

Comparing the Treatment of white Spot Lesions Using 18% Hydrochloric Acid (HCL) Microabrasion & 37% Orthophosphoric Acid (H₃po₄) Microabrasion Techniques

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Abstract

Objective: To measure the changes in orthodontically induced white spot lesion size , using 18% hydrochloric acid microabrasion & 37% orthophosphoric acid microabrasion techniques.

Materials & Methods: Patients who had developed multiple white demineralised enamel lesions on teeth after post fixed orthodontic therapy were treated in this study. The study consisted of 20 patients, 10 patients in 18% hydrochloric acid (HCL) microabrasion group and 10 patients in 37% orthophosphoric acid microabrasion group. Both the groups underwent micro abrasion once in a week for a month i.e. four times in 1 month period. The area of the white spot lesions decreased significantly in both the groups. The success rate for both the group were calculated.

Result: There was statistically significant decrease of white spot lesion before and after treatment in 18% hydrochloric acid microabrasion group and 37% orthophosphoric acid microabrasion group.

Statistics: Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 14.

Conclusion: As the day progresses the size of white spot lesion reduces, microabrasion technique is one of the best known method to treat white spot lesion & using 18%hcl gives better result when compared to 37% H₃PO₄.

Keywords: white spot lesions, 18% HCL , 37% orthophosphoric acid

I. Introduction

Since the dawn of history, tooth wear has proved to be a fascination to mankind. The other parts of the body repair themselves to a certain degree but teeth being the hard structures are incapable of repair^[1,2]. The term white spot lesion (WSL) was coined by Fejerskov et al. Ogard B^[3] as “the first sign of a caries lesion on enamel that can be detected with the naked eye.” and the reason for this is that the lesion looks more white than the surrounding surface of tooth structure which changes in light scattering of decalcified porous enamel leading to white appearance .The oral environment can develop these into either cavities or stay stable or heal to a certain extent^[1,4,5]

The aim of my study was to quantify changes in orthodontically induced white spot lesion size after the use of hydrochloric acid pumice microabrasion technique v/s phosphoric acid microabrasion.

II. Materials and methodology

The study consisted of 20 patients. 10 patients in HCL group and 10 patients in H₃PO₄ group. In 10 patients who are under HCL group, procedure will be undertaken using 18% HCL and pumice slurry ,the procedure will be repeated for 10 times. Microabrasion procedure will done 2 times in a week for 2 weeks. For 10 patients who are under H₃PO₄ group, 37% H₃PO₄ will be used for microabration procedure. Before treatment and after treatment photographs will be taken using Nikon d5200 and the surface area tooth and surface area of white spot lesion will be measured using autocad software and percentage will be calculated.



Figure 1A



Figure 1B

Figure 1A and 1B showing material used in the study.

Methodology for 18% HCL group The patients were examined on the dental chair by using the overhead light . All the demineralised lesions were recorded, and pre-orthodontic treatment photographs were examined to ensure that no lesions were visible before orthodontic treatment. For each patient, 2 demineralised lesions affecting either incisors or canines or premolar were randomly selected for microabrasion. The experimental teeth was cleaned with pumice and water by using a rubber cup in a slow contra angle hand piece. A rubber dam was applied to isolate these teeth. Sodium bicarbonate and water paste was placed on the rubber dam to protect against inadvertent splashing of the hydrochloric acid. 18% hydrochloric acid was mixed with a fine pumice powder to form a slurry. This mixture was applied on to the buccal surface of each experimental tooth with a small wooden toothpick. The slurry was agitated into the tooth surface for 10 seconds and then washed off with an air – water spray. The cycle of acid pumice application, agitation, and washing was repeated 10 times for each experimental tooth. Finally, the tooth was washed for 30 seconds.



Figure 2A



Figure 2B

Figure 2A and 2B showing tooth before and after microabrasion using 18%HCL

III. Methodology For 37% H₃PO₄ Group

The patients were examined on the dental chair by using the overhead light . All the demineralised lesions were recorded, and pre-orthodontic treatment photographs were examined to ensure that no lesions were visible before orthodontic treatment. For each patient, 2 demineralised lesions affecting either incisors or canines or premolar were randomly selected for microabrasion. The experimental teeth was cleaned with pumice and water by using a rubber cup in a slow contra angle hand piece. A rubber dam was applied to isolate these teeth. Sodium bicarbonate and water paste was placed on the rubber dam to protect against inadvertent splashing of the hydrochloric acid. 37% orthophosphoric acid was mixed with a fine pumice powder to form a slurry. This mixture was applied on to the buccal surface of each experimental tooth with a small wooden toothpick. The slurry was agitated into the tooth surface for 10 seconds and then washed off with an air – water spray. The cycle of acid pumice application, agitation, and washing was repeated 10 times for each experimental tooth. Finally, the tooth was washed for 30 seconds.



Figure 3A



Figure 3B

Figure 3A and 3B showing tooth before and after microabrasion using 37%H₃PO₄

Image Acquisition :

The participants will be examined while they are seated on a dental chair; the examinations will be conducted when the participants have dry tooth surfaces after undergoing debonding procedure. All incisors, canines and premolars of each participant will be examined for the presence of white spot lesions.

In addition to photographic records of the debonding, standardized intraoral images will be taken perpendicular to the affected surface of every tooth of each patient by using a digital camera (NIKON D5200)

In this group, follow up photographic records will be taken four times in 1 month period till final microabrasion treatment.

To avoid the potential side effect of light reflections, stable illumination with ring flash and cross – polarizing filters will be used.

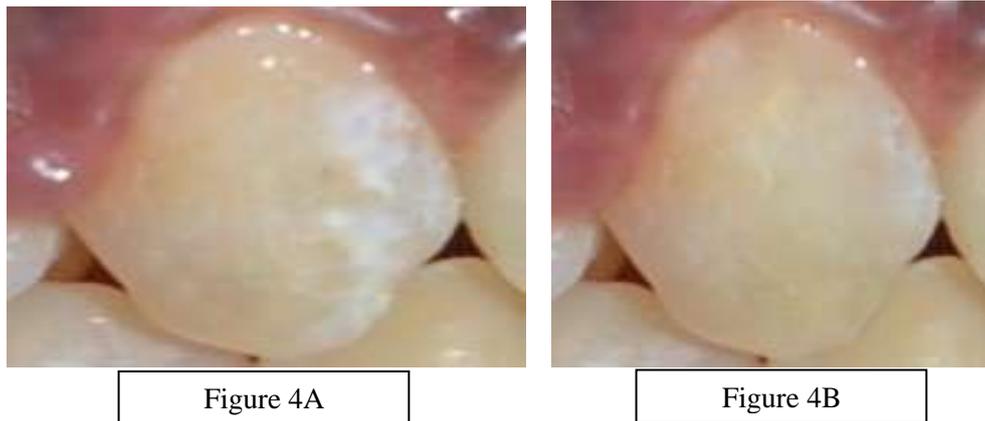


Figure 4A and 4B showing tooth picture captured using an D-slr camera

Image processing:

Image-processing software (AutoCAD - 2011, Autodesk Inc, San Rafael, Calif) will be used to quantify the size (in mm²) of the visible areas of the demineralised lesions and the size of the affected tooth's vestibular surface. After determination of both of these values, the area affected by demineralization will be expressed as a percentage of the total tooth surface. The images will be reanalyzed after a month to determine the reproducibility of the method. Thus, the extent of white spot lesion formation will be determined . The extent of white spot lesion formation will be determined again after the patients have completed their respective treatment regimens.

The success rate of treatment for each tooth will be determined by comparing the extent of white spot lesion formation before and after treatment by using the following formula²:

$$\text{Extent of white spot lesion} \quad \text{EWSL} = \frac{\text{Area of lesion}}{\text{Area of vestibular surface of the tooth}} \times 100$$

$$\text{Success rate(SR)} = \frac{\text{EWSL (T0)} - \text{EWSL (T1)}}{\text{EWSL (T0)}} \times 100$$

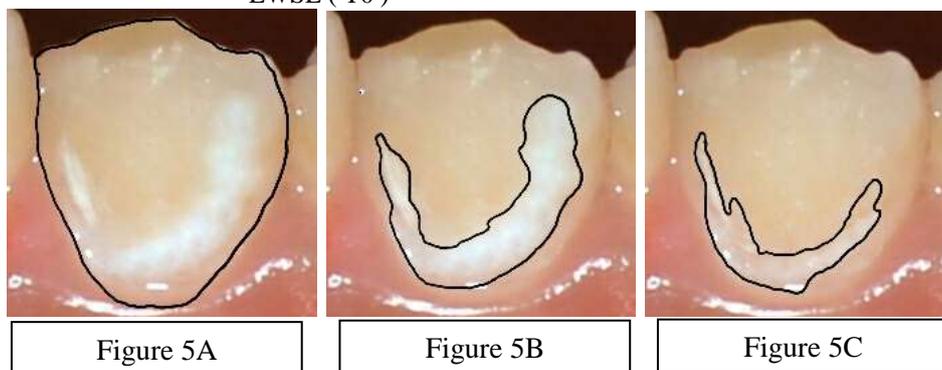


Figure 5A - Showing total tooth surface area with white spot lesion, **Figure 5B** - Showing extent of white spot lesion before treatment, **Figure 5C** - Showing extent of white spot lesion after treatment.

IV. Statistics

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 14. Descriptive statistics were calculated for 18% HCL microabrasion & 37% H₃PO₄ microabrasion group. A paired t-test was used to determine the difference in the mean percentage changes within each treatment group. A student t-test was used to determine the difference in the mean percentage change of success rate within 18% HCL microabrasion & 37% H₃PO₄ microabrasion group

Outcome variables after the treatment of 18% HCL group and 37% H₃PO₄ microabrasion group were, percentage of WSL's and the success rate. Percentage of WSL were compared before and after treatment using paired t-test. 18% HCL microabrasion & 37% H₃PO₄ microabrasion group comparison was done by the success rate between each group using student t-test. P value below 0.05 were set as the significance level.

V. Result

Table 1 shows 18% HCL group patients who were included in the study and the teeth which were included. It also shows the percentage of white spot lesion before and after treatment and the success rate for each tooth.

Table 2 shows 37% H₃PO₄ group patients who were included in the study and the teeth which were included. It also shows the percentage of white spot lesion before and after treatment and the success rate for each tooth. The descriptive statistics and statistical comparison of pre treatment and post treatment white Spot Lesion percentage of 18% HCL group are listed in table 3. The descriptive statistics and statistical comparison of pre treatment and post treatment white Spot Lesion percentage of 37% H₃PO₄ group are listed in table 4. The descriptive statistics for success rates of the 18% HCL and 37% H₃PO₄ group are listed in table 5.

In graph 1 shows percentage of reduction white spot lesion before and after treatment in 18% HCL group and graph 2 shows percentage reduction of white spot lesion before and after treatment in 37% H₃PO₄ group.

In graph 3 shows success rate between 18% HCL group and 37% H₃PO₄ group is seen in percentage.

Final results show statistically significant decrease of WSL's in 37% H₃PO₄ group where mean value of percentage of white spot lesion before treatment was 21.14% and mean value of percentage of white spot lesion after treatment was 11.16%.

There was statistically significant decrease of white spot lesion in 18% HCL group where mean value of percentage of white spot lesion before treatment was 24.76% and mean value of percentage of white spot lesion after treatment was 8.40%

However the success rate in the 18% HCL group was 66.39% which was significantly higher when compared to 37% H₃PO₄ group which was 48.34%.

18% HCL group (10 patients ,2 teeth in each patient , total of 20 teeth)

Sl. NO	Patient name	% of white spot lesion before treatment	% of white spot lesion after treatment	Success Rate
1.	AKHIL	51.29% 33.07%	20.78% 7.73%	59.48% 76.62%
2.	ASHALATHA	31.09% 18.87%	12.08% 6.18%	61.14% 67.24%
3.	DINOOP	27.45% 24.67%	4.66% 8.35%	83.02% 66.15%
4.	FAIZA	16.64% 21.56%	4.80% 5.91%	71.15% 72.58%
5.	FEBIN	48.32% 35.88%	19.41% 12.10%	59.83% 66.27%
6.	NAYANA	32.19% 19.75%	10.71% 6.87%	66.72% 65.21%
7.	RAMEEZ	12.86% 15.15%	4.63% 5.62%	63.99% 62.90%
8.	SHAANTHA	13.67% 9.33%	4.12% 3.45%	69.86% 63.02%
9.	SHASHIDAR	23.25% 20.71%	11.64% 5.48%	49.93% 73.53%
10.	SUMITHRA	22.03% 17.51%	6.04% 7.6%	72.58% 56.59%

Table 1: showing percentage of white spot lesion before and after treatment and their success rate

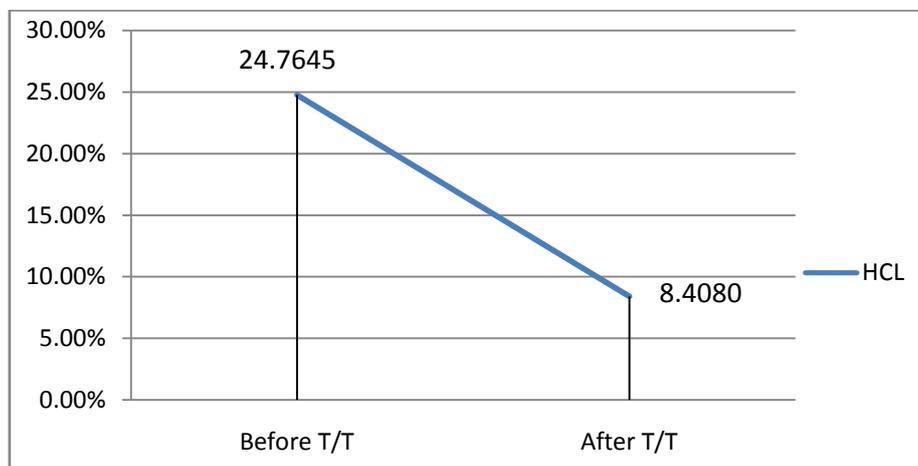
37% H₃PO₄ group (10 patients , 2 teeth in each patient , total of 20 teeth)

Sl. NO	Patients name	% of white spot lesion before treatment	% of white spot lesion after treatment	SUCCESS RATE
1.	ATHIRA	24.51% 9.05%	13.53% 4.32%	44.7% 52.26%
2.	JEBIN	9.63% 10.68%	4.84% 5.22%	49.74% 51.12%
3.	MAHESH	17.76% 24.54%	10.35% 12.72%	41.7% 48.16%
4.	NITHIN SASHIDAR	19.88% 17.76%	10.42% 9.42%	47.58% 46.9%
5.	PREETHI	43.43% 19.34%	26.52% 8.56%	38.93% 55.7%
6.	SAHANA	10.30% 9.10%	4.82% 4.36%	53.20% 52.08%
7.	SHAANA	27.11% 32.49%	16.34% 18.21%	39.72% 43.95%
8.	SHIFA	24.59% 29.14%	11.42% 13.92%	53.55% 52.23%
9.	SHYAM SHASHI	14.29% 21.21%	6.82% 11.27%	52.27% 46.86%
10.	YELAMMA	29.70% 28.46%	15.92% 14.25%	46.39% 49.92%

Table 2 : Patients teeth showing percentage of white spot lesion before and after treatment and their success rate

Table 3: Descriptive Statistics For 18% Hcl

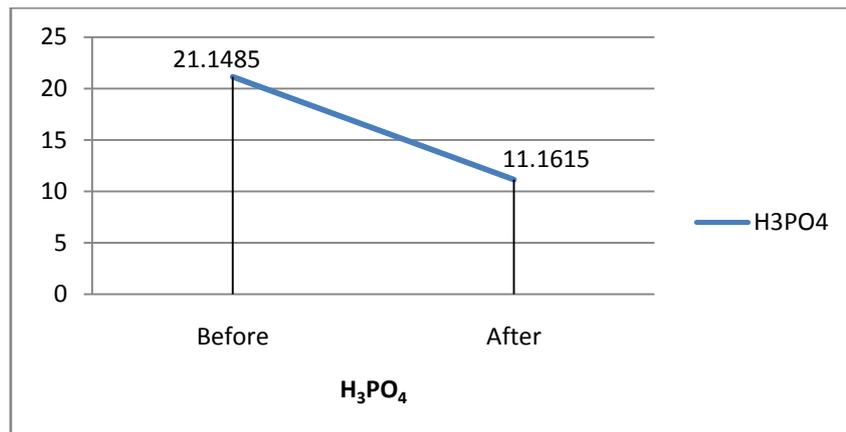
	N	Mean Percentage	Std. Deviation
Before	20	24.7645	11.15405
After	20	8.4080	4.80085



Graph 1: 18% HCL group showing percentage of reduction of white spot lesion before and after treatment

Table 4: Descriptive Statistics For 37% H₃po₄

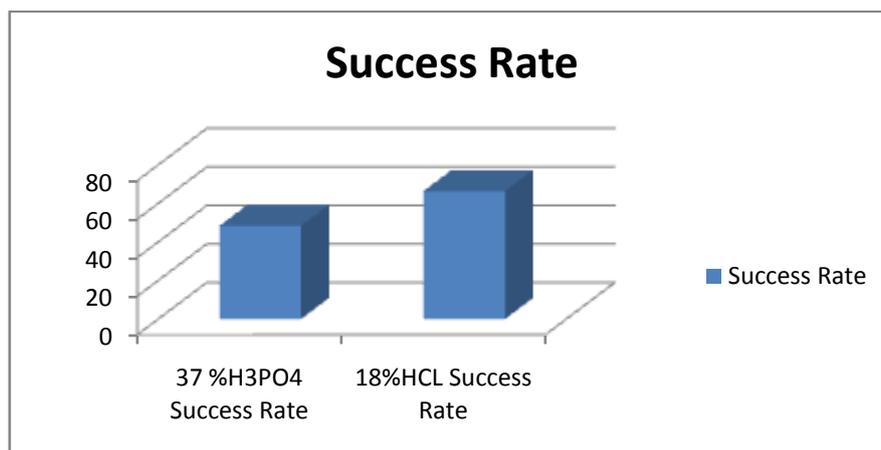
	N	Mean	Std. Deviation
Before	20	21.1485	9.21130
After	20	11.1615	5.61339



Graph 2: 37% H₃PO₄ group showing percentage of reduction of white spot lesion before and after treatment

Table 5: Descriptive Statistics and Statistical Comparison of success rate of HCL and H₃PO₄ group in percentage (%)

	N	Mean	Std. Deviation
H ₃ PO ₄ Success Rate	20	48.3480	4.73057
HCL Success Rate	20	66.3905	7.47075



Graph 3 (Bar graph): Showing success rate between 18% HCL group and 37% H₃PO₄ group in percentage (%)

VI. Discussion

Any impairment in the formation of the inorganic part of enamel may cause enamel demineralization. These defects of the enamel surface can exhibit white opacities, brown yellow, or orange spots and streaks, or multicolored superficial defects^[6,7].

Removal of superficial discolorations of enamel is commonly based on mild acid etching in combination with rotary application of an abrasive medium. Microabrasion not only removes the stained surface layer of the enamel but also creates a highly polished and compact surface layer^[8,9,10,11].

This study was started with the aim of noting down the capability of two different acids of different concentration and their successfulness in treating the post orthodontic demineralised white spot lesion. In this study two method of treating white spot lesion were employed i.e. 37% orthophosphoric acid and 18% hydrochloric acid microabrasion technique. Both the groups were compared with each other to know the amount of white spot lesion reduction. During orthodontic treatment accumulation of plaque, stains, food debris and cariogenic microorganisms seen in and around the orthodontic bracket leading to decreased pH and causing acidic environment leading to demineralisation of tooth surface around bracket system. These are seen as white spot lesions which is one of the warning signs to spot the tooth decay^[12,13,14]. Removal of fixed orthodontic appliance reduces plaque accumulation which in turn reduces cariogenic microorganisms and by natural process starts remineralisation of white spot lesions. In 3-4 months the demineralisation of lesion tends to disappear with

good oral hygiene and additional use of fluoridated tooth pastes, gums, mouth rinse helps to prevent white spot lesion progression and helps in remineralizing the demineralised enamel^[15,16].

Miereles et al. showed that enamel treated with H₃PO₄ produced a rougher surface than enamel treated with HCL^[17]. The increased roughness observed with H₃PO₄ could be attributed to a less aggressive decalcification, producing a selective conditioning pattern on enamel surface, leaving a more granular and irregular surface. They showed that the mean surface roughness was statistically lower for HCL than H₃PO₄ and deeper demineralization and a larger total demineralization area was observed for HCL. Due to deeper demineralization with HCL, patients may develop sensitivity later. It is suggested that the H₃PO₄-pumice compound can be used safely in dental clinics with a similar improvement in appearance of white spot lesion^[17].

VII. Conclusion

Most of the patients show poor compliance to orthodontic treatment leading to accumulation of plaque in and around the orthodontic brackets, which acts as a favourable site for cariogenic microorganisms. Post debonding white spot lesions tend to reduce overtime. Microabrasion is a technique which should be done in patients with moderate to severe white spot lesions, as the lesion in these patients will be large, sometimes stained leading to poor aesthetics. Finally the study concluded that microabrasion with 18% Hydrochloric acid followed by application of fluoride gel is a very effective technique in treating white spot lesion when compared to microabrasion with 37% orthophosphoric acid.

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