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Research Paper

The effects of varying alcohol concentrations commonly found in mouth rinses on the force decay of elastomeric chain (In vitro study)

Lalitha CH, Srinivas Kumar, Archana, Praneeth Reddy, Syed Amjad Hussain, Krishna Chaitanya, Salman

(Department of Orthodontics and Dentofacial Orthopedics, AMEs Dental College and Hospital, Raichur, India)

Abstract:
Introduction: For tooth movement and space consolidation, elastomeric power chain is frequently utilised in orthodontics. Various factors have been shown to impact the amount of force decay observed with elastomeric chains. In order to reduce plaque build-up and consequently avoid demineralization, mouth rinses should be administered during orthodontic mechanotherapy. Chlorhexidine acts in a preventive manner in the reduction of bacterial plaque, in patients undergoing orthodontic treatment. As a result of structural and molecular changes brought on by the mouthwash's alcohol component, the elastomeric chain begins to degrade. But ethanol's ability to force elastomeric chain breakdown at varied doses, as found in different mouthwashes, is a concern. This study aimed to investigate if increasing alcohol concentrations causes more elastomeric chain force decay by testing the impact of alcohol on force decay of elastomeric chains in vitro.
Aim: to evaluate the effect of alcohol concentration on the force decay
Objective: to see if the force degradation on the elastomeric chain in various mouthwashes increases with the alcohol content.
Materials and Methods: A study was conducted to test the effect of alcohol exposure on orthodontic elastomeric chain. A total of 20 specimens were divided into 4 test groups. Test groups exposed to different alcohol concentration of different commercially available mouth rinses (Cepacol -14% alcohol, Listerine - 21.6% alcohol chlorhexidine 11.6% alcohol and colgate plax 8.5%) for 60 seconds twice a day. Force measurements were taken at five time points (initial, 1 day, 7 days, 21 days, and 28 days).
Results: There were no significant differences among groups at the initial time point. Statistically significant effects of time on force decay were seen in all.
***Key words**: elastomeric chain, mouthwash, force degradation, dontrix guage*

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I. Introduction

Elastomeric power chain is commonly used in orthodontics to facilitate tooth movement and consolidate space. These polyurethane materials are manufactured as a spool of linked elastic chain, which can be cut to the specific number of modules needed. Due to the viscoelastic properties of power chain, however, the loss of force over time is inevitable and several studies have been done to illustrate this force decay.

There are two types of elastomers used in orthodontics. The first type is natural elastomers, which are used in inter-arch mechanics and which are usually referred to as ‘‘elastics.’’ The second type is synthetic elastomers, which are used in elastomeric chains, ligatures, or elastic threads and which are usually referred to as ‘‘elastics.

Orthodontic elastomeric chains are used in any movement that requires pulling, such as tooth retraction and protraction, space closure, and rotation correction. One of the biggest shortcomings of elastomers is the rapid decay of force over time. Clinically, orthodontic elastomeric chains are replaced at 3- to 4- week intervals as a result of force decay.

The use of mouthwashes during orthodontic treatment is recommended by dentists for the maintenance of oral hygiene and a reduction in the frequency of caries lesions. Several studies that have investigated the force degradation of different orthodontic elastics as the result of different pH, artificial saliva formulations,

temperatures, and alcohol concentrations in mouthwashes. Therefore, the aim of the study is to test the effect of alcohol on force decay of elastomeric chains in vivo in order to determine if increasing alcohol concentrations results in an increased amount of elastomeric chain force decay.

II. AIM OF THE STUDY

- The aim of the study was evaluate the force degradation of elastomeric chains when they exposed to different alcohol containing mouth washes.

Objectives of the study

- To evaluate the force degradation on elastomeric chain when exposed to different mouth washes.
- To assess the force decay on increasing the concentration of alcohol in different mouth washes.

III. MATERIALS AND METHOD

1. Elastomeric chain
2. Dentrix guage
3. Chlorhexidine mouth wash (11.6%)
4. Listerine mouthwash (21.6%)
5. Colgate plax (8.5%)
6. Cepacol (14%)

Method of Collection of Data

SAMPLE: The present study consists 20 samples of elastomeric chain they are divided into 4 groups:

1] Listerine group (11.6%)
2] Chlorhexidine group(11.6%)
3] Cepacol group (14%)
4] Colgate plax group (8.5%)

IV. METHODOLOGY

An in vivo study is carried out to test the effect of alcohol exposure on orthodontic elastomeric chain. A total 20 samples of were divided into 4 test groups. Four test groups were each exposed to different alcohol concentrations 21.6%, 11.6%, 14% and 8.5% for 60 seconds twice a day. Force measurements were taken at six time points (initial, 1 day, 7 days, 14 days, 21 days, and 28 days) by Dentrix gauge.

V. STATISTICAL ANALYSIS

The Statistical software IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) was used for the analyses of the data and Microsoft word and Excel were used to generate graphs, tables etc**.** Descriptive quantities data will be expressed in mean and standard deviation respectively. Analysis of variance (ANOVA) was used to find the significance of study parameters between the groups (Inter group analysis). Further post hoc analysis was carried out if the values of ANOVA test were significant.

VI. RESULTS

(Listerine)

Figure 1: Comparison of the force decay in terms of {Mean (SD)} after inserting in Listerine at different time intervals using Repeated measures ANOVA test

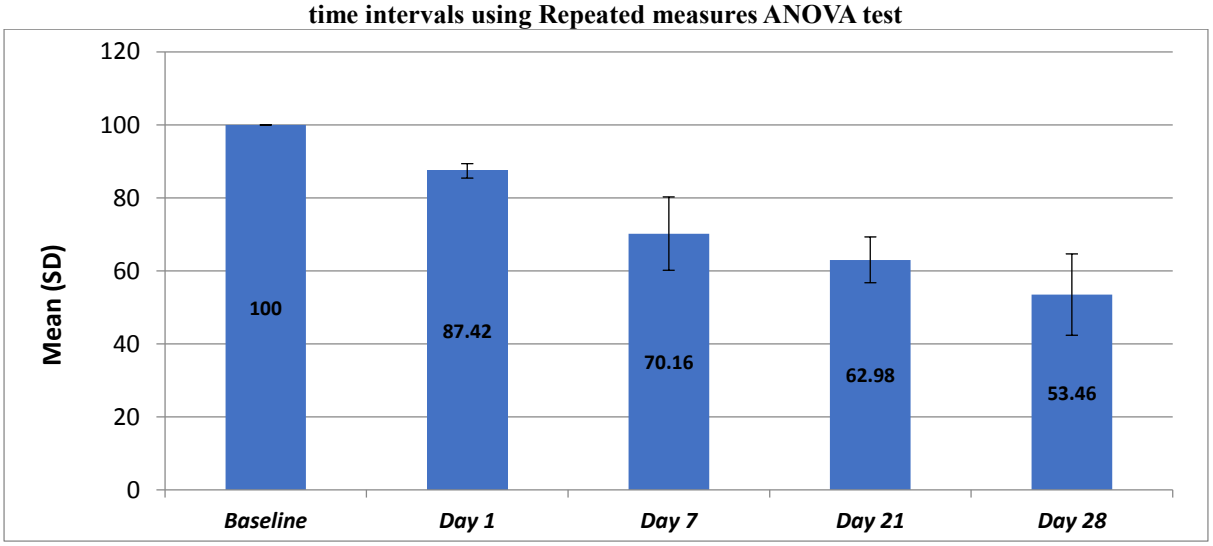


Figure 1 demonstrated that the force degradation of the listerine mouth wash shows that base line degradation of force was kept in the initial days was 100 and after one day the force level came to 87.42 and on day 7 70.16 and after 21 days the force level came to 62.98 and after 28 days the force level came to 53.46.

(Chlorhexidine)

Figure 2: Comparison of the force decay in terms of {Mean (SD)} after inserting in Chlorhexidine at different time intervals using Repeated measures ANOVA test

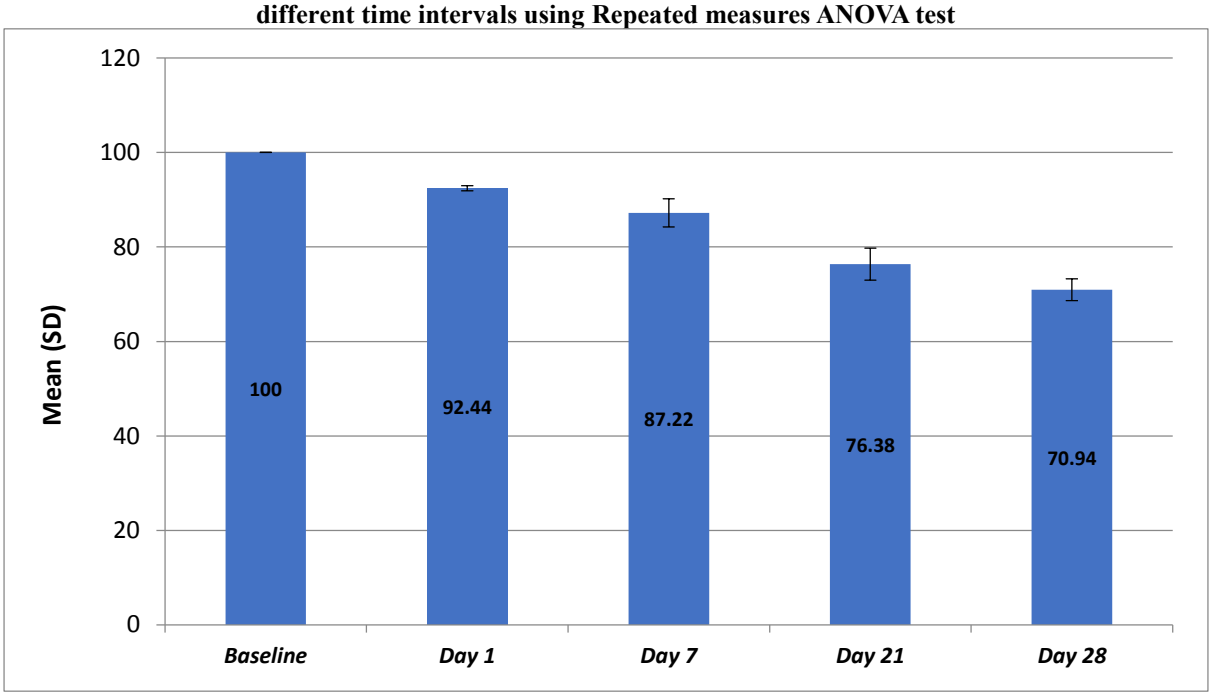


Figure 2 demonstrated that the force degradation of the chlorhexidine mouth wash shows that base line degradation of force was kept in the initial days was 100 and after one day the force level came to 92.44 and on day 7 87.22 and after 21 days the force level came to 76.38 and after 28 days the force level came to 70.94.

(Cepacol)

Figure 3: Comparison of the force decay in terms of {Mean (SD)} after inserting in Cepacol at different time intervals using Repeated measures ANOVA test

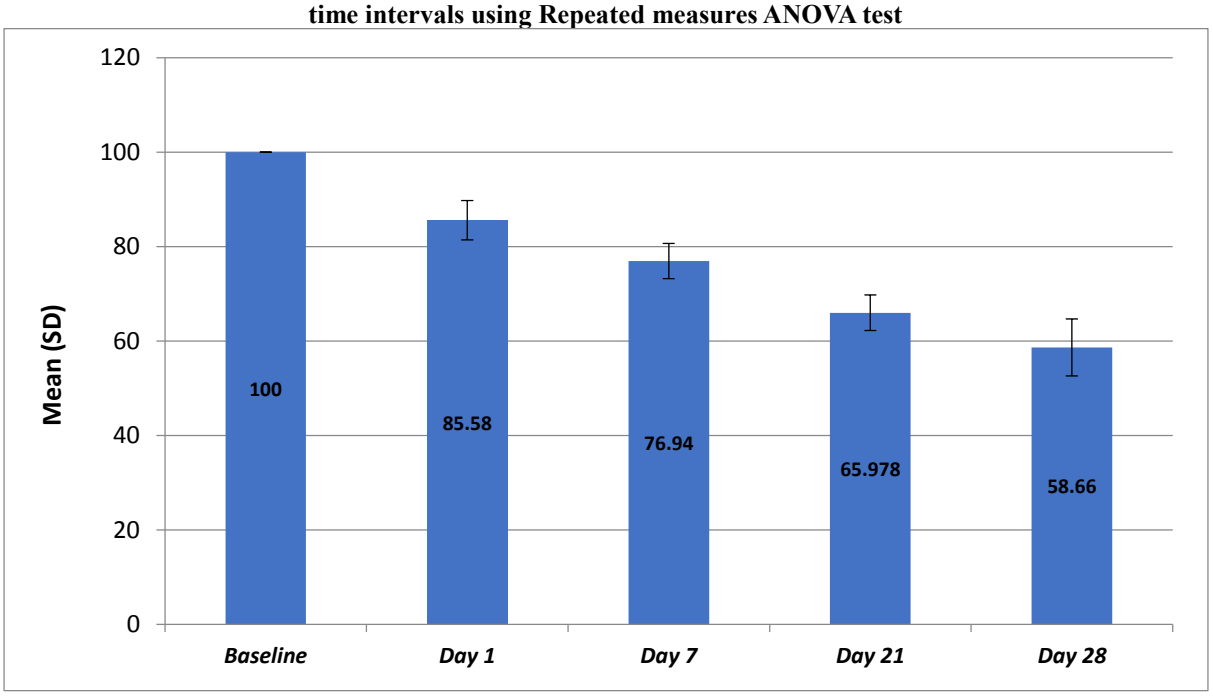


Figure 3 demonstrated that the force degradation of the cepacol mouth wash shows that base line degradation of force was kept in the initial days was 100 and after one day the force level came to 85.58, on day 7, 76.94 and after 21 days the force level came to 65.978 and after 28 days the force level came to 58.66.

(Colgate plax)

Figure 4: Comparison of the force decay in terms of {Mean (SD)} after inserting in Colgate plax at different time intervals using Repeated measures ANOVA test

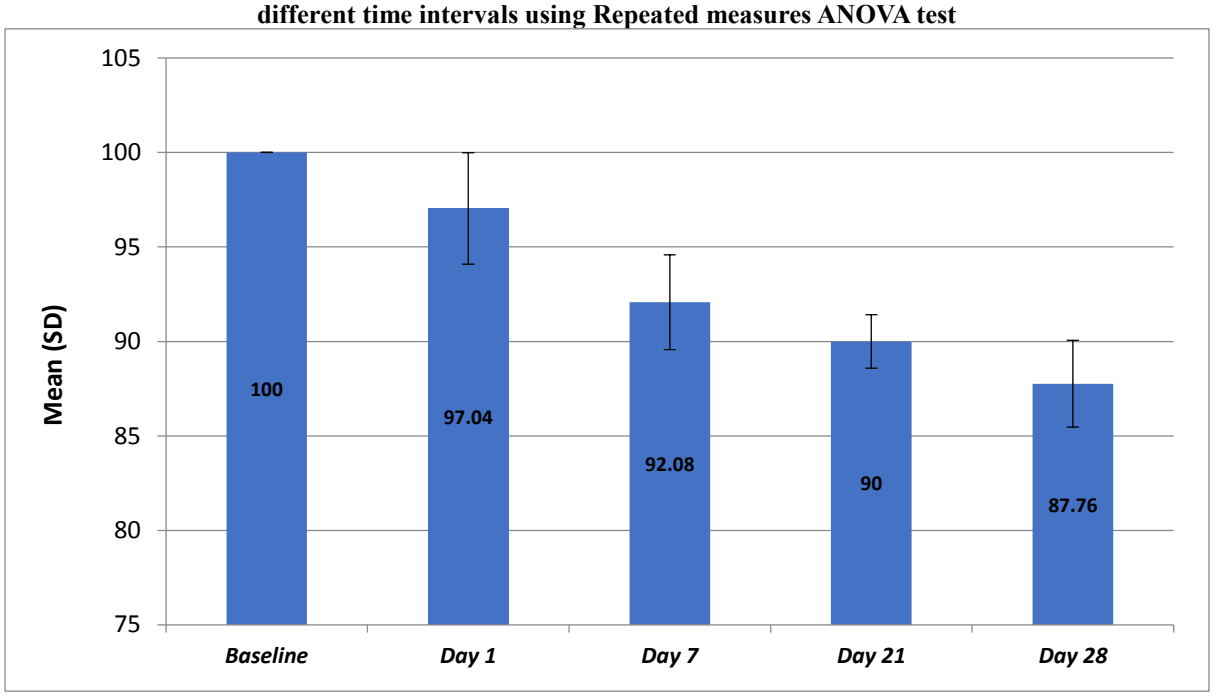
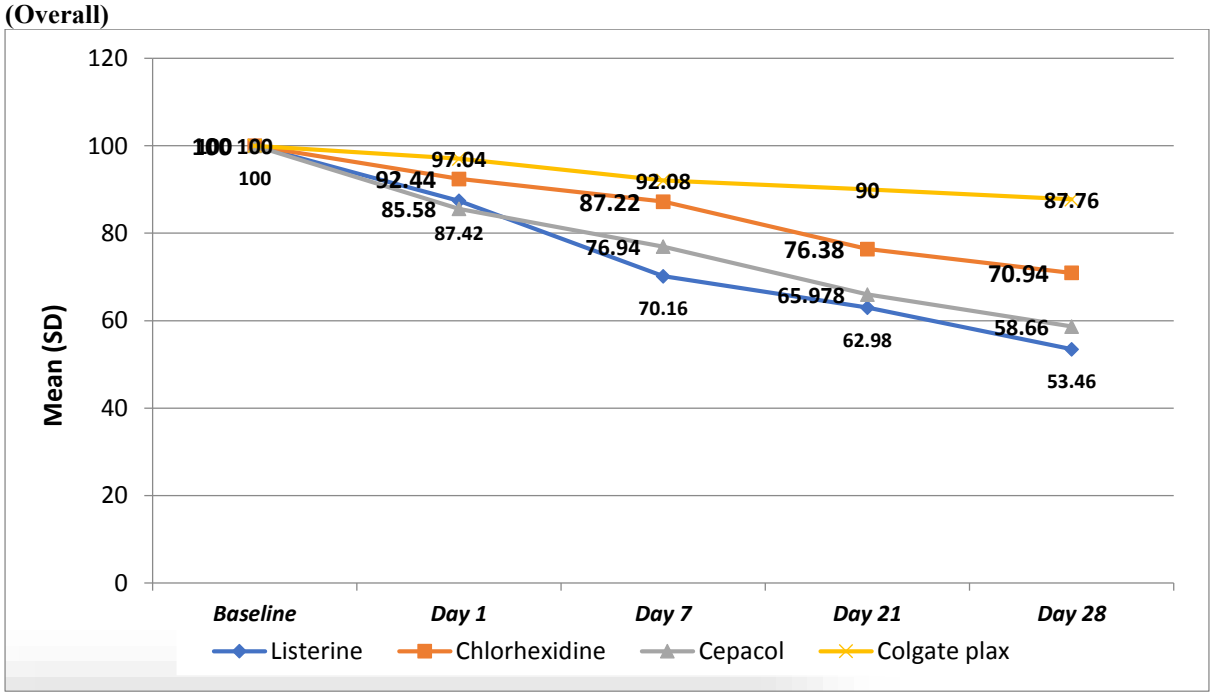


Figure 4 demonstrated that the force degradation of the colgate plax mouth wash shows that base line degradation of force was kept in the initial days was 100 and after one day the force level came to 97.04 and on day 7 , 92.08 and after 21 days the force level came to 90 and after 28 days the force level came to 87.76.

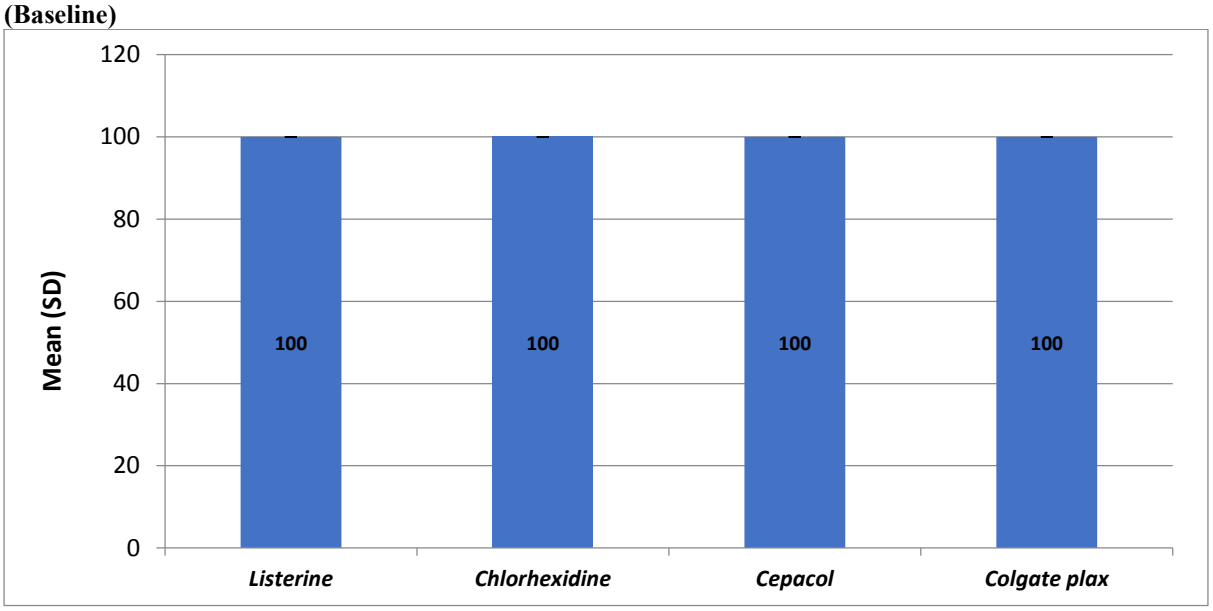
(Overall)



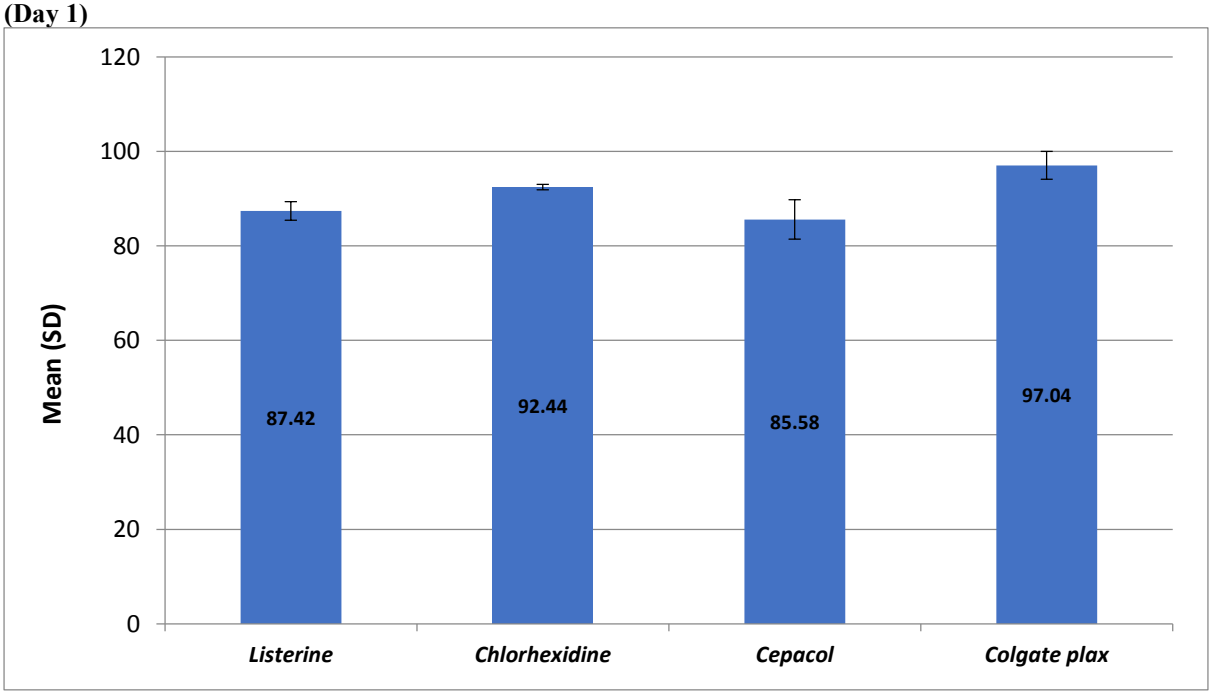
Figures (Intergroup)

Figure 1: Comparison of the force decay in terms of {Mean (SD)} after inserting in different solutions at different time intervals using ANOVA test

(Baseline)

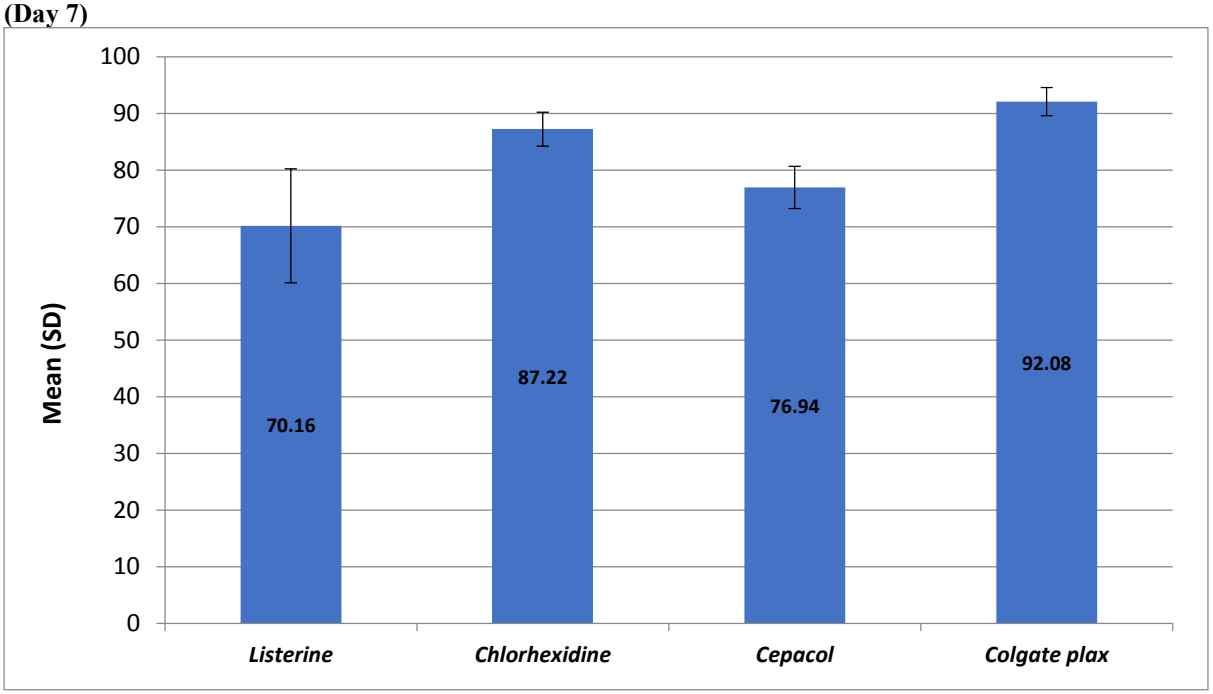


(Day 1)



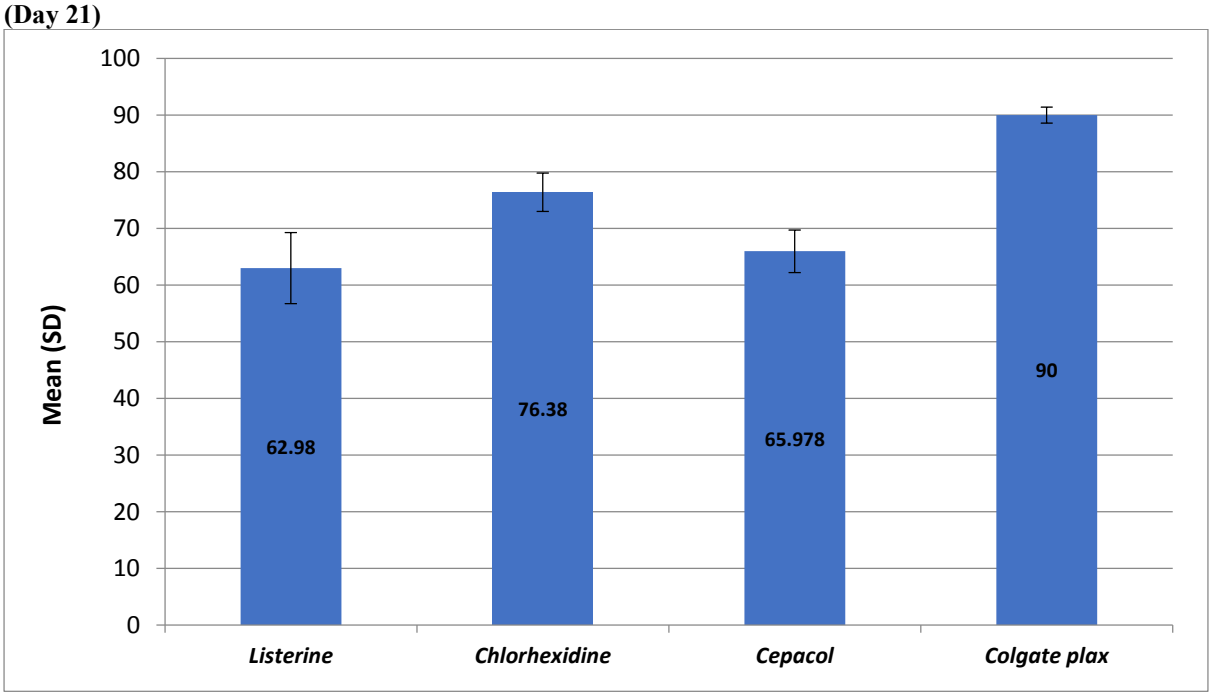
Figures shows statically significant results that on day one the force degradation was for listerine was 87.42, chlorhexidine was 92.44, cepacol was 85.58 and for the colgate plax was 97.04.

(Day 7)



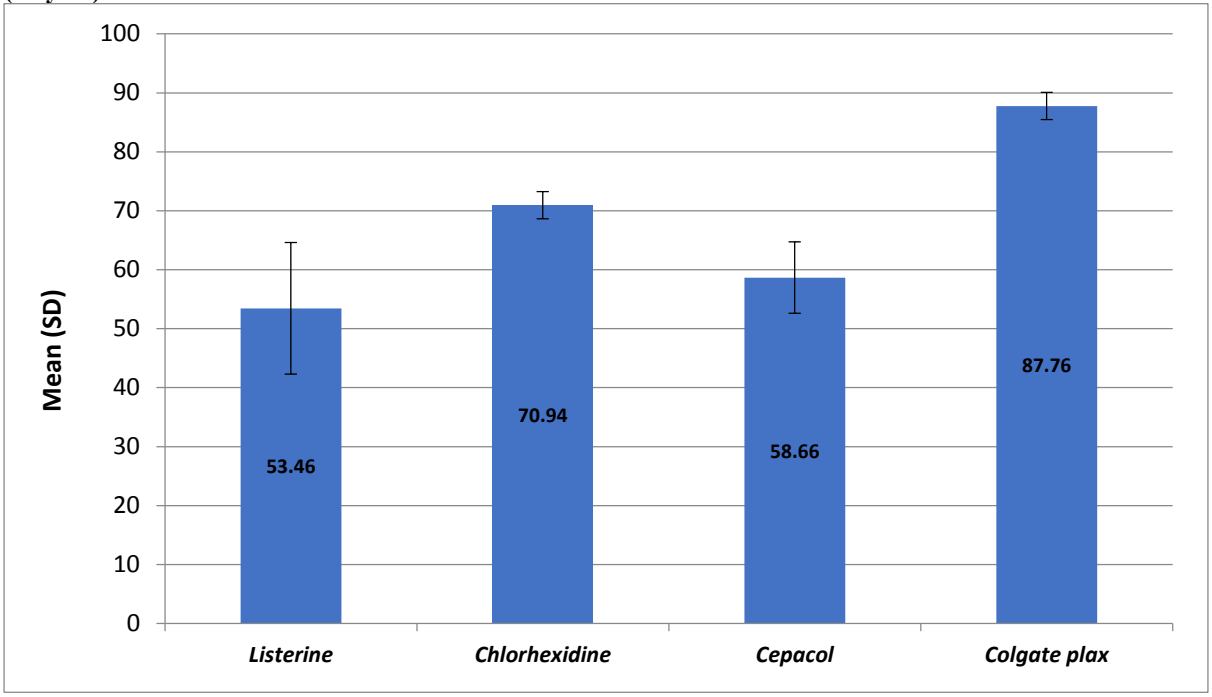
Figures shows statically significant results that on day 7th the force degradation was for listerine was 70.16, chlorhexidine was 87.22, cepacol was 76.94 and for the colgate plax was 92.08.

(Day 21)



Figures shows statically significant results that on day 21st the force degradation was for Listerine was 62.98, chlorhexidine was 76.38, cepacol was 65.975 and for the Colgate plax was 90.

(Day 28)



Figures shows statically significant results that on day on 28th force degradation was for Listerine was 53.46, chlorhexidine was 70.94, capicola was 58.66 and for the Colgate plax was 87.76.

VII. DISCUSSION

Elastomeric chains got wide popularity in daily orthodontic practice because they are economic, relatively hygienic, required less chair time and some types contain fluoride that reduced enamel decalcification. The clear type was undergoing discoloration by foods and drinks causing aesthetic problems.

Moreover, these elastics exhibited load relaxation when stretched beyond their elastic limit and this force loss made it intricate for practitioners to determine the actual force applied to dentition. In this study, four types of mouthwashes with different concentration of the alcohol were used to determine their effect on the force degradation of of clear elastic chains.

one of the studies done by Pithon et al revealed that there was no significant difference between immersion of elastomeric chains in two types of whitening mouthwashes. However, this was not in accordance with the results of the present study showed a significant decrease of elastomeric chain force immersed in mouthwash containing alcohols. In a recent study by Mirhashemi et al. evaluated the effect of different mouthwashes on active tiebacks it was concluded that Persica mouthwash caused greater force loss in comparison with control group. They also reported that active tiebacks of different colours had a different force loss pattern and different response to chemical agents such as mouth rinses. This was in accordance with our study in the present study also observed the force decay of elastomeric chain when exposed to different mouthwashes.

A study conducted by Sarmad S Al Kasar observed that the use of fluoridated mouthwash causes force degradation of elastomeric chains. Another study by Ramazanzadeh BA et al concluded that daily use of NaF mouth rinse does not affect force degradation of elastomeric chains. The force degradation of elastic chain in fluoridated mouthwash solution more than others could be due to fluoride ions present in solution. In our study it was observed that alcohol containing mouthwashes also causes the force decay of the elastomeric chain.

A study by Terrah M et al evaluated the effect of alcohol on force decay of the elastomeric chains. They concluded that alcohol causes an increase in force decay of elastomeric chains over time but concertation dependence force decay was not observed. This was in accordance with present study it was noted that alcohol causes the force decay of the elastomeric chain.

One of the studies conducted by Amir Hussain et al they have compared the effects of three different mouthwashes including persica, chlorhexidine, sodium fluoride and the combination of chlorhexidine and sodium fluoride on force decay of orthodontic elastomeric chains. Application of persica, chlorhexidine, sodium fluoride and the combination of chlorhexidine and sodium fluoride mouthwashes had no adverse effect on the force degradation of orthodontic elastomeric chains. The results of our study were in contrast with results of this study in our study it was noticed that mouth washes affect the force decay of the elastomeric chains.

One of the studies conducted by Ali R et al they evaluated and compared the force degradation of two types of elastomeric chains following deferent periods of immersion in zinc-containing mouthwashes. They have

concluded that there is no clinically significant deterrence between both types of elastomeric chains, although Super Elasto-Force delivered a higher force level. pH of the mouthwashes could play a role in force degradation over time, rather than other ingredients including zinc. But in our study, it was noted that alcohol also play important role in the force decay of the elastomeric chain.

Limitations of the study

- In this study only one type of elastomeric chain was tested to evaluate the effect of different mouthwashes on the force decay pattern. However, it is suggested that different type of elastomeric products be compared in accordance with their behavior in exposure to different mouth rinses.
- Moreover, several new mouthwashes are introducing every day for orthodontic patients and evaluating the effect of other commercially available mouthwashes on the mechanical properties of elastomeric chains is suggested for further studies.
- Further studies should be conducted to ascertained the degree of elastomeric chain force decay observed when exposed to alcohol in vivo .

VIII. CONCLUSION

- Within the limitation of this study, it was concluded that the application of alcohol containing chlorhexidine (11.6%), listerine (21.6%), Cepacol(14%) and colgate plax (8.5%) mouthwashes had adverse effect on the force decay of elastomeric chains.
- Alcohol causes an increase in force decay of elastomeric chain over time.

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