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Effectiveness Of Resin Based Sealant Application On Pits, Fissures and Bracket/Band Tooth Interface in Molars of Pediatric Patients Undergoing Fixed Orthodontic Therapy

Isha Jatana Midha[1], Shalini Garg[2] , Abhishek Dhindsa[3], Neetu Jain[4], Shireen Opal[5] and Anil Gupta[6]
[1]Pediatric and Preventive Dentistry, Dental Surgeon at Central Polyclinic, United Arab Emirates.E mail* shaloosandeep@gmail.com
[2]Department of Pediatric and Preventive Dentistry, Faculty of Dental Sciences, SGT University, Gurugram,Haryana
[3], Department of Pediatric and Preventive Dentistry, Swami Devi Dayal Dental College, Barwala, Haryana
[4]Department of Pediatric and Preventive Dentistry University, Mullana,Ambala, Haryana
[5]Pediatric and Preventive Dentistry, Content Head at Remedo Healthcare. India
[6]Department of Pediatric and Preventive Dentistry, SGT University, Gurugram, Haryana, India.

ABSTRACT
To evaluate effectiveness of sealant application as coating on pit, fissures and tooth-band interface margin on gingival health, microbial count and occurrence of caries in molars banded for fixed orthodontic therapy in pediatric patients. A prospective split mouth design study in subjects of 8-16 years. 44 molars scheduled for banding in 22 subjects undergoing bilateral fixed orthodontic therapy were taken as a unit of study and randomly divided via split mouth design into 2 groups. Plaque index, DMFT/def and salivary mutans Streptococci count were recorded and assessed before commencement of fixed orthodontic treatment/ baseline data, after standardized orthodontic banding procedure and at 1month, 6 and 12 months. Significantly less mean individual tooth plaque score in study teeth as compared to control teeth after 1 month of therapy (p=0.021) and highly significantly less in study teeth at last visit (p=0.004). Intra group comparison of control tooth showed significantly high rise in MS count after 6 months of therapy (p=0.011) while highly significant decrease in Study tooth Plaque MS count from baseline to 6 months (p=0.000). A very highly significant difference in ICDAS II scores and smooth surface/occlusal caries occurrence more in control tooth versus study tooth at last visit(p= 0.000) . Smooth surface and occlusal caries of the control tooth were significantly correlated with the control tooth MS count. (p=0.002) Application of hydrophobic sealant along with cementation of bands in young permanent first molars may prove to be significantly effective and non-compliant preventive adjunctive method of caries prevention, especially in pediatric patients.
Keywords: *Banded molars, caries incidence,* extended sealant*, permanent molars, mutans streptococci*

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INTRODUCTION

Fixed orthodontic appliances are an example of external interferences which can disturb the delicate balance of oral microflora[1]. They increase caries risk Increase in caries risk due to hinderance in self-cleansing pathways of a banded tooth, decrease in PH, increased in dental plaque deposition, and change in tooth biofilm towards cariogenic bacteria [2-5]. Banding in molars is a standardized procedure which creates an unwanted space for bacterial growth due to loss of natural spillways, anatomical form, and self-cleansing tooth contours. These appliances also make routine oral hygiene practices challenging leading to a continuous cycle of increased microbial population deposition [6-7].Mutans streptococci (MS) are known to be associated with initiation and progress of dental caries. They adhere to tooth surface, produce lactic acid through from dietary sucrose. Development of white spot lesions of enamel is a frequent problem in faced by clinicians. It may be up to 50-70%[8]of total teeth banded/bonded and early lesions can appear within month of application along with plaque deposition. New rough surfaces presented by the appliance provide opportunities for bacterial colonization by increasing the potential surface area, which creates suitable niches for bacterial colonization and preventing the dislodgement of new microbial colonies. The purpose of sealing grooves and occlusal crevices is to reduce the bacterialload by smoothing highly anfractuous occlusal shapes that favour food and bacteria retention. Extending the sealant application to fill the band-tooth interface would be a rational and easily attainable preventive treatment modality. Hence, the main site of action of pit and fissure sealant lies at the tooth restoration interface. A sealant coating on smooth surfaces along with extended sealant on pit and fissure and bracket/band tooth circumferential interface on teeth banded may act as a barrier that can protect the underlying enamel from the acids produced by plaque during the fermentation of sucrose[9]. Further, this will make tooth more self-cleaning and less retentive for plaque accumulation. The aim of the present clinical study was to evaluate the effectiveness of pit fissure and molar band interface sealant application on gingival status, MS count and caries on molars banded for orthodontic treatment in pediatric patients.

MATERIAL AND METHODS

A prospective study was designed as split mouth, in the subjects with completely erupted permanent first molars with the age between 8-16 years undergoing bilateral fixed appliance therapy. The study protocol and design were approved by Institutional Ethical Committee and retrospectively registered with Central trial registry of India, CTRI/2015/02/005543

SAMPLE SELECTION

Subjects scheduled for bilateral fixed orthodontic therapy were examined using WHO (2013) assessment form and 30 patients of age group of 8-16 years were taken as a convenience sample. A total of 22 orthodontic patients having completely erupted permanent first molars were included in the study following inclusion & exclusion criteria and after the participation consent was obtained from their parents/guardian. Inclusion criteria were fully erupted permanent first molars, no systemic disease, Bilateral Banding /Bonding in posterior region, Cooperative and motivated patients. Exclusion criteria were medically compromised/ physically handicapped child, Child on antibiotic therapy for over a period of 6 weeks, reduced salivary flow/ Xerostomia, Unusual tooth morphology. Randomization of the arch for the study and control tooth was done via the chit method. 44 molars scheduled for banding in 22 subjects undergoing bilateral fixed orthodontic therapy were taken as a unit of study. Further, banded molars were randomly divided via split mouth design into 2 groups (Figure 1).

A)Recording of baseline data

The preformed patient information and record form was explained to the patient. A complete history and the interview of the patient scheduled for fixed orthodontic therapy along with a 7-day diet chart with consent form was taken. Before schedule of 1st visit for fixed orthodontic therapy, plaque index, DMFT/def and salivary mutans Streptococci count were taken. Individual educational and motivational patient counseling was done in each patient.

B) Recordings of baseline data of the study and control tooth

The baseline records of experimental and control teeth in terms of plaque index (Sillness & Loe), gingival Index (GI) (Loe & Sillness), visual caries assessment (ICDAS II) and plaque MS count were recorded before application of orthodontic bands /brackets. The patients were recalled after 1, 6 and 12 months and all above mentioned parameters were reassessed.

C) Mutans Streptococci (MS) count:Mutans streptococci count of saliva was taken before starting of the orthodontic treatment.

Collection of saliva:

Saliva samples of participants were collected in the morning (9am-11am) from ventral surface of tongue with sterile cotton applicator. This was transferred then and there to capped labeled sterile tubes, made up of polypropylene, (HIMEDIA) containing Todd-Hewitt broth media for further transport to laboratory. (Figure 2)

Collection of plaque before and after Banding:

Patients were given appointment for first slot in morning (9am-11am), for sample collection without brushing and eating anything**.** The plaque samples were taken from the available grooves on the tooth, banded molar, surface after proper isolation with cotton rolls. It was obtained from adhesive tooth cement surfaces along with the gingival surface of the band by the aid of a sterile wooden toothpick. It was then transferred into Todd Hewitt Broth transport media

Transfer and Analysis of MS Count (Saliva, Study and Control Tooth

Isolation of MS and strain identification was performed in the Department of Microbiology. 0.2 units of Bacitracin per ml sucrose were added to achieve 20% concentration agar. Diluted saliva MSB Agar plates (Figure 2) were inoculated with diluted saliva and incubated in candle jar for 48 hours at 37°C with 5% carbon dioxide. Gram-stained slides prepared and examined under Microscope (Nikon) at 100X resolution . The characteristics of colony's morphology like rounded, raised and blue structure with size pinpoint to pin size. They were rough in surface texture and easily detachable from agar media surface . They were also tested for mannitol fermentation, catalase, and oxidase tests on brain heart infusion. Sucrose was used as positive control and brain heart infusion broth as negative control. The change in the media color shows the ability to utilize carbohydrate. A blinded and calibrated examiner did colony counting of saliva and plaque samples by Digital colony Counter (SPECTROMICS) (Figure 3). Records for MS count were taken at baseline, after 4 weeks and 6 months.

D) Banding of study and control teeth

Band cementation method was standardized as per prophylaxis, band adaptation technique and the type of cement used (GC FUJI I); and all the techniques were done by the single operator. Occlusal surface of the study tooth was sealed before banding and circumferential enamel band interface was sealed after banding & cementation (GC FUJI I). The contra lateral control tooth was cemented (GC FUJI I) and was left unsealed.

E) Method of Application of sealants on study tooth

Before band cementation, all the pits & fissures of occlusal and buccal or lingual/palatal of the study molars were sealed with the light cure fluoride releasing sealant (Clinpro, 3M). The occlusion was checked with articulating paper for any interference. After banding of permanent first molars, study tooth was sealed with the sealant on the enamel, band circumferential interface and between the band tooth interfaces. Patients were kept on a regular follow up at an interval of 1, 6 and 12 months.

STATISICAL ANALYSIS:

Statistical evaluation was done using SPSS version 17 software. Mean, standard deviation and range was calculated for all parameters. Paired t tests and Wilcoxon signed ranked test were used to compare the intra and intergroup parameters. Pearson's correlation, Levene's Test for Equality of Variances were used as applicable.

RESULTS

Frequency distribution according to gender was 50% female/male (n=11 each) of mean age 13.59 + 1.99 years (Table 1). Significant sharp increase in total Plaque index after 1 month of the commencement of fixed orthodontic therapy (p=0.005**) and this increase was significant at last visit interval also (p= 0.047*) though the increase was stabilized (Table 2). Table 3 depicts sharp increase in saliva MS count after 1 month and this increase was stabilized at 6 months. No significant difference was found at baseline up to 1 month period (p= 0.057), baseline to six months (p= 0.624) and one month to six months (p= 0.078).

82 % of the patients were caries free (DMFT+ deft score<1.) Patients were in low-risk category with a mean of DMFT+ deft score of 0.81. 63.6% patients were caries free. Patients were in low caries risk category with a mean DMFS+ defs score of 1.71 (< 2).Table 4 Intragroup comparison of study tooth PI showed Baseline > 1 month > last visit, difference was not statistically significant at Baseline-1 month (p=0.478), baseline-last visit (0.204).A Significant increase in plaque score was noted between baseline to 1month (p=0.026*), whereas no significant was at baseline to last visit (p =0.058). Table 4b Inter group comparison showed significantly less mean individual tooth plaque score in study teeth as compared to control teeth after 1 month of therapy (p=0.021*) and this became highly significantly less in study teeth at last visit (p=0.004**)

SM count observed to be lesser in study group in comparison to control group at 1 month (p= 0.027*). This reduced number of SM count became highly significant at 6 months (p = 0.000***). Intragroup comparison between baseline and last visit; control tooth showed a highly significant increase in ICDAS score in smooth surface caries (p=0.000) and occlusal caries (p=0.003**) at last visit. Significant difference was in the ICDAS II scores and smooth surface caries (p=0.000) and occlusal caries (p= 0.003) between control and study tooth at last visit. Table 5 depicts significant correlation between study tooth MS and saliva MS count (p =0.027*) A very highly significant difference between study and control tooth MS count was seen (p=0.000***) Figure 4. Smooth surface and occlusal caries of the control tooth were highly significantly correlated with the control tooth MS count (p= 0.002**). The mean DMFT increased from 1 to 2.52 indicating the increase in the caries risk from low to moderate. Highly significant increase in DMFS+ defs was seen from Baseline to last visit (p= 0.004**).The prevalence of new carious lesions in control group was 68.42% (p= 0.003**) compared to study group.Table 6 showed highly significant correlation of high sweet score to MS levels of saliva was seen (p=0.004**) whereas a significant relation of the moderate sweet score with MS levels of saliva (p=0.011*) was seen. The plaque index in the Control tooth increased significantly (0.026*) after 1month of bands cementation, which can be explained by obvious increase in the plaque retentive areas. Resin based sealant in present study blocked all retentive areas like grooves, crevices, occlusal facets, circumferential junction between tooth and band interface making itself cleansing leading to reduction in bacterial load by smoothing highly anfractuous tooth form.

Table 1: Frequency distribution of study and control teeth

Tooth	Study tooth	Control tooth
16	27.3%	4.5%
26	4.5%	27.3%
36	13.6%	54.5%
46	54.5%	13.6%

Table 2 Comparison in mean values of total plaque index PI at baseline, 1month, last visit

		Mean + Std. Deviation	Mean difference between pairs	P value
Pair 1	plaque I baseline	0.689+0.266	-.19721	0.005**
plaque I at 1month	0.887+0.339			
Pair 2	plaque I baseline	0.678+0.262	-.224579	0.047*
plaque I at last visit	0.903+0.476			

*significant **highly significant ***very highly significant

Table 3: Mean values of salivary mutans streptococci count at baseline, 1month, and 6 month

mutans streptococci count	Mean+ Std. Deviation	Minimum	Maximum
Baseline	4.3X103+4.79X103	0	104
1month	2.4X104+4.03X104	0	105
6 month	7.7X103+2.27X104	0	105

Table 4: Intragroup and Intergroup comparisons of Study and Control tooth Plaque Index at baseline, 1month and last visit

	N	Mean+Std. Deviation	Minimum	Maximum
PI Study baseline	22	3.86+1.356	2	7
PI Study 1 month	19	3.68+1.416	1	8
PI Study last visit	19	3.37+1.499	1	7
PI control baseline	22	4.05+1.397	2	7
PI control 1month	19	4.58+1.575	2	8
PI control last visit	19	4.74+1.195	3	7

Table 4a: Intra Group Comparison

Study tooth PI	Baseline to 1month	Baseline last visit	1month to last visit
P value	0.478	0.204	0.528
Control tooth PI	Baseline to 1month	Baseline last visit	1month to last visit
P value	0.026*	0.058	0.253

Table 4b: Intergroup Comparison

Wilcoxon Signed Ranks Test			
	PI control bl - PI Study bl	PI control 1month - PI Study 1 month	PI control last visit - PI Study last visit
Z	-0.665(a)	-2.307(a)	-2.858(a)
P value	0.506	0.021*	0.004**
a Based on negative ranks.			

Table 5: Correlation between Plaque indexes (total), salivary mutans Streptococci count, Control and study tooth Plaque mutans streptococci count, Control and study tooth Plaque Index, Control and study tooth occlusal and smooth surface caries (ICDAS II)

plaue Index	Pearson Correlation	Plaque Index (total)	Saliva MS Count	Plaque MS control tooth	Plaque MS study Tooth	PI Study Tooth	PI control Tooth	Study tooth occlus al caries (ICDA S II)	Control tooth occlusal caries(ICDAS II)	Study tooth smooth surface caries(ICDAS II)	Control Tooth smooth surface caries(ICDAS II)
		1	0.208	0.307	0.239	-0.045	-0.071	0.008	0.053	0.163	0.443
P value	0.440	0.248	0.373	0.869	0.794	0.975	0.846	0.547	0.085		
saliva MS Count	Pearson Correlation	0.208	1	0.358	0.505*	0.226	0.220	0.181	0.445	0.158	0.381
P value	0.440	0.133	**0.027***	0.400	0.414	0.459	0.056	0.518	0.107		
plaque MS control	Pearson Correlation	0.307	0.358	1	-0.066	-0.404	-0.352	0.344	0.671**	0.213	0.654**
P value	0.248	0.133	0.789	0.121	0.181	0.149	**0.002****	0.381	**0.002****		
plaque MS study tooth	Pearson Correlation	0.239	0.505*	-0.066	1	0.135	0.245	-0.385	0.103	0.366	0.286
P value	0.373	0.027 *	0.789	0.619	0.359	0.104	0.674	0.123	0.234		
PI Study Tooth	Pearson Correlation	- 0.045	0.226	-0.404	0.135	1	0.922**	-0.043	-0.379	0.139	-0.166
P value	0.869	0.400	0.121	0.619	0.000**	0.875	0.147	0.608	0.538		
PI control tooth	Pearson Correlation	- 0.071	0.220	-0.352	0.245	0.922**	1	-.015	-0.286	0.097	-0.163
P value	0.794	0.414	0.181	0.359	0.000*	.957	0.283	0.722	0.546		
study tooth occlusal	Pearson Correlation	0.008	0.181	0.344	-0.385	-0.043	-0.015	1	0.417	-0.032	0.065
P value	0.975	0.459	0.149	0.104	0.875	0.957	0.076	0.897	0.793		
control tooth occlusal	Pearson Correlation	0.053	0.445	0.671**	0.103	-0.379	-0.286	.417	1	0.340	0.571*
P value	0.846	0.056	0.002**	0.674	0.147	0.283	.076	0.154	0.011*		
study tooth smooth	Pearson Correlation	0.163	0.158	0.213	0.366	0.139	0.097	-.032	0.340	1	0.485*
P value	0.547	0.518	0.381	0.123	0.608	0.722	.897	0.154	0.035		
Control tooth smooth	Pearson Correlation	0.443	0.381	0.654**	0.286	-0.166	-0.163	.065	0.571*	0.485*	1
P value	0.085	0.107	0.002**	0.234	0.538	0.546	.793	0.011*	0.035*		

significant **highly significant ***very highly significant

Table 6: Correlation of sugar exposure with DMFT+ dift, DMFS+ difs, Plaque Index, salivary mutans streptococci levels

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		95% CI Interval of the Difference
								Lower		Upper
DMFT+dift at lastvisit	Good	0.096	0.761	--0.496	13	0.628	-.500	1.009	-2.679	1.679
watch out zone	-0.464	6.893	0.657	-.500	1.077	-3.054	2.054			
DMFS + difs at last visit	Good	0.143	0.711	-0.080	13	0.937	-.100	1.250	-2.800	2.600
watch out zone	-0.084	9.185	0.935	-.100	1.192	-2.788	2.588			
plaque Index at last visit	Good	4.275	0.059	-1.797	13	0.096	-.486500	.270787	-1.071501	0.098501
watch out zone	-1.334	4.476	0.246	-.486500	.364817	-1.458323	0.485323			
salivary Mutans Streptococci count last visit	Good	2.083	0.173	-2.980	13	0.011*	-1.700	.570	-2.932	-0.468
watch out zone	-.511	12.192	0.004**	-1.700	.484	-2.753	-0.647			

*significant **highly significant ***very highly significant

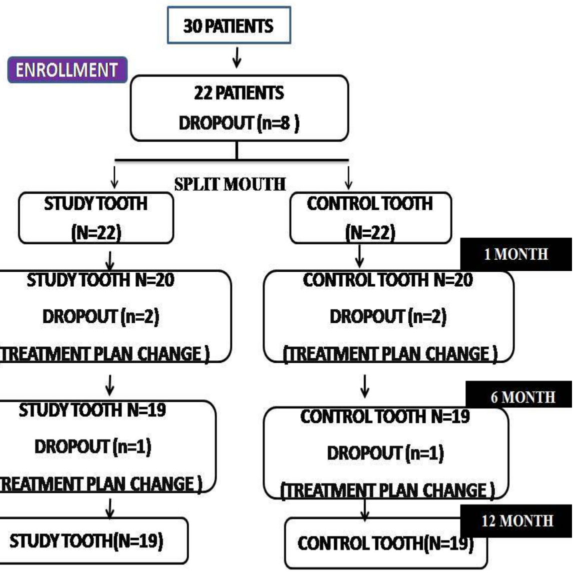
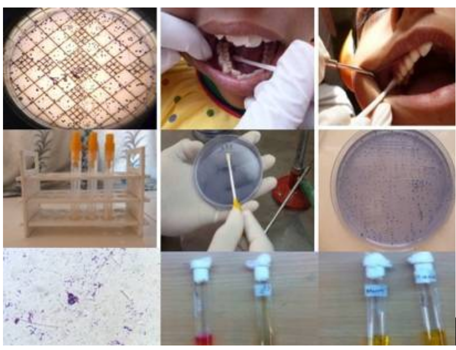


Figure 1 flow chart of t prospective split mouth design



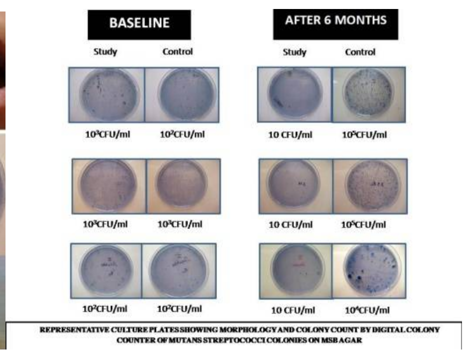


Figure 2 : Sample collection Figure 3 morphology and colony count

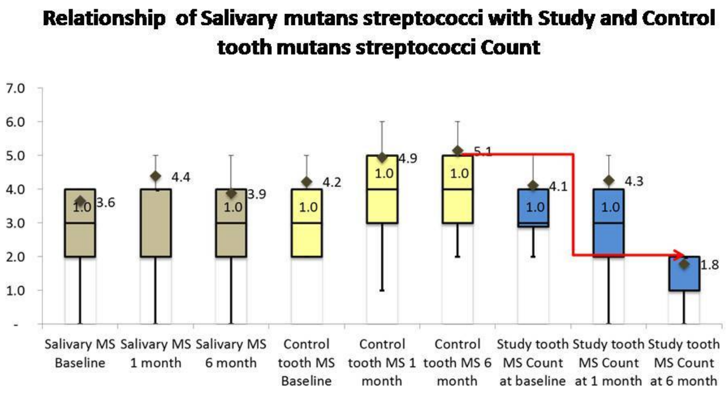


Figure 4 Relationship of Salivary mutans streptococci with Study and Control

DISCUSSION

Fixed orthodontics in pediatric dentistry is used for minor tooth movements, space management, habit breaking appliances and interceptive orthodontic treatment. It requires application of orthodontic bands on young permanent first molars (preferential tooth for anchorage). Cementation of bands/brackets/wires jeopardizes normal oral ecology; deposition of plaque and impaired gingival health puts young enamel on high risk for caries (up to 2- 96% prevalence has been reported)[9]. MS uses carbohydrates as energy source to form lactic acid, leading to lower pH and demineralization of enamel. Band on tooth interface is an altered environment oral environment, including increased MS and decreased pH. MS preferentially colonize around the teeth and orthodontic appliances, as the complex designs of orthodontic appliances impede proper access for cleaning[10-11].Attachment used for fixed therapy allows accumulation of microbial plaque by altering anatomy and creating retention areas a disruption in ecology, creating a condition which may actas a substrate for the establishment of mutans streptococci[12].

Loss of normal anatomical form of banded teeth constitutes host related risk factor like altered contact points and blocked spillways due to cementation of bands around labial& lingual surfaces, harboring the deposition of dental plaque leading to demineralization of enamel[13]. The enamel can lose up to half of its inorganic content [14-15].Application of bands/brackets/wires on teeth in pediatric patients form inaccessible areas where bristles of brush cannot reach, especially in posterior teeth. Further saliva cannot perform its cario-protective function by its normal washout mechanism to now unreachable areas [16-18]. Clearance of food debris is a primary requirement for dental hygiene along with routine preventive topical Fluoride application. [19-20].Both bacterial plaque clearance and fluoride function is compromised atthe most vulnerable sites such as proximal edges and cervical surfaces [21].In tooth targeted prevented measures, the purpose of putting sealants on pit and fissure sealants of molars is to reduce the bacterial load by smoothing these vulnerable shapes that favor food retention and harbor bacteria, and thereby making cleaning possible and easier.

This novel approach of extended use of sealant was that it was applied on all pits and fissures of occlusal surface, buccal and lingual/palatal surfaces and band-tooth margin interface after cementation of bands. Clinpro Sealant used in the study is a light-cure, unfilled, low viscosity, fluoride releasing pit and fissure sealant with Bis GMA-TEGDMA resin. The whole methodology was standardized regarding age, gender, time interval, baseline data recording DMFT+ deft (low caries risk), DMFS+ defs (lowcaries risk), plaque score, salivary MS count, oral hygiene instructions, split mouth study design, band application, cementation, sealant application, baseline and follow up criteria. The mean time for which the subjects were examined was 7.3 months i.e., between baseline and last visit depending upon their schedule of orthodontic therapy. DMFT+ deft, DMFS+ defs, total Plaque Index [Sillness and Loe], salivary MS count and individual tooth parameters for study and control tooth i.e., Plaque index, Plaque MS count, Gingival index, and occurrence of caries (ICDASII criteria) were assessed at different time intervals. DMFT+ deft assessed in the present study at baseline to last visit, was increased by 40% and thesefindings were like various other studies. The DMFS/defs increase in the present study was by 42% from baseline to last visit and similar increase was observed in various studies [22]. This increase in caries occurrence shows the role of fixed orthodontic therapy in increasing risk, new lesion development and increased severity of caries leading to increase in treatment demands.

Significant total increase (p= 0.047*) in the Plaque index by 72% post orthodontic therapy was seen in present study and similar results were reported by other authors . Non-significant increase in the salivary MS counts frombaseline-1 month and 6 months was same as in studies by Sandham *et al* [23]and Chen et [24]. Saliva MS level were not affected in follow-up samples in a study conducted by Twetman *et al*. [25]. The reason for insignificant change in saliva MS count may be that salivary count depends on multiple systemic and local factors like immunity another routine oral preventive measure (which control saliva MS count more than individual tooth plaque MS count). Also, development of microbial dental plaque is multifactorial process affected by diet, age, gender, saliva type, systemic disease, and other host factors[26]. Withthe above results, significant increase in the total Plaque index by72%, ii)increase in salivary MS from baseline to 1 month by 17% iii) DMFT+deft increase by 40% iv) DMFS+defs increase by 42%; we interpret that all patients were on high caries risk, as early as after 1 month. Regarding individual tooth parameters**,** the mean MS count of the control teeth in the present study increased significantly (p= 0.011*) from baseline to last visit.

MS counts in study teeth decreased significantly (p= 0.000) after 6 months of therapy, even lesser than baseline level. The difference between mean MS count in study and control teeth was also very highly significant(p= 0.000***). Twetman *et al* in 1997[25] observed a significant decrease in MS count with the 3 applications of chlorhexidine varnish in2 week or in a monthly mode: similarly, Naorungroj *et al* in2010[27] reported decreases in MS count with fluoride containing resin-based sealant. Which shows one time professional sealing on banded young permanent molar may prove to be effective tooth targeted non complaint method of caries prevention by effectively controlling MS colonization.

New carious lesions were observed in 68.42% control teeth (p= 0.003**) by ICDAS II criteria whereas only 15.7% in study teeth (p=0.003**). High occurrence of smooth surface caries on control teeth may be due to post cementation microleakage. Usyal in 2010 observed very high microleakage scores at tooth, cement, and band interface [28]. A highly significant correlation (Pearson's) was found between Control teeth MS and occurrence of smooth/occlusal surface caries. This extended fissure sealant uses at tooth band interface along with sealing pit and fissures can be used in routine as an additional, effective method of caries prevention to eliminate vulnerable areas associated with application orthodontic bands in molars.

CONCLUSION

In the present study application of hydrophobic sealant along with cementation of bands in young permanent first molars may prove to be significantly effective and non-compliant preventive adjunctive method of caries prevention, especially in pediatric patients. However more studies in a larger sample size including more parameters might be necessary for further research in this area.

REFERENCES

1. Smiech-Slomkowska G, Jablonska-Zrobek J. (2007). The effect of oral health education on dental plaque development and the level of caries-related Streptococcus mutans and Lactobacillus spp. Eur J Orthod; 29(2):157–60.
2. KamberR, Meyer-Lueckel H, Kloukos D, Tennert C, Wierichs RJ. (2021). Efficacy of sealants and bonding materials during fixed orthodontic treatment to prevent enamel demineralization: a systematic review and meta-analysis. Sci Rep. ;11(1):16556
3. Sagarika N, Suchindran S, Loganathan S, Gopikrishna V. (2012). Prevalence of white spot lesion in a section of Indian population undergoing fixed orthodontic treatment: An in vivo assessment using the visual International Caries Detection and Assessment System II criteria. J Conserv Dent ; 15(2):104–8.
4. Zingler S, Pritsch M, Wrede DJ, Ludwig B, Bister D, Kneist S, et al. (2014). A randomized clinical trial comparing the impact of different oral hygiene protocols and sealant applications on plaque, gingival, and caries index scores. Eur J Orthod ; 36(2):150–63.
5. Rosenbloom RG, Tinanoff N. (1991). Salivary Streptococcus mutans levels in patients before, during, and after orthodontic treatment. Am J Orthod DentofacialOrthop; 100(1):35–7.
6. Zanatta FB, Ardenghi TM, Antoniazzi RP, Pinto TMP, Rösing CK. (2012). Association between gingival bleeding and gingival enlargement and oral health-related quality of life (OHRQoL) of subjects under fixed orthodontic treatment: a cross-sectional study. BMC Oral Health; 12(1):53.
7. Linjawi AI. (2020). Sealants and White Spot Lesions in Orthodontics: A Review. J Contemp Dent Pract.;21(7):808-814.
8. Tasios T, Papageorgiou SN, Papadopoulos MA, Tsapas A, Haidich AB. (2019). Prevention of orthodontic enamel demineralization: A systematic review with meta-analyses. OrthodCraniofac Res. 22(4):225-235
9. Fornell AC, Sköld-Larsson K, Hallgren A, Bergstrand F, Twetman S. (2002). Effect of a hydrophobic tooth coating on gingival health, mutans streptococci, and enamel demineralization in adolescents with fixed orthodontic appliances. Acta Odontol Scand; 60(1):37–41.

10. Scheie AA, Arneberg P, Krogstad O. (1984). Effect of orthodontic treatment on prevalence of Streptococcus mutans in plaque and saliva. Eur J Oral Sci ; 92(3):211–7.
11. Badawi H, Evans RD, Wilson M, Ready D, Noar JH, Pratten J. (2003). The effect of orthodontic bonding materials on dental plaque accumulation and composition in vitro. Biomaterials ; 24(19):3345–50.
12. Liu J, Bian Z, Fan M, He H, Nie M, Fan B, et al. (2004). Typing of mutans streptococci by arbitrarily primed PCR in patients undergoing orthodontic treatment. Caries Res ; 38(6):523–9.
13. Lara-Carrillo E, Montiel-Bastida N-M, Sánchez-Pérez L, Alanís-Tavira J. (2010). Effect of orthodontic treatment on saliva, plaque and the levels of Streptococcus mutans and Lactobacillus. Med Oral Patol Oral Cir Bucal; 15(6): e924–9.
14. Peros K, Mestrovic S, Anic-Milosevic S, Slaj M. (2011). Salivary microbial and nonmicrobial parameters in children with fixed orthodontic appliances. Angle Orthod; 81(5):901–6.
15. Tanner ACR, Sonis AL, Holgerson PL, Starr JR, Nunez Y, Kressirer CA, et al. (2012). White-spot Lesions and Gingivitis Microbiotas in Orthodontic Patients. J Dent Res; 91(9):853-8.
16. Yap J, Walsh L, Naser-ud Din S, Ngo H, Manton D.(2014). Evaluation of a novel approach in the prevention of white spot lesions around orthodontic brackets. Aust Dent J; 59(1):70–80.
17. Sun M, Kang Q, Li T, Huang L, Jiang Y, Xia W. (2014). Effect of high-fructose corn syrup on Streptococcus mutans virulence gene expression and on tooth demineralization. Eur J Oral Sci; 122(3):216–22.
18. Jung WS, Kim H, Park SY, Cho EJ, Ahn SJ. (2014). Quantitative analysis of changes in salivary mutans streptococci after orthodontic treatment. Am J Orthod Dentofacial Orthop; 145(5):603–9.
19. Chang H, Walsh L, Freer T. (1999). The effect of orthodontic treatment on salivary flow, pH, buffer capacity, and levels of mutans streptococci and lactobacilli. AustOrthod J; 15(4):229–34.
20. Ousehal L, Lazrak L, Es-said R, Hamdoune H, Elquars F, Khadija A. (2011). Evaluation of dental plaque control in patients wearing fixed orthodontic appliances: A clinical study. IntOrthod; 9(1):140–55.
21. Zachrisson BU, Zachrisson S. (1971). Caries incidence and orthodontic treatment with fixed appliances. Eur J Oral Sci 79(2):183–92.
22. Uysal T, Ramoglu SI, Ertas H, Ulker M. (2010). Microleakage of orthodontic band cement at the cement-enamel and cement-band interfaces. Am J Orthod DentofacialOrthop; 137(4):534–9.
23. Sandham HJ, Nadeau L, Phillips HI. (1992). The Effect of Chlorhexidine Varnish Treatment on Salivary Mutans Streptococcal Levels in Child Orthodontic Patients. J Dent Res ; 71(1):32–5.
24. Chen Y, Wong RWK, Seneviratne CJ, Hagg U, McGrath C, Samaranayake LP. (2013). The effects of natural compounds-containing mouthrinses on patients with fixed orthodontic appliance treatment: clinical and microbiological outcomes. Int J Paediatr Dent; 23(6):452–9
25. Twetman S, Petersson LG. (1997). Effect of different chlorhexidine varnish regimens on mutans streptococci levels in interdental plaque and saliva. Caries Res ; 31(3):189–93.
26. Kleinberg I. (2002). A Mixed-bacteria Ecological Approach to Understanding the Role of the Oral Bacteria in Dental Caries Causation: an Alternative to Streptococcus mutans and the Specific-plaque Hypothesis. Crit Rev Oral Biol Med; 13(2):108–25.
27. Naorungroj S, Wei H-H, Arnold RR, Swift Jr. EJ, Walter R. (2010). Antibacterial surface properties of fluoride-containing resin-based sealants. J Dent; 38(5):387–91.
28. Uysal T, Ramoglu SI, Ertas H, Ulker M. (2010). Microleakage of orthodontic band cement at the cement-enamel and cement-band interfaces. Am J Orthod DentofacialOrthop 2010; 137(4):534–9s

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