Research Article

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Force Degradation of Power Chain with Varied Mouth Rinses: An In Vitro Study

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ABSTRACT

Background: To evaluate the effect of three commercially available mouth rinses on percentage of force decay of Power chains used for orthodontic space closure.

Aims & Objective*:* Effect of various mouth rinses on force decay of power chains and comparing effect of mouth rinses on transparent and grey chains.

Material and method: Commercially available closed transparent and grey from rabbit Force Company were used in this study. The samples of power chains were stretched in four jigs and immersed in three mouth rinses (Colgate Plax, Listerine and Hexidine) and one in distilled water(control group).Force levels were calculated at various time intervals with the force gauge.

Result: Force decay was statistically significant at day 1.The force decay was highest for the Listerine having more alcohol concentration and least with Colgate Plax.

Conclusion: Oral environmental factors affect the force decay properties of these products.

Keywords: Mouth rinses, Power chains, Force gauge.

INTRODUCTION

Elastomeric power chain is commonly used in orthodontics for space management. Power chain has the advantage of being relatively inexpensive, easily applied and good patient cooperation. Power chains are polyurethanes, thermosetting products of a step-reaction polymerization process with a hydroxyl bond. These chains are fabricated either by die cut stampling or injection molding technique and are commercially available in varying diameter and configuration with or without pigments.

Power chains are exposed to mouth rinses, prescribed by the orthodontist specially in case where patient is unable to maintain proper oral health. These mouth rinses might affect the properties of elastomeric chain within the oral cavity. This in vitro was aimed to know the effect of mouth rinses on the properties of power chain.

AIM AND OBJECTIVES

1. Effect of varied mouth rinses on force decayed of power chains.

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2. To compare the effect of mouth rinses on transparent and grey Power chains.
3. To find suitable mouth rinses during orthodontic treatment with minimum effect on Power chains.

MATERIAL AND METHOD

The most commonly mouth rinses prescribed by the orthodontist in north India were selected.

1. Listerine (alcohol concentration of 21.6 %)
2. Hexidine (alcohol free)
3. Colgate Plax (alcohol conc. Of 12%)

The alcoholic content of mouth rinses was recorded with the official website of the manufacturer.

Two power sampled were taken -

1. Transparent closed rabbit force power chains (rabbit force power chains, USA as sample 1)
2. Grey closed rabbit force power chain (rabbit force power chains, USA as sample 2)

Initial force value of each sample was recorded.

Four rectangular, acrylic jigs were made to provide a framework for the simulated canine retraction. Each jig having two half of different colour with canine bracket and molar tube bonded in each half at a distance of 25mm, to represent the spatial relation between the first molar and canine in a bicuspid extraction case (figure 1).

Four groups were made according to mouth rinses in petri dishes

1. Controlled group with D1 water (deionized water) at pH 7
2. Second group with Listerine mouth rinse in a petri dishes
3. Third one with Hexidine
4. Fourth with Colgate Plax

The Power chain sample1 and 2 engaged in each four jigs and immersed one jig in each group (figure 2). All sample exposed for 2 min. three time in a day and with the help of force gauge (figure 3), force value of power chains was calculated at 0 day(T0), 1day(T1), 2nd days(T2), 3rd days(T3), 4th days(T4),5th day(T5),6th day(T6) and 7th day(T7) of period. The jigs are stored in distilled water between the immersion periods. This protocol was repeated ten times with fresh power chain.

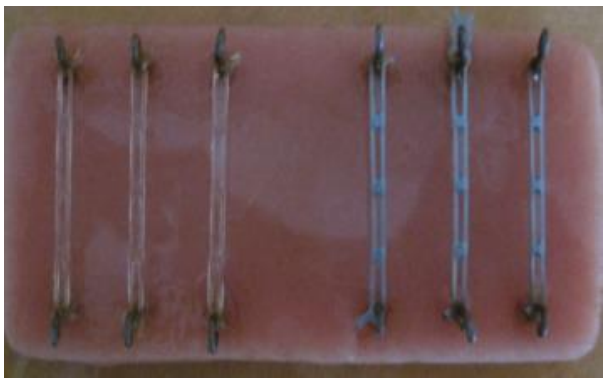


Fig 1: Rectangular jig with sample1 and sample2.

Fig 2: Two sample along with jig inserted in test solution.

Fig 3: Force Gauge.

RESULTS

The force decay mean value of each group was calculated and the initial force level of sample1 and sample2 at T0 level is 245gm and 260gm respectively. (Table 1).

The data was recorded as per the protocol of the study at T1, T2, T3, T4 and T5. It was tabulated and subjected to significant test in form of percentage and then p value was calculated

- The force decay of sample1 and sample 2 in Colgate Plax- significant result at T1, T2, T3, T4 and T5(P≤0.05)
- The force decay of sample1 and sample 2 in Listerine significant result at T1, T2, T3, T4 and T5 level (P ≤ 0.05)
- The force decay of sample1 and sample 2 in Hexidine significant result at T1, T2, T3, T4 and T5 level (P ≤ 0.05)
- The percentage in force decay in case of colgate plax as compared to Listerine and hexidine w.r.t. to controlled group is much less at T1 ,T2,T3 T4 and T5 level.

Table 1a: showing mean force decay value of sample1 and sample2 in distilled water.

Time interval	N	Mean force value(in gms)
T1-Sample1	3	215
Sample2	3	210
T2-Sample1	3	163
Sample2	3	166
T3-Sample1	3	145
Sample2	3	156
T4-Sample1	3	151
Sample2	3	148
T5-Sample1	3	141
Sample2	3	146

Table 1b: showing mean force decay value of sample1 and sample2 in Colgate Plax.

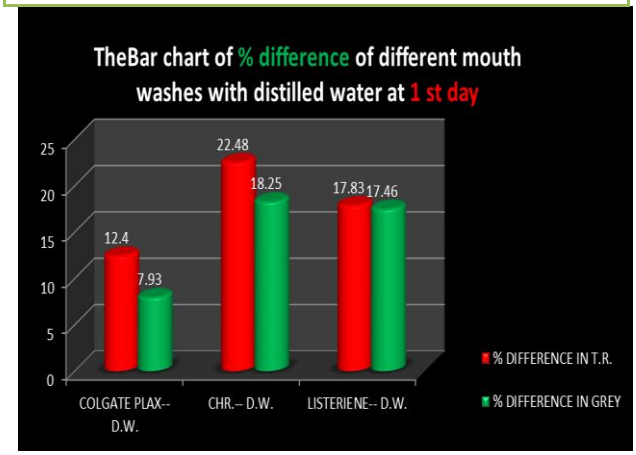
Time interval	N	Mean force value(in gms)
T1-Sample1	3	188
Sample2	3	193
T2-Sample1	3	155
Sample2	3	163
T3-Sample1	3	150
Sample2	3	151
T4-Sample1	3	125
Sample2	3	135
T5-Sample1	3	125
Sample2	3	135

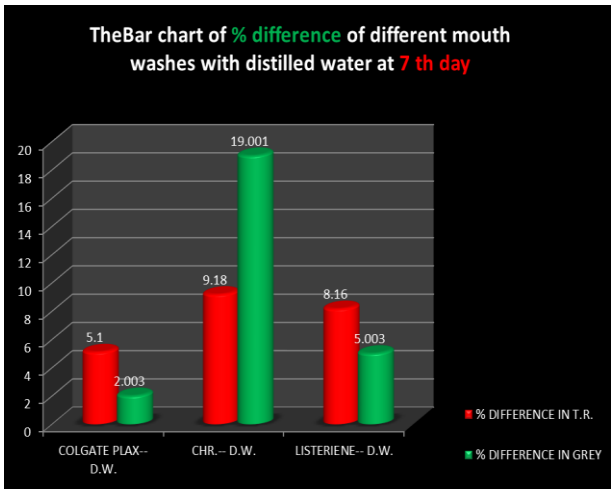
Table 1c: Showing mean force decay value of sample1 and sample2 in Listerine.

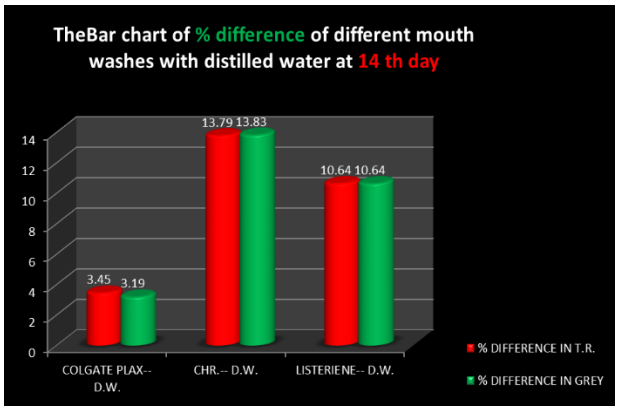
Time interval	N	Mean force value(in gms)
T1-Sample1	3	176
Sample2	3	173
T2-Sample1	3	150
Sample2	3	158
T3-Sample1	3	130
Sample2	3	140
T4-Sample1	3	120
Sample2	3	128
T5-Sample1	3	121
Sample2	3	121

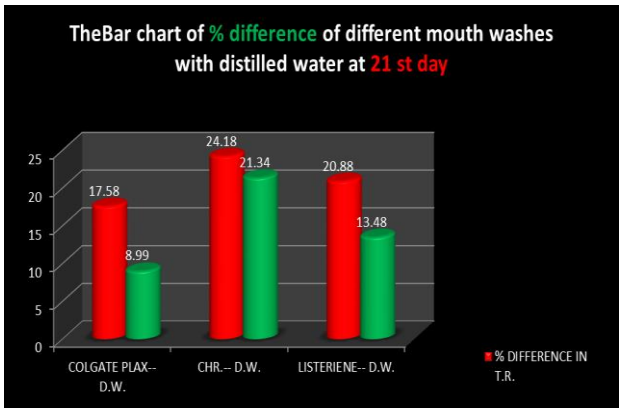
Table 1d: showing mean force decay value of sample1 and sample2 in Hexidine.

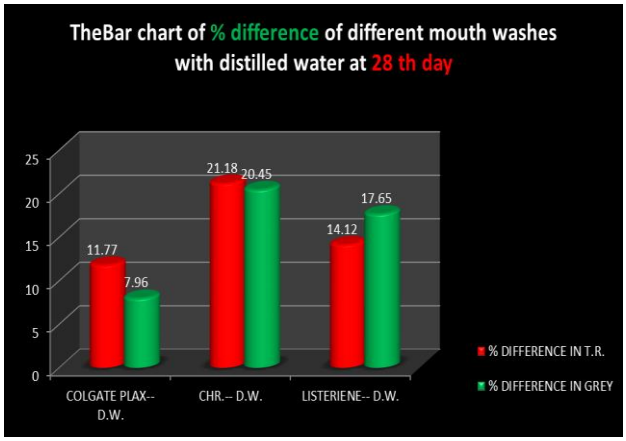
Time interval	N	Mean force value(in gms)
T1-Sample1	3	166
Sample2	3	171
T2-Sample1	3	148
Sample2	3	135
T3-Sample1	3	125
Sample2	3	135
T4-Sample1	3	115
Sample2	3	116
T5-Sample1	3	111
Sample2	3	116











DISCUSSION

Power chains are used to close extraction spaces in orthodontics. Force decay is a factor associated with polyurethane E-chains thus orthodontist should be aware of the varied factors affecting the rate of force decay of power chains.

Louis et al[2] evaluated the force decay of grey power chain and concluded that the greatest force loss occurred in the first 24 hrs. and heat had a pronounced effect on force decay and permanent deformation. Hershey and Reynolds[3] conducted study on force decay properties of power chain and found a 50% of force loss after the first day, with 40% of the original force remaining after 4 weeks. Ash and Nikolai[4] concluded that there was no difference between force decay rates of clear and grey power chains in vivo and vitro.

However, very few studies have been conducted on the effect of mouth rinses and their varying alcohol concentration as that is the first and foremost measure of oral hygiene maintenance. Terrah M. Larabee et al[1] evaluated the effect of alcohol containing mouth rinses on the force decay properties of power chain and found that alcohol increases the force decay but alcohol concentration has no affect at all. Chlorhexidine present in mouthwash solution may plasticize or cause disruption of the intermolecular bonds[6]

Thus the present study was aimed to evaluate the effects of commonly used mouth rinses in north India on the force decay properties of power chains during orthodontic space closure in vitro. Commercially available closed transparent and grey from rabbit Force Company were used in this study. The samples of power chains were stretched in four jigs and immersed in three mouth rinses (Colgate Plax, Listerine and Hexidine) and one in distilled water (control group).Force levels were calculated at various time intervals with the force gauge. All test groups showed significantly increased force decay compared with the control group. Among the test groups it was observed that as the alcohol concentration increased force degradation increased. It was minimum with Colgate Plax (12% alcohol) and maximum with Listerine (21% alcohol). Listerine Original appears to have a plasticizing effect on elastomeric chains & long- term use may adversely affect orthodontic

therapy[5]. These results were different from the previous reported studies on effects of alcohol concentration.

In addition to the effect of varying alcohol concentration it was also observed that force decay percentage was highest at 24 hrs. and grey chain showed less decay rate with colgate plax as compared to transparent chain but the overall decay pattern was similar for both power chains tested with other two mouth rinses.

Further study with different mouth rinses varying in alcoholic concentration is needed to throw light on the effect of mouth rinses on the force decay properties of Power chains.

CONCLUSION

1. Orthodontic space closure is commonly initiated with power chains and oral environmental factors like diet are going to affect the force decay properties of these products.

2. Alcohol causes an increase in force decay of power chains over time. With increase concentration causing increase decay.

3. The force decay was highest at 24 hrs. after placement and its increase in case where Listerine is used and least with Colgate Plax mouth rinse.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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