bleeding on probing, and surface-formed contact (broad contact area) between the primary molar teeth were useful medium for a proximal caries in the primary dentition [6]. According to the anatomical structure of the types of contact areas in the recent study, it is logical to suggest that the I- and S-type

contact areas might cause to greater plaque aggregation than the O- and X-types. These unreachable contact areas could lead to more plaque aggregation and difficult in maintaining oral hygiene. This situation could further increase the chance of dental caries for the teeth in contact.[7] There are few studies in the literature that have conducted the prevalence of OXIS contact areas of primary molars. Hence the purpose of this study is to determine the contact area variations in primary molars among three –to five –year aged preschool children.

Materials & Methods

Source of Data

The present study was conducted in the Department of Pediatric and Preventive Dentistry, Rama Dental College Hospital and Research Centre, Kanpur (U.P)

Methods of Collections of Data

The sample for this study consisted of 75 children of age group 3-5 years visiting Rama Dental College Hospital and Research Centre, Kanpur (U.P). The children were selected following an oral examination performed under light using mouth mirror with good reflecting surface and explorer on dental chair. The inclusion and exclusion criteria notified below were considered during this selection procedure.

Inclusion Criteria

- The child should be in good health with no history of major systemic illness or allergies.
- Patient should be of 3 to 5 years of age.
- Child patient with at least one quadrant involving caries free in primary molars as examined intraorally.
- Children having good oral hygiene.

Exclusion Criteria

- Child with special healthcare needs.
- Presence of developmental anomalies in sizes and shape of the teeth.
- Presence of proximal caries in between contact areas of primary teeth.
- Child having severe gag reflex.

Method

- Child patient who fulfilled the inclusion criteria were selected for the study.
- A full depth alginate impression of maxillary and mandibular arches of the each child was made using stainless steel stock impression trays**.**
- The impression were washed under tap water and disinfected using glutaraldehyde.
- The study die models were made.
- The interproximal contact observed is scored in the form of O (open contact), X (point contact), I (straight contact), and S (curved contact) shape), as seen from an occlusal view of the each maxillary and mandibular die models
- The closed/ open nature of the contact was assessed using dental floss in the contact areas. If resistance was felt in a contact area, it was scored according to the shape (Figure 2 & 3). If there was no resistance, the contact area was scored as open.

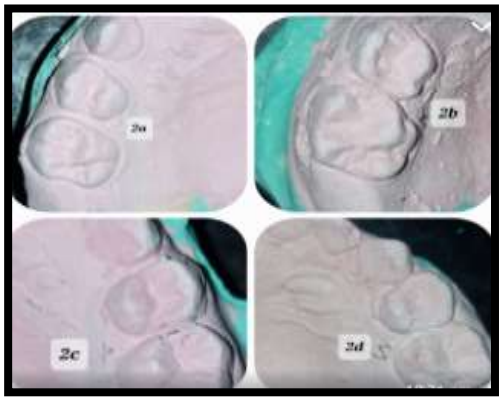


Figure 2: Representative sectional stone model of contact areas of primary molars in the maxilla (a) Depicting "O" or open type of contact (b) Depicting "X" or point type of contact (c) Depicting "I" or straight type of contact (d) Depicting "S" or curved type of contact

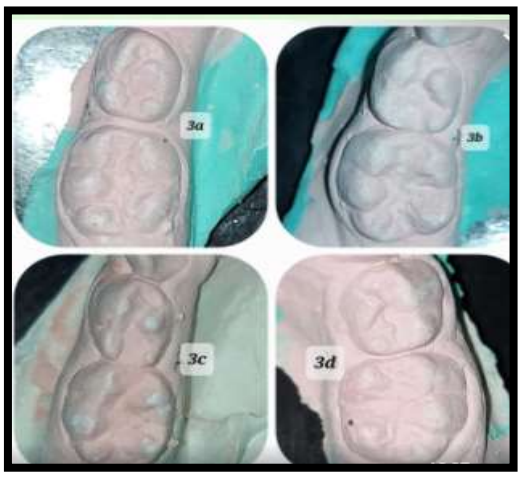


Figure 3: Representative sectional stone model of contact areas of primary molars in the mandible. (a) Depicting "O" or open type of contact. (b) Depicting "X" or point type of contact. (c) Depicting "I" or straight type of contact. (d) Depicting "S" or curved type of contact

Statistical Analysis

The data were double entered and analyzed in STATA 14.2 software. The data of each type of contact namely O, X, I or S were recorded on accustom-made data sheet. The comparison of inter-arch and intra-arch variability was done using chi-square test. A p-value of <0.05 was considered statistically significant.

Results

The present study was conducted to determine the contact area variations in primary molars among three to five year aged preschool children. The final sample consists of 75 subjects whose impression were taken and cast were poured and die models were made. Table 1 shows age distributions of the die models. In the total sample size of 75 die models, 40 were maxillary and 35 were mandible . The mean age of the subjects was 4.3±0.4 yeas, ranging from 3 to 5 years. There was 37% cast sets at age of 3 years, 33% for 4 years and 30% was 5 years. There was no statistically

significant difference observed between age wise. Table 2 shows percentage distributions of type of contact as per age group. In maxillary arch at age of 3 years the prevalence of O , X , I and S type contact was 26%, 33%, 38% & 3% respectively . At age of 4 years the prevalence of O, X , I and S type contact was 31%, 27%, 38% & 4% respectively .At aged group of 5 years the prevalence of O , X , I and S type contact was 33%, 13%, 54% and 0% respectively. In mandibular arch at age of 3 years the prevalence of O , X , I and S type contact was 18%, 28%, 43% & 11% respectively. At age of 4 years the prevalence of O , X , I and S type contact was 17%, 29%, 46% & 8% respectively. At age of 5 years the prevalence of O , X , I and S type contact was 11%, 28%, 56% & 5% respectively. Table 3 shows prevalence in contact in primary molars in maxilla and mandible. In the total sample size of 75 die models, 40 were maxillary and 35 were mandible . In maxillary arch the prevalence of O type of contact was 29% (right side 30% & 28% left side) . The prevalence of the X type of contact was 28% (right side 23% & 33% left side). The prevalence of the I type of contact was 41% (right side 48% & 35% left side) . The prevalence of the S type of contact was 3% (right side 0% & 5% left side). In the mandibular arch the prevalence of O type of contact was 16% (right side 14% & 17% left side). The prevalence of the X type of contact was 29% (right side 34% & 23% left side). The prevalence of the I type of contact was 47% (right side 43% & 51% left side). The prevalence of the S type of contact was 9% (right side 9% & 9% left side). Table 4 shows inter- arch and intra –arch comparison of O, X, I and S types of contacts. In maxilla intra –arch comparison with right side versus left side showed that there was statistically significant difference for O, X and I type of contacts. In mandible intra –arch comparison with right side versus left side was showed that there was a statistically significant difference for O and X type of contact. The inter-arch comparison between the maxilla and mandible was showed that there was no statistically significant difference between right and left side.

Table 1: Age distribution of the die models used

Age (Years)	**Values**
Mean ±SD Range	4.3 ± 0.4 3-5.5
Age Wise	
3 years n (%)	28 (37%)
4 years n (%)	25 (33%)
5 years n (%)	22 (30%)
p-value	0.678

Table 2: Percentage distribution of type of contacts as per age wise

Age wise (Years)	**n (%)**	**Maxilla**					**Mandible**				
		Quadrants	**O n (%)**	**X n (%)**	**I n (%)**	**S n (%)**	**Quadrants**	**O n (%)**	**X n (%)**	**I n (%)**	**S n(%)**
3 years	28 (37%)	39	10 (26%)	13 (33%)	15 (38%)	1 (3%)	28	5 (18%)	8 (28%)	12 (43%)	3 (11%)
4 years	25 (33%)	26	8 (31%)	7 (27%)	10 (38%)	1 (4%)	24	4 (17%)	7 (29%)	11 (46%)	2 (8%)

5 years	22 (30%)	15	5 (33%)	2 (13%)	8 (54%)	0 (0%)	18	2 (11%)	5 (28%)	10 (56%)	1 (5%)
Total	75 (100%)	80	23 (29%)	22 (28%)	33 (41%)	2 (2%)	70	11 (16%)	20 (28%)	33 (47%)	6 (9%)

Table 3: Prevalence of type of contacts in Primary Molars in Maxilla and Mandible

	Right (n=40)	Left (n=40)	Total	Right (n=35)	Left (n=35)	Total	p-value*
O n (%)	12 (30%)	11 (28%)	23 (29%)	5 (14%)	6 (17%)	11 (16%)	0.666
X n (%)	9 (23%)	13 (33%)	22 (28%)	12 (34%)	8 (23%)	20 (29%)	0.297
I n (%)	19 (48%)	14 (35%)	33 (41%)	15 (43%)	18 (51%)	33 (47%)	0.421
S n (%)	0 (0%)	2 (5%)	2 (3%)	3 (9%)	3 (9%)	6 (9%)	0.155

Table 4: Inter-arch and intra-arch comparison of O, X ,I & S types of contacts

	Maxilla (Right vs Left)	Mandible (Right vs Left)	Right Side (Maxilla vs Mandible)	Left Side (Maxilla vs Mandible)
O	<0.001	<0.001	0.602	0.102
X	0.013	0.025	0.283	0.736
I	<0.001	0.140	0.040	0.842
S	-	0.608	-	0.019

Discussion

A well-contoured, properly positioned, firm proximal contact is important to maintain the integrity of the dental arches and the health of the supporting structures[8]. In primary molars contacts were broader, flatter, and situated farther gingivally than the contact points between permanent molars.[9] The types of interproximal contact areas of primary molars were first described in a cross-sectional study (2018), which reported four different types of contact areas: open (O); point (X); straight (I); and curved (S)[4]. Hence, a three dimensional assessment and a classification of interproximal contacts might facilitate a complete understanding of the relationship of adjoining surfaces of teeth at different levels, namely the coronal, middle, and apical third[10]. Based on the morphology of the OXIS contact types, the I and S types may be at more risk for approximal caries than the O and X types. There are very few studies in the literature that have evaluated the prevalence of different interproximal contact areas in of primary molars according to OXIS classification. The present study was undertaken to determine the contact area variations in primary molars among three to five year aged preschool children. In the present study impression were taken cast were poured and die models were made. The OXIS criteria was used to score the contact areas of primary molar from the occlusal view of the die models. Similar method was used to evaluate OXIS contact areas in primary molars using a die model in the study conducted by Walia T,et al.,(2021)[11] and Muthu M Set al., (2020)[6.] However in a study conducted by Kirthiga M et al ., (2018)[5] they evaluated different type of intact interproximal contact areas in primary molars using CBCT.

In the present study we preferred using die models to evaluate the contact area variations in primary molars instead of CBCT scans as CBCT is not recommended for study of contact areas in children, as radiation exposure in children and young people is assisted with greater risk of stochastic effect. The most frequent uses of CBCT in children are for temporomandibular joint (TMJ) investigation, localization of unerupted teeth , the identification of resorption in relation to unerupted teeth and disorders in tooth eruption[5].

Age Wise Distribution of Children

In the present study 300 contacts were obtained from 75 children in which 40 were maxillary and 35 were mandibluar die models. The mean age of children was 4.3± 0.4 years, ranging from 3 to 5 years. There were 37% children at age of 3 years, 33% children at age of 4 years and 30% children at age of 5 years. In the study by Walia T,et al.,(2021)[11], they observed that in centre 1,200 contacts were obtained from 78 children with a mean age of 4.44 years and in centre 2, 200 contacts were obtained from 50 children with a mean age of 3.5 years.

Prevalence Distribution of Type Of Contacts As Per Age Group

In present study we observed that the prevalence distribution of type of contact as per age wise in the maxillary arch at age of 3 years the prevalence of I , X, O & S type contact was 38%, 33%, 26% and 3% . So in the present study we observed that the most common contact in the maxillary arch was I type followed by X, O type and the least common was S type contact area. The result of the present study is in accordance to the study conducted by Walia T et al.,(2021)[11].They also observed that the prevalence distribution of type of contact as per age wise maxillary arch at age of 3 years in centre 1, the prevalence of I , X, O & S type contact was 57.8%, 22.8%, 15.2% and 4.3%. In present study we observed that the percentage distribution of type of contact as per age group in the maxillary arch at age of 4 years the prevalence of I , X, O & S type contact was 38%, 31%, 27% and 4%. So in the present study we observed that the most common contact in the maxillary arch was I type followed by O, X type and the least common was S type contact area. However in the study conducted by Walia T et al., (2021) [11] they also observed that the percentage distribution of type of contact as per age wise maxillary arch at age of 4 years the prevalence of I, X, O & S type contact was 52.7%, 21.1%, 20% and 6.3%. In present study we observed that the percentage distribution of type of contact as per age wise in the maxillary arch at age of 5 years the prevalence of I, X, O & S type contact was 54%, 33%, 13% and 0%. So in the present study we observed that the most common contact in the maxillary arch was I type followed by O, X type and the least common was S type contact area. However in the study conducted by Walia T et al., (2021)[11] they observed that the percentage distribution of type of contact as per age wise maxillary arch at age of 5years and above the prevalence of O , X, I & S type contact was 38.5%, 30.8%, 23.1% and 7.7%. In present study we observed that the percentage distribution of type of contact as per age wise in mandibular arch at age of 3 years the prevalence of I , X, O & Stype contact was 43%, 28%, 18% and 11%. So in the present study we observed that the most common contact in the mandibular arch was I type followed by X, O type and the least common was S type contact area. However in the study conducted by Walia T et al.,(2021)[11].They also observed that the percentage distribution of type of contact as per age wise in mandibular arch at

age of 3 years the prevalence of I , S , O ,& X type contact was 75.5%, 17%, 6% and 1.5%. In present study we observed that the percentage distribution of type of contact as per age wise in mandibular arch at age of 4 years the prevalence of I , X, O, & S type contact was 46%, 29%, 17% and contact was 8%. So in the present study we observed that the most common contact in the mandibular arch was I type followed by X, O type and the least common was S type contact area. In the present study we observed that the prevalence distribution of type of contact as per age wise in mandibular arch at age of 5 years and above the prevalence of I , X , O & S type contact was 56%, 28%, 11% and 5%. So in the present study we observed that the most common contact in the mandibular arch was I type followed by X, O type and the least common was S type contact area. In present study we observed that when the age group were compared with type of contacts, the most common was I across all age groups followed by X. The result of the present study is in accordance to the study conducted by Walia T et al.,(2021)[11] , they also observed that when the age group were compared with type of contacts per age –group the most common was I across all age groups followed by X.

Prevalence of Type Of Contact In Primary Molars In Maxilla And Mandible Die Models

In the present study we observed that the prevalence of type of contacts in primary molar in maxillary die model the most common was I (41%), followed by O (29%), X (28%) and the least common was S type of contact was (3%). The result of the present study is in similar lines with the study conducted by Kirthiga M et al., (2018) [5] who also observed that the prevalence of type of contacts in primary molar in maxillary die model the most common was I (67.4%), followed by O (13.9 %), X (13.9%) and the least common was S type of contact was (4.6%). However in the study conducted by Walia T et al.,(2021) [11] they observed that the prevalence of type of contacts in primary molars in maxillary die model in centre 1,the most common was I (53%), followed by X (22.5%), O (19%) and the least common was S type of contact was (5.5%) and in centre 2 the prevalence of type of contacts of primary molar I (75.5%), followed by S (17%), O (6%) and the least common was X type of contact was (1.5%). However in the study conducted by Muthu M S et al .,(2020)[6] they observed that the prevalence of type of contacts in primary molar in maxillary die model the most common was I (68.9%),followed by S (19.1%), O (8.6%) and the least common was X type of contact was (3.6%). In the present study we observed that in maxillary arch that the prevalence of type of contact of O type of contact was 29% in which 30% was on right side and 28% was on the left side. In the study conducted by Walia T et al.,(2021)[11] , they observed that in maxillary arch the prevalence of O type of contact was 38% in which 6.5% in right side and 5% was on the left side in centre 1and in centre 2 in maxillary arch the prevalence of O type of contact was 6% in which 2% in right side and 1.5% on the left side. However in the study conducted by Kirthiga M et al., (2018) [5] they also observed that in maxillary arch the prevalence of O type of contact was 13.9% in which 3% was on the right side and 3% was on the left side. In the present study we observed that in maxillary arch the prevalence of the X type of contact was 28% in which 23% was on the right side and 33% was on the left side. In the study conducted by Walia Tet al.,(2021)[11] , they observed that in maxillary arch the prevalence of X type of contact was 22.5% in which 5.5% was on the right side and 7.5% was on the left side in centre 1 and however in centre 2 in maxillary arch the prevalence of X type

of contact was 1.5% in which 0.5% was on the right side and 0% on the left side. In the study conducted by Kirthiga M et al., (2018)[5] they observed that in maxillary arch the prevalence of X type of contact was 13.9% in which 1% was on the right side and 5% was on the left side. In the present study we observed that in maxillary arch the prevalence of the I type of contact was 41% in which 48% was on the right side and 35% was on the left side. In the study conducted by Walia Tet al.,(2021)[11] , they observed that in maxillary arch the prevalence of I type of contact was 53% in which 10% was on the right side and 7.5% was on the left side in centre 1 and however in centre 2 in maxillary arch the prevalence of I type of contact was 75.5% in which 18.5% was on the right side and 18.5% on the left side. In the study conducted by Kirthiga M et al., (2018)[5] they observed that in maxillary arch in which the prevalence of I type of contact was 67.4% in which 15% was on the right side and 14% was on the left side. In the present study we observed that in maxillary arch the prevalence of the S type of contact was 3% in which 0% was on the right side and 5% was on the left side. However in the study conducted by Walia Tet al.,(2021)[11] , they observed that in maxillary arch in which the prevalence of S type of contact was 5.5% in which 2% was on the right side and 0.5% was on the left side in centre 1and in centre 2 in maxillary arch the prevalence of S type of contact was 17% in which 4% was on the right side and 5% on the left side. Kirthiga M et al .,(2018)[5] in their study they observed that in maxillary arch in which the prevalence of S type of contact was 4.6% in which 2% was on the right side and 0% was on the left side. In the present study we observed that the prevalence of type of contacts in primary molar in mandibular die model the most common was I (47%), followed by X (29%), O (16%) and the least common was S type of contact was 9%. The result of the present study is in similar lines with the study conducted by Kirthiga M et al .,(2018)[5] who also observed that the prevalence of type of contacts in primary molar in mandibular die model the most common was I 64.5%,followed by X 32.2 %, O 3% and the least common was S type of contact was 0%. The result of the present study was in accordance to the study conducted by Walia T et al.,(2021)[11] , they also observed that the prevalence of type of contacts in primary molars in mandibular die model in centre 1,the most common was I (53%), followed by X (22.5%), O (19%) and the least common was S type of contact was 5.5 % and however they observed that in centre 2 the prevalence of type of contacts of primary molar I (75.5%),followed by S (17%), O (6%) and the least common was X type of contact was 1.5%. The study conducted by Muthu M S et al., (2020)[6] in there study they observed that the prevalence of type of contacts in primary molar in mandibular die model the most common was I (75.5%),followed by S (15.3%), O (5.8%) and the least common was X type of contact was 3.3%. In the present study we observed that in the mandibular arch the prevalence of I type of contact was 47% in which 43% was on right side and 51% was on the left side. However in the study conducted by Walia Tet al.,(2021)[11] , they observed that in mandible arch the prevalence of I type of contact was 53% in which 17.5% was on the right side and 18% was on the left side in centre 1and in centre 2 in mandibular arch the prevalence of I type of contact was 75.5% in which 19.5% was on the right side and 19% on the left side. However in the study conducted by Kirthiga M et al ., (2018) [5] they observed that in mandibular arch in which the prevalence of I type of contact was 67.4% in which 15% was on the right side and 14% was on the left side. In the present study we observed that in the mandibular arch the prevalence of O type of contact was 16% in which 14% was on

right side and 17% was on the left side. However in the study conducted by Walia Tet al.,(2021)[11], they observed that in mandbular arch the prevalence of O type of contact was 19% in which 4% was on the right side and 3.5% was on the left side in centre 1and in centre 2 in mandibular arch the prevalence of O type of contact was 6% in which 1.5% was on the right side and 1% on the left side. The study conducted by Kirthiga M et al.,(2018) [5] they observed that in mandibular arch in which the prevalence of O type of contact was 3% in which 1% was on the right side and 0% was on the left side. In the present study we observed that in mandibular arch the prevalence of the X type of contact was 29% in which 34% on the right side and 23% on the left side. However in the study conducted by Walia Tet al.,(2021) [11] they observed that in mandibular arch the prevalence of X type of contact was 22.5% in which 5% was on the right side and 4.5% was on the left side in centre 1 and in centre 2 in mandibular arch the prevalence of X type of contact was 1.5% in which 0% was on right side and 1% on the left side. Kirthiga M et al., (2018) [5] in their study observed that in mandibular arch the prevalence of X type of contact was 32.2% in which 2% was on the right side and 8% was on the left side. In the present study we observed that in mandibular arch the prevalence of the S type of contact was 9% in which 9% was on the right side and 9% was on the left side. However in the study conducted by Walia Tet al.,(2021) [11], they observed that in mandibular arch the prevalence of S type of contact was 5.5% in which 0.5% was on the right side and 2.5% was on the left side in centre 1and in centre 2 in mandibular arch the prevalence of I type of contact was 17% in which 4% was on the right side and 4% on the left side. Kirthiga M et al., (2018)[5] in their study observed that in mandibular arch the prevalence of S type of contact was 0% in which 0% was on the right side and 0% was on the left side.

Inter-Arch and Intra-Arch Comparison of Primary Molars

In the present study we observed that the intra –arch comparison with right side versus left side showed that there was statistically significant difference for O, X and I type of contacts in maxilla and in mandible we observed that the intra –arch comparison with right side versus left side was showed that there was a statistically significant difference for O and X type of contact and in the inter-arch comparison between the maxilla and mandible was showed that there was no statistically significant difference between right and left side. However in the study conducted by Muthu M S et al.,(2020)[6] they observed that the intra –arch comparison with right side versus left side showed no statistically significant difference in maxilla and mandible but in inter-arch comparison between the maxilla and mandible was showed that there was statistically significant difference regarding O, I and S types of contact on the right and left side. Further studies should be undertaken which focuses on the prevalence of contact areas in primary molar using OXIS contact classification in different population.

Conclusion

Among the different types of contacts, the most common contact in maxilla was observed as I (41%), followed by O (29%) , X (28%) and S (3%). In the mandible, the most common contact type was I (47%), followed by X (29%), O (16%) and S (9%). when the total prevalence of maxillary and mandibular arch was compared there was no statistically significant difference observed. Further studies should be

undertaken which focuses on the prevalence of contact areas in primary molar using OXIS contact classification in different population.

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