

Association between Chewing Side Preference and Dental Caries among Deciduous, Mixed and Permanent Dentition

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ABSTRACT

Introduction: Chewing Side Preference (CSP) is said to occur when mastication is recognized exclusively/consistently or predominantly on the same side of the jaw. It can be assessed by using the direct method - visual observation and indirect methods by electric programs, such as cinematography, kinetography and computerized electromyography.

Aim: The present study was aimed at evaluating the prevalence of CSP in deciduous, mixed and permanent dentitions and relating its association with dental caries.

Materials and Methods: In a cross-sectional observational study, 240 school going children aged 3 to 18 years were randomly allocated to three experimental groups according to the deciduous dentition, mixed dentition and permanent dentition period. The existence of a CSP was determined using

a direct method by asking the children to chew on a piece of gum (trident sugarless). The Mann Whitney U-test was used to compare the CSP and also among the boys and girls. The Spearman's Correlation Coefficient was used to correlate CSP and dental caries among the three study groups and also among the groups.

Results: CSP was observed in 69%, 83% and 76% of children with primary, mixed and permanent dentition respectively ($p > 0.05$). There was no statistically significant association between the presence of CSP and dental caries among the three study groups.

Conclusion: There was a weak or no correlation between gender and distribution of CSP and between presence of CSP and dental caries.

Keywords: Chewing pattern, Mastication, Preventive orthodontics, Unilateral chewing

INTRODUCTION

Nutrition is an integral component of oral health and has a synergistic relationship with it [1]. Nutrition plays a significant role in the development, maintaining integrity of the oral cavity and the progression of oral diseases. The diet and nutrition are considered important environmental factors in the etio-pathogenesis of craniofacial diseases [2].

Diet plays a vital role on the integrity of the teeth, pH, saliva and composition of plaque. Nutrition has a systemic effect on the integrity of the oral cavity, including teeth, periodontium and oral mucosa [3]. A balanced diet is one which contains essential nutrients from each food group in recommended servings presented for the optimal functioning of the human. The masticatory system which consists of the teeth, their supporting structures, jaws and Temporomandibular Joints (TMJs) and the masticatory muscles which function together as a unit directly or indirectly in the process of mastication.

The mastication or chewing is performed bilaterally on both sides simultaneously. When the number of the masticatory cycles on one side is about 30% higher than those performed on the opposite side, this pattern is known as unilateral chewing pattern. This unilateral chewing pattern can be further classified as consistent unilateral chewing (all masticatory cycles on same side) and predominant unilateral chewing (more than 70% masticatory cycles on same side) [4,5].

Chewing Side Preference (CSP) is present when mastication is consistently or predominantly performed on the same side [6,7]. Assessment of CSP can be made by direct method in the form of visual observation [6,8] and indirectly by electronic programs

such as cinematography, kinetography and computerized electromyography [9-13]. The direct method involves the visual observation of the side that the bolus is positioned. This is a simple, practical and a fast test without any misinterpretation which is more accurate than the indirect methods [13,14].

Bilateral CSP plays a significant role in the craniofacial growth and development, stimulates the eruption of the teeth and increases the dental arch dimensions [15].

The study was planned to evaluate the prevalence of chewing side preference in deciduous, mixed and permanent dentitions and the association between dental caries and chewing side preference in primary, mixed and permanent dentitions.

MATERIALS AND METHODS

A cross-sectional observational study was conducted among the children of Achrol district, rural Jaipur, Rajasthan, India, over a period of two months. The ethical clearance for the study was obtained from the Institutional Ethical Committee of NIMS University, Jaipur, Rajasthan, India. Prior written informed consent was obtained from parents of children participating in the study. A total of 240 children were randomly selected based on the inclusion criteria: children of either gender having good general health, not undergoing any orthodontic or orthopaedic treatment and without any neurological disorder. Sample size was determined based on previous studies [16,17] with a confidence interval of 95% and 80% power of study. The participants were divided into three groups of 80 children each.

Group I: Children aged 3-5 years presenting with deciduous dentition.

Group II: Children aged 6-12years presenting with mixed dentition.

Group III: Children aged 13-18years presenting with permanent dentition.

The caries score (DMFS/defs), of the participants was recorded by a single calibrated examiner (kappa coefficient = 0.91) with the help of a trained assistant using modified DMFT index. The CSP was recorded by another calibrated examiner (kappa coefficient = 0.90). The existence of CSP was recorded using visual method as described by Mc Donnell ST et al., in 2004 [6]. The children were asked to chew on a piece of sugar less chewing gum (Orbit) using posterior teeth. After a brief span of 15 seconds, the children were asked to stop chewing and smile in order to observe the side that chewing gum was positioned (either right or left). This procedure was repeated after intervals of 5 seconds each for seven times.

The CSP of the children were classified according to the following criteria [16]:

1. Consistent chewing side preference-Right (CCSP-R) : 7/7 strokes on the right side.
2. Consistent chewing side preference-Left (CCSP-L) : 7/7 strokes on the left side.
3. Predominant chewing side preference-Right (PCSP-R) : 5/7 or 6/7 strokes on the right side.
4. Predominant chewing side preference-Left (PCSP-L) : 5/7 or 6/7 strokes on the left side.

STATISTICAL ANALYSIS

The data obtained was tabulated and subjected to statistical analysis to facilitate comparison. Descriptive statistic was used to observe the prevalence of CSP. The Mann Whitney U-test was used to compare the CSP and also among the boys and girls. The Spearman's Correlation Coefficient was used to correlate CSP and dental caries among the three study groups and also among the group.

RESULTS

The CSP was observed in 69%, 83% and 76% of children with primary, mixed and permanent dentition respectively. There was no statistically significant (p>0.05) association between Observed Preferred Chewing Side [OPCS] on the right and the left side. There was no significant difference in the distribution of CSP (right or left side) between boys and girls in each of the age groups. [Table/ Fig-1] describes the distribution of gender, age and presence of CSP among primary, mixed and permanent dentition.

[Table/Fig-2] describes the distribution of the CSP among each group.

		Primary Dentition N=80	Mixed Dentition N=80	Permanent Dentition N=80
Gender	Boys	44 (55%)	41 (51.2%)	42 (52.5%)
	Girls	36 (45%)	39 (48.8%)	38 (47.5%)
Age (years)		4.18 ± 0.792	9.03 ± 1.835	15.00 ± 1.583
CSP present		55 (68.7%)	66 (82.5%)	61 (76.2%)
CSP absent (NP)		25 (31.2%)	14 (17.5%)	19(23.7%)

[Table/Fig-1]: Descriptive statistics of the three groups.
*Statistical significance was considered at (p<0.05)

Groups	N	CCSP-R	CCSP-L	PCSP-R	PCSP-L	OPCS-R	OPCS-L	NP
I	80	15	20	8	12	23	32	25
II	80	18	19	16	13	34	32	14
III	80	21	17	12	11	33	28	19

[Table/Fig-2]: Distribution of CSP among the groups.
*Statistical significance was considered at (p<0.05)

Study Groups	OPCS-R	OPCS-L	Mann Whitney U Test	p-value
Primary Dentition	23	32	2480.00	0.135
Mixed Dentition	34	32	3160.00	0.874
Permanent Dentition	33	28	4000.00	0.417

[Table/Fig-3]: Comparison between the CSP among the three study groups.
*Mann Whitney U test
*Statistical significance was considered at (p<0.05)

Study Groups		Boys	Girls	Mann Whitney U Test	p-value
Primary Dentition	OPCS-R	11	12	726.000	0.416
	OPCS-L	17	15	768.000	0.784
Mixed Dentition	OPCS-R	14	20	662.500	0.124
	OPCS-L	17	18	762.000	0.674
Permanent Dentition	OPCS-R	21	12	651.000	0.097
	OPCS-L	15	13	786.000	0.889

[Table/Fig-4]: CSP in boys and girls among the three study groups.
*Mann Whitney U test
*Statistical significance was considered at (p<0.05)

Study Groups	OPCS	Dental Caries Score	Spearman's Correlation Coefficient	p-value	
Primary Dentition	Right	23	0.48 ± 0.779	-0.128	0.257
	Left	32	0.40 ± 0.789	0.100	0.376
Mixed Dentition	Right	34	0.86 ± 1.003	0.044	0.696
	Left	32	0.84 ± 0.961	0.101	0.371
Permanent Dentition	Right	33	0.54 ± 0.826	-0.080	0.478
	Left	28	0.39 ± 0.720	0.090	0.426

[Table/Fig-5]: Correlation of CSP and dental caries among the three study groups.
*Spearman's Correlation Coefficient test
*Statistical significance was considered at (p<0.05)

Groups	CSP Score	Dental Caries Score	Spearman's Correlation Coefficient	p-value	
Group I	CCSP-R	15	0.48 ± 0.779	-0.189	0.092
	CCSP-L	20	0.40 ± 0.789	0.027	0.813
	PCSP-R	8	0.48 ± 0.779	0.049	0.666
	PCSP-L	12	0.40 ± 0.789	0.197	0.079
Group II	CCSP-R	18	0.86 ± 1.003	0.190	0.092
	CCSP-L	19	0.84 ± 0.961	0.122	0.280
	PCSP-R	16	0.86 ± 1.003	-0.141	0.212
	PCSP-L	13	0.84 ± 0.961	0.054	0.632
Group III	CCSP-R	21	0.54 ± 0.826	0.161	0.155
	CCSP-L	17	0.39 ± 0.720	-0.018	0.877
	PCSP-R	12	0.54 ± 0.826	-0.308	0.005
	PCSP-L	11	0.39 ± 0.720	-0.103	0.364

[Table/Fig-6]: Correlation of dental caries and CSP among the groups.
*Spearman's Correlation Coefficient test
*Statistical significance was considered at (p<0.05)

The CSP among each group was evaluated and compared in [Table/Fig-3]. There was no significant association observed in the CSP among each dentition.

[Table/Fig-4] describes the gender-wise CSP among the three study groups. There was no significant association of CSP and the gender in all three dentitions. [Table/Fig-5,6] shows correlation of CSP and dental caries among the three study groups. There was no statistically significant association between the presence of CSP and dental caries among the three study groups.

DISCUSSION

Chewing preference is usually inherent, centrally controlled, but can affect social and personal learning experiences [18,19]. Hoogmartens MJ et al., stated that chewing preference could

be determined from the peripheral reflex system, which is often proposed to explain other lateral preferences [18].

It has been clearly established that people do not exhibit the same mandibular movements when they chew. Some people need additional chewing cycles to treat the same bolus of food compared to others. Also, the amplitude and period of muscular contraction varies from person to person. However, some reproducibility exists for each human being. The chewing pattern depends on the patient's oral rehabilitation status. Usually the number of prosthetic tooth replacements increase with age; hence, greater number of cycles are necessary to chew. Moreover, older people need greater number of cycles to chew harder food stuffs owing to reduced perception [20].

The prevalence of CSP in deciduous and mixed dentition in the present study was similar to the findings of Mc Donnell et al., i.e. 92% of CSP in children with mixed dentition [6]. The prevalence of CSP in permanent dentition in our study is similar to the findings of Christensen et al., (68%), Pond LH et al., (77%) and Nissan J et al., (97.9%) [7,8,19]. Certain studies have reported a higher prevalence of CSP to the right side in permanent dentition [9,10,20]. The results of the present study are consistent with the findings of above studies.

It has been reported that a higher prevalence of CSP is observed in deciduous and mixed dentition compared to permanent dentition because children have difficulties in lateralizing food smoothly and efficiently [21]. According to Mc Donnell ST et al., children find it difficult to move the bolus from one side of the mouth to the other [6]. In the present study, the children during mixed dentition period exhibited more CSP followed by permanent dentition and primary dentition. In deciduous as well as mixed dentition, the structures of the stomatognathic system are in a constant process of alteration and adaptation. Chewing adapts the changes that occur in the oral cavity, which may result in increased occurrence of CSP.

Our study found no significant association between the gender and their chewing side preference. McDonnell et al., Nissan Jet al., and Hoogmartens MJ et al., also observed no significant association between gender and CSP [6,19,22]. Diernberger et al., reported that a significantly higher proportion of CSP was observed in females compared to male adults [23].

In another study, it was found that right sidedness was preferred when chewing hard food (73.68%) and for soft food (57.89%). However, this association was not found with hand/other-sidedness [24]. Another study tested for sidedness, found its reproducibility in 90% of subjects only with almonds (a medium hardness food) as opposed to jerky or asparagus. This study concluded that CSP was not a fixed characteristic and it is the texture that seems to affect sidedness [25].

The unilateral chewing pattern cannot be an acceptable standard in children, because chewing plays a significant role in craniofacial development, periodontal tissue stability, occlusion harmony, orofacial muscle development, stimulus in the eruption of teeth and increase in dental arch dimensions [26,27]. The children and their respective parents were made aware of the unilateral chewing pattern and its effects. Parents were advised to use reward therapy in order to encourage the child to break the habit.

LIMITATION

However, as the sample size in the present study was small, further studies are needed with a larger sample size and also the previously reported studies were designed differently, making comparisons difficult.

CONCLUSION

The early diagnosis of the CSP in a child which is either an exclusively or consistently preferred CSP may prevent the unilateral

chewing pattern from triggering various consequences in the stomatognathic system in adulthood. CSP was observed in 69%, 83% and 76% of children with primary, mixed and permanent dentition respectively. There was a weak or no correlation between gender and distribution of CSP; and between presence of CSP and dental caries. The studies reported were mostly designed very differently, making good comparisons difficult. Although, further studies are needed to clarify the clinical relevance of these findings, it will not be wrong in saying that our masticatory adaptation process deals with the special characteristics of the food we chew. CSP can lead to several deleterious consequences and hence, eliminating it early by removing the etiological factors thereby, leading to the development of an ideal occlusion.

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