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Evaluation and Comparison of Force Decay Characteristics of Latex andNon-Latex Orthodontic Elastics in Vitro Study

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Abstract: *Elastics are a source of continuous orthodontic force with considerable force decay through the first day of use, most of the decay is in the first hour. There is hardly any phase of fixed orthodontic treatment which is completed without their use. They provide the reliable force delivery and are most economical. The present in vitro study was undertaken to evaluate force decay characteristic of orthodontic latex and non-latex elastics over 36hours.120 samples (Latex elastics-60 and Non-latex elastics-60) were mounted between crimpable hook and molar hook on the acrylic typhodonts at the 25mm distance with split mouth design (right side-latex elastic and left side- non-latex elastic) for intermaxillary and intramaxillary pattern. The acrylic typhodonts were stored in commercially available Wet mouth solution at room temperature throughout the test. There is significant difference in force decay between latex and non-latex elastics at time interval 12hr, 24hr and 36hr ($p \leq 0.0001$). The force decay was more obvious in non-latex orthodontic elastics than in latex elastics. There was no significant difference in force decay between latex intramaxillary and intermaxillary traction and for non-latex intramaxillary and intermaxillary traction.*

Keywords:*Force decay, intramaxillary and intermaxillary, Latex and Non-latex elastics*

I. Introduction

Materials used in an orthodontic office to apply force to move teeth include archwire loops, coil springs, elastics and synthetic elastomers. Elastics are a source of continuous orthodontic force with considerable force decay through the first day of use, most of the decay is in the first hour. There is hardly any phase of fixed orthodontic treatment which is completed without their use. They provide the reliable force delivery and are most economical.These auxiliaries, made from natural rubber, are replaced on a daily basis, but concern associated with their use pertains to the force relaxation of these materials.Clinical treatment procedures should take in to consideration the rapid initial force decay of elastics material that occurs during the first day and the residual forces remaining. They can be latex or non-latex that is polyurethane based. Advantages of latex elastics include their high flexibility, relatively increased force, low costs, and greater ability to return to their original dimensions after substantial deformation compared with non-latex elastics. It is easy for patients themselves to change the elastics and maintain good oral hygiene.

Over the years, there is an increase in the cases of latex 2 sensitivity, and consequently this demands the production and commercialization of latex-free products. In the 1960s an alternative synthetic material, or latex-free, was introduced in Orthodontics.

Since the early 1990s synthetic products have been offered in the market for latex-sensitive patients and are sold as non-latex elastics. There is limited information on the risk that latex elastics may pose to patients. Some have estimated that 0.12–6% of the general population and 6.2% of dental professionals have hypersensitivity to latex protein-2. Although the risk is not yet clear, it would still be inadvisable to prescribe latex elastics to a patient with a known latex allergy.

The clinical guidelines for the use of latex elastics may not necessarily apply to the use of non-latex elastics. Consequently, the material properties of non-latex elastics must be evaluated experimentally and compared with latex materials to develop clinical guidelines for non-latex elastics.Some studies suggest that the latex elastics do not need to be replaced frequently because after the extreme rate of force decay on the 1st day the force would remain relatively constant for the 2nd day. Clinician using orthodontic elastics need to know the forces applied to teeth at a given extension and how this force declines over time, which depends upon different type of elastics composition and manufacturer.The results depend upon the conditions under which the elastics were tested. They lose some force when tested under water, artificial saliva or in the mouth. Exposure of latex to air was found to cause a loss of force. Variation in composition occur in elastic depend upon the place of purchase.

In the present vitro study, efforts have focused on evaluation and comparison of force decay characteristics of latex and non-latex elastics for intramaxillary and intermaxillary tractions in commercially available wet mouth solution at room temperature over 36hours.

II. Review Of Literature

In 1976, a study by Wong[1],looked at two manufactures E-chains distracted to and maintained at 17mm while stored in water at 37˚ C. His data suggested that the greatest amount of force loss took place in the first 3hours and that, in agreement with Andreasen and Bishara, an initial force loss of 50% to 75% occurred in the first 24hours. He also found considerable variation in the initial force delivery of chains from different manufactures.

In 1980, Nikolai RJ et al[2]examined and compared the behavior over time, under periodic, interrupted loading of four activating elements: a latex elastic, a natural rubber elastic, soft-pull spring, and a medium-pull spring. They concluded that one set of springs, incorporated in a headgear, need not be changed during the normal course of extraoral appliance wear. On the other hand, the relaxation of the natural rubber elastics over the initial 14-hour period was judged excessive: their use, at least to high levels of activation, is not recommended.

In 1990,Huget et al[3] tried to define the mechanisms that contribute to the time-dependent load decay phenomenon of elastomeric chains. The chains were loaded to 50%, 100%, and 200% of the original length followed by 90 seconds of recovery time before being subjected to a second loading. They concluded that the load decay associated with elastomeric chains for 1 and 7 days of water storage may be the result of water sorption and the concurrent formation of hydrogen bonds between the water molecules and macromolecules of the elastomers.

In 1990, Ferriter et al[4]studied in vitro the effect of pH on the force degradation rates of seven commercial orthodontic polyurethane chain elastics and concluded that all the test products yielded a significantly greater force-decay rate in the basic (pH 7.26) solution than in the acidic (pH 4.95) solution over 4 weeks. A hypothesis is presented that the decay rate of orthodontic polyurethane chain elastics is inversely proportional to the oral pH.

In 1993, Liu CC et al[5] investigated the applicability of compliance measurement to the assessment of the viscoelastic properties oflatex and vulcanized cis-polyisoprene orthodontic elastic, compared these measurements with force decay measurements, and assess the effect of repeated stretching on the force decay and compliance properties of these elastics. They concluded that both the force decay and compliance measurements showed latex orthodontic elastics were remarkably stable despite significant repeated stretching.

In 2000, Kanchana P et al[6] studied the force extension characteristics of orthodontic elastic made ofnatural rubber latex by manufacturers subjected to static testing under dry and wet condition. The authorsconcluded that under dry test conditions, there were significant differences ($P< .0001$) between comparable sizesof elastics among all manufacturers but, from a practical point of view, these changes can be neglected becausethey do not have direct clinical application. The characteristics of force degradation was immediately reducedafter initial elongation and then kept gradually decreasing throughout the 3-day period. There were significantdifference in force degradation characteristics ($P<0.0001$) between extensions, force magnitudes, and manufacturers.

In 2001, Russell et al[7]assessed the mechanical properties of latex and non-latex orthodontic elastics, they found a reduction in force to 75% of the manufacturer's values with the latex elastics and a reduction to 60% to manufacturer's value with non-latex elastics. They concluded that the latex elastics are superior to non-latex elastics in terms of mechanical properties.

In 2003, Michael L. Kersey et al[8]were studied to determine the effects of repeated stretching (cyclic testing) and static testing on the force decay properties of two different types of orthodontic elastics from a singlesupplier. Samples of American Orthodontics 0.25 inch, 4.5 Oz (6.35mm, 127.5 g) latex and non-latex elastics were used. Static testing involved stretching the elastics to three times marketed internal diameter (19.05mm) andmeasuring force levels at interval over 24 hours. Cyclic testing used the same initial extension but cycled the elastics in additional 24.7mm to simulate extension with maximal opening in the mouth. Cyclic testing causedsignificantly more force loss andthis difference occurredprimarily within the first 30minutes.

In 2003,Chung Hwang et al[9]compared the mechanical and biological properties of latex and siliconerubber bands under dry and wet conditions. When extended three times the lumen diameter the silicone elasticsexhibited greatest force decay which approximated 30% force decay over 2 days. Latex elastics also showed a similar pattern of decay. But the silicone elastics exhibited increased force decay as extension increased.Biologically silicone elastics were found to be superior to latex elastics and they showed less discrepancy of forcedegradation between air and saliva conditions.

In 2003, Kersey ML et al[10] compared 4 brands of non-latex orthodontic elastics with respect to initial force produced and force decay over a 24-hours period and concluded that the force decay patterns of all brands were very similar, but there were significant differences in their abilities to withstand testing. Grouped average percentages of initial force at 4, 8, 24 hours were 68%, 61%, and 49%, respectively, for the elastics that did not break during testing

In 2004,Mark Henson et al[11]evaluated the neuronal cytotoxicity of latex and non-latex orthodontic elastics. Neurotoxicity was checked in murine cerebral cortical cell cultures. Latex elastics were found to be associated with more cell death than the non-latex elastics. Cytotoxicity of latex elastics was found to be due to presence of zinc containing compounds added during pre-vulcanization process. But because ingestion of zinc is not a health risk, the results suggested that, in spite of higher cytotoxicity of latex elastics than the non-latex elastics their use in orthodontic field is acceptable.

In 2006,Gioka et al[12]assessed the force relaxation of latex elastics occurring within 24 hours of extension and estimated the extension required to reach the reported force. This study concluded that Latex elastics show force relaxation in the order of 25%, which consists an initial high slope component and a latent part of decreased rate. Most of the relaxation was shown to occur within the first 3-5 hours after extension, regardless of size, manufacturer, or force level of the elastic.

In 2006, Bertoncini C et al[13]evaluated the effectiveness of non-latex elastics regarding their use in clinical practice for latex- intolerant individuals. The latex elastics undergo less loss of force than the non-latexelastics. Regarding the variation of the inner diameter, in every test, non-latex elastics showed a moresignificantdeformation thanlatex ones and the difference was significant.

In 2007,Wang et al[14]evaluated force degradation characteristics of orthodontic latex elastics in vivo and in vitro. Samples of 3/16-inch latex elastics were investigated, for the intermaxillary and intramaxillary tractions. The elastics in the control groups were set in artificial saliva and dry room conditions and were stretched 20 mm. This Study concluded that various environments affected the force degradation of orthodontic elastics. The force decay was more obvious in intermaxillary tractions than in intramaxillary tractions. The most significant force degradation occurred in first half hour. But the magnitudes of force loss were different.

In 2010, Daniel J. Fernades et al[15]evaluated the force extension relaxation of different manufacturers and diameters of latex elastics subjected to static tensile under dry and wet conditions. Sample sizes of 15 elastics from American Orthodontics, TP (La porte, Ind), and Morelli Orthodontics (Sorocaba SP, Brazil) were used. Significant differences in force extension relaxation were noted for elastics from these manufacturers. Force relaxation over the time period was AO>Morelli>TP for 3/16 elastics, AO>TP>Morelli for ¼ elastics, and TP>AO>Morelli for 5/16 elastics.

In 2010, Aljhani As et al[16] tested the force decay properties of different kinds of orthodontic elastics after subjecting them to static and cycling testing and concluded that there are no significant differences between different groups of latex elastics in terms of force loss or even between the different groups of the non-latex elastics under static testing. There was significant difference observed between latex and non-latex groups which was due to the different structure and composition of the polymer involved.

In 2012, Oesterie LJ et al[17] surveyed practicing orthodontists to determine the interarch latex elastic forces they prescribe in different malocclusion scenarios and concluded that there were considerable variations in the forces selected for all cases. Latex elastic force decays significantly during clinical use. Elastics should be selected with initially higher forces than desired.

III. Materials And Method

The present in vitro study was designed for evaluation and comparison of force decay of orthodontic latex and non-latex elastics (3/16 inch size, 4.5oz-medium force, 4.8 mm diameter, American orthodontics) at the Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Ahmedabad, which consist of 120 samples (Latex elastics-60 and Non-latex elastics-60)

3.1. ARMAMENTARIUM:

- Latex And Non-Latex elastics of size 3/16 inch, 4.5 Oz-medium force, 4.8 mm diameter (American Orthodontics).
- Push-pull meter with load cell capacity of 300gm (YUYUTSU). The maximum permissible tolerance was ±0.2gms.
- Acrylic typhodont of fixed orthodontic mechanics with preadjusted edgewise appliance (PAE), DAMON and ICE technique.
- Crimpable hooks
- Commercially available Wet mouth solution (which is used for wetting dry mouth caused by any therapy or disorders). Ingredients are : water, glycerine, cellulose gum, sodium saccharin, parabens, flavour
- Tweezer
- Curved probe
- Marker
- Vernier caliper

- Scale

Intermaxillary and intramaxillary distance of 25mm was kept from molar hook to crimpable hook.

3.1.1 ***armamentarium***

3.2. Method:

The samples of orthodontic latex and non-latex elastic of 3/16 inch size, 4.5oz-medium force, 4.8 mm diameter (American orthodontic) were collected. They were within their expiration dates and stored in sealed plastic packages in a cool and dark environment at room temperature. For vitro study elastics were set in artificial condition (Wet mouth solution). Elastics were mounted between crimpable hook and molar hook on the acrylic typhodont at 25mm distance (figure). The samples in the study with split mouth design were categorized in to two groups for force measurementtwelve times.Force measurements were taken at 11 intervals: 0, 1, 2, 3, 6, 9, 12, 24, 27, 30, 33 and 36hours.

Group-A -Latex elastics on right side
Subgroups:
Subgroup ***A1***- Intramaxillary traction
Subgroup ***A2*** -intermaxillary traction

Group-B - Non-latex elastics on left side
Subgroups:
Subgroup ***B1***- Intramaxillary traction
Subgroup ***B2*** **-**intermaxillary traction

3.2.1. right side-latex elastics

3.2.2.left side- non-latex elastics

3.2.3. typhodonts in wet mouth solutions

Time: Schedule For Force Measurement

1st DAY		NIGHT TIME		2nd DAY	
Interval	**Time**	**Interval**	**Time**	**Interval**	**Time**
Baseline (0hr)	9am(After Breakfast)	12hr	9pm To 9am	12hr	9am(24hrs)
1hr	10am (1hr)	Same Elastics Continued			
1hr	11am(2hrs)				
1hr	12pm(3hrs)			3hr	12pm(27hrs)
3hr	3pm(6hrs)			3hr	3pm(30hrs)
3hr	6pm(9hrs)			3hr	6pm(33hrs)
3hr	9pm(12hrs)			3hr	9pm(36hrs)

With the help of tweezer, each elastic band was carefully transferred to the hook of push-pull meter. Force magnitude of the elastics when stretched at the distance of 25mm along the Vernier Caliper were recorded immediately after they transferred on hook of push-pull meter. The tensile readings were recorded in grams. The direction of the hook of the push-pull meter was kept along the long axis of the elastics. To ensure the consistency of the tests, all measurements were performed by one observer.

3.2.4.force measurement of latex intreamaxillary and intermaxillary elastics with push-pull gauge

3.2.5.force measurement ofnon-latex intreamaxillary and intermaxillary elastics with push-pull gauge

For each group and interval, the mean, percentage and standard deviations were calculated. Post Hoc Tukey test was used to determine statistically significant differences among various testing materials and different time intervals.

IV. Result And Discussion

Elastics have long become an essential part of the orthodontic clinic, and their importance and widespread use have attracted interest in orthodontic research.For the present in vitro study 30 typhodont with fixed orthodontic appliance (American orthodontics, Damon clear and ICE) were selected for intramaxillary-class I and intermaxillary-class II traction. Elastics were not removed except for force measurement. This study compared only one company's latex elastic with its non-latex elastic of size 3/16 inch, 4.5oz medium force, 4.8mm diameter - only one size and force level of elastics (American Orthodontics). The force measurement system we used push-pull meter with load cell capacity of 300gms with maximum permissible tolerance ±2gmsa significant advantage of the system used in this study.

Various studies has proven that the degree of swelling of solvent to latex rubber is higher in extension than in relaxation. Thus the elasticity and force decay are different in various environment-artificial saliva, dry air condition, wet mouth solution, oral environment of different subjects etc. In the present vitro study there was static extension and relatively lower room temperature, pH of wet mouth solution was 7.21 which is almost similar to oral environment.

Table and Graph- 4.1shows comparison of force decay of latex and non-latex elastics in intramaxillary traction at various time intervals between subgroup A1 and B1 in vitro study, which was highly significant at 12hr, 24hrand 36hr ($p \leq 0.0001$). The percentage of initial force remaining was 80.54% for A1 and 75.49% for B1, there was a more force loss of 5.05% in B1 at 12hr. After a period of 12hrs the force was measured on 2nd day for 24hrs. The force was 75.50% for A1 and 69.50% for B1, there was a more force loss of 6% in B1 at 24hr. At the 36hrinterval the force was 66.35% for A1 and 58.31% for B1, there was a more force loss of 8.04% in B1, which isslightly higher than 12hr and 24hr intervals. The results of this study indicate the differences in force magnitudeof latex and non-latex intramaxillary elastics, there was more force loss of 5.53% over 24hrs and 6.36% over 36hrs in B1 than A1with minimum difference of 0.95% force loss between 12 to 24hrs at night. **The** rates of force decay of intramaxillary elastics at 12hr,24hr and 36hr was 19.46%, 24.50% and 33.65% for latexelastics and 24.51%,30.50%, 41.69% for non-latex elasticrespectively.

Table And Graph No.4.1: Comparison Of Force Decay Of Latex And Non-Latex Elastics In Intramaxillary Traction At Various Time Interval Between Subgroup A1 And B1.

TIME INTERVAL	N		MEAN DIFFERENCE (A1-B1)	SD	P – VALUE
	A1	B1			
Baseline (0 Hour)	30	30	0.1667	0.54	1.000
1 Hour	30	30	5.08	2.21	.019
2 Hour	30	30	-15.41	1.02	0.000
3 Hour	30	30	5.83	0.89	.000
6 Hour	30	30	-32.25	204.24	.0
9 Hour	30	30	7.0833	0.76	0.000
12 Hour	30	30	8.25	0.73	.000
24 Hour	30	30	9.75	1.40	.000
27 Hour	30	30	10.8333	0.53	0.000
30 Hour	30	30	12.51	0.14	0.000
33 Hour	30	30	12.6500	0.14	0.000
36 Hour	30	30	13.00	1.17	.000

$p<0.05$ = significant, $p<0.01$ = highly significant.

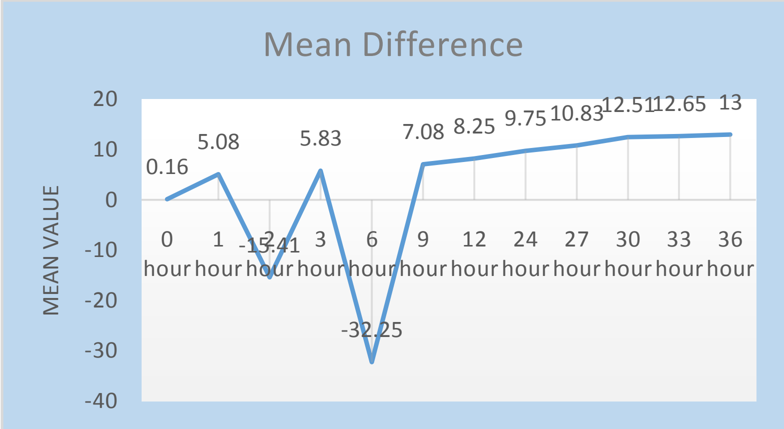
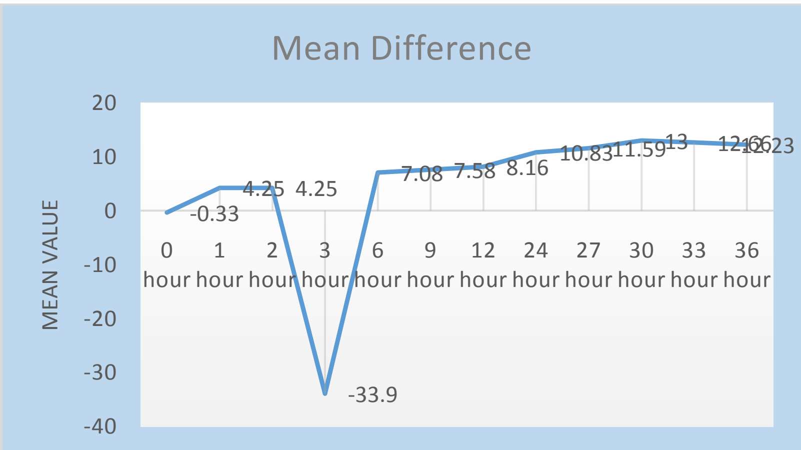


Table and Graph- 4.2 shows comparison of force decay of latex and non-latex elastics in intermaxillary traction at various time intervals between subgroup A2 and B2 in vitro study. There was significant difference at 12hr,24hr, 36hr time interval as p≤0.0001. The percentage of initial force remaining was 79.99% for A2 and 74.75% for B2 at 12hr, there was a more force loss of 5.24% in B2. After a period of 12hrs the force was measured on2nd day for 24hrs, the force was 75.36% for A2 and 68.47 % for B2, there was a more force loss of 6.89% in B2 at 24hr during night. At the 36hr interval the force was 65.42% for A2 and 57.68% for B2, there was a more forceloss of 7.74% in B2, which is slightly higher than 12hr and 24hr intervals. The results of this study indicate the differences in force magnitude of latex and non-latex intermaxillary elastics, there was more force loss in B2 thanA2. **The rates of force decay of intermaxillary elastics at 12hr,24hr and 36hr was 20.01%, 24.64% and34.58% for latex elastics and 25.25%, 31.53%, 42.32% for non-latex elastic respectively.**

Table and Graph No.4.2: Comparison Of Force Decay Of Latex And Non-Latex Elastics In Intermaxillary Traction At Various Time Interval Between Subgroup A2 And B2.

TIME INTERVAL	N		MEAN DIFFERENCE (A2-B2)	SD	P – VALUE
	A2	B2			
Baseline (0 Hour)	30	30	-0.3333	0.87	1.000
1 Hour	30	30	4.2500	0.98	.132
2 Hour	30	30	4.2500	0.64	0.132
3 Hour	30	30	-33.900000	208.56	.678
6 Hour	30	30	7.0833	0.15	1.000
9 Hour	30	30	7.5833	0.84	0.002
12 Hour	30	30	8.1667*	0.42	.000
24 Hour	30	30	10.833333*	1.14	.000
27 Hour	30	30	11.5900	0.76	0.000
30 Hour	30	30	13.0000	0.24	0.000
33 Hour	30	30	12.6666	0.54	0.000
36 Hour	30	30	12.2333*	0.88	.000

P≤0.05 = Significant, P≤0.01= Highly Significant.



Similar to the study by *Rusesell et al*, the results of the present study indicate a significant difference between the two materials. Therefore, simple in vitro testing is unable to represent the actual clinical applications. According to study by *Aljhani As and Aldrees AA*, there was significant difference observed between latex and nonlatex groups which was due to the different structure and composition of the polymer involved. Study by *Bertoncini et al* indicated that non-latex elastic become more deformed with use than latex. The latex elastics undergo less loss of force than the non-latex which was significant.

Table and Graph-4.3shows comparison of force decay of latex elastics in intramaxillary and intermaxillary traction at various time interval between subgroup A1 and A2. There was no significant difference in force decay at various time interval (p=1). The rates of force decay of latex elastics at 12hr,24hr and 36hr was 19.46%, 24.50% and 33.65% for intramaxillry elastics and 20.01%, 24.64%, 34.58% for intermaxillry elastics respectively.

Table and Graph No.4.3: Comparison Of Force Decay Of Latex Elastics In Intramaxillary And In Intermaxillary Traction At Various Time Interval Between Subgroup A1 And A2

Time interval	N		Mean Difference (A1-A2)	SD	p – value
	A1	A2			
Baseline(0 Hour)	30	30	-0.833	0.24	1.000
1 Hour	30	30	.8333	0.67	.999
2 Hour	30	30	16.9177	0.54	0.000
3 Hour	30	30	1.250000	0.51	1.000
6 Hour	30	30	.0833	0.87	1.000
9 Hour	30	30	.833	0.48	1.000
12 Hour	30	30	.8333	0.69	1.000
24 Hour	30	30	.166667	0.28	1.000
27 Hour	30	30	0.667	0.79	1.000
30 Hour	30	30	0.2614	0.24	1.000
33 Hour	30	30	0.7500	0.47	1.000
36 Hour	30	30	1.4333	0.98	.998

p≤0.05 = significant, p≤0.01= highly significant.

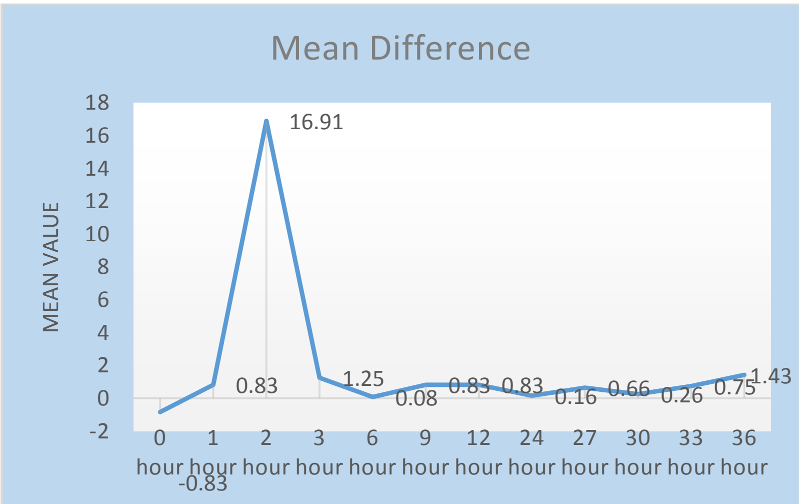
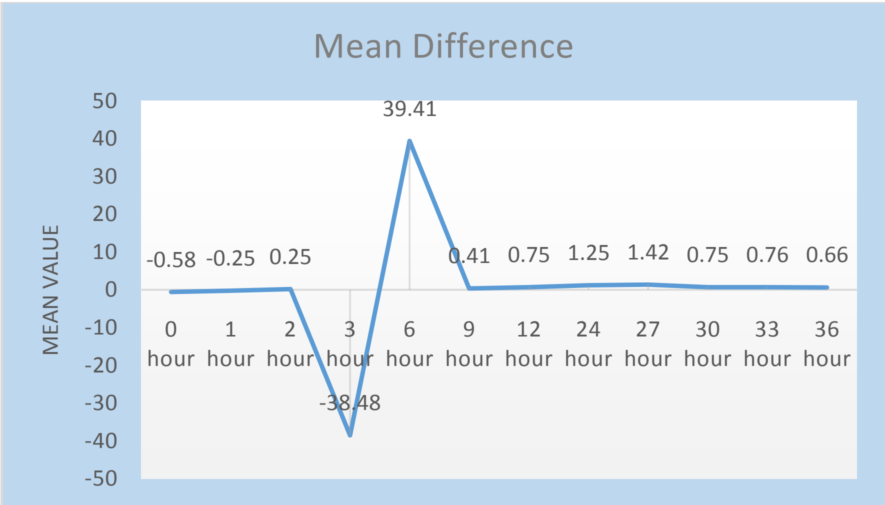


Table and Graph-4.4shows comparison of force decay of non-latex elastics in intramaxillary and intermaxillary traction at various time interval between subgroup B1 and B2. There was no significant difference in force degradation between B1 and B2 (p≤1). The rates of force decay of non-latex elastics at 12hr,24hr and 36hr was 24.51%, 30.50% and 41.69% for intramaxillry elastics and 25.25%, 31.53%, 42.32% for intermaxillry elastics respectively.

Table and Graph No.4.4: Comparison Of Force Decay Of Non-Latex Elastics In Intramaxillary And In Intermaxillary Traction At Various Time Interval Between Subgroup B1 And B2.

TIME INTERVAL	N		MEAN DIFFERENCE (B1-B2)	SD	P – VALUE
	B1	B2			
Baseline (0 Hour)	30	30	-0.5833	0.83	1.000
1 Hour	30	30	-.2500	0.56	1.000
2 Hour	30	30	.2500	0.64	1.000
3 Hour	30	30	-38.483333	208.17	.520
6 Hour	30	30	39.4167	203.52	.446
9 Hour	30	30	0.4167	0.75	1.000
12 Hour	30	30	.7500	0.46	1.000
24 Hour	30	30	1.250000	0.02	.998
27 Hour	30	30	1.4233	0.18	0.994
30 Hour	30	30	0.7500	0.02	1.000
33 Hour	30	30	0.7667	0.54	1.000
36 Hour	30	30	.6667	0.69	1.000

P≤0.05 = Significant, P<0.01= Significant.



The oral environment exerts greater effects on the elastics. This occurs because the oral cavity includes a wide array of potent aging factors such as pH fluctuations, temperature, enzymatic and microbial actions etc. However much in vitro approaches underestimate the extent and severity of intraoral agents, some variables could be reproduced. These variable consist of time, load, temperature, humidity and stretching, similar to study by ***Daniel J. Fernandes et al.***

V. Conclusion

There is significant difference between subgroup A1 and B1 at time interval 12hr, 24hr and 36hr (p≤0.0001).The percentage of initial force remaining after 12hrs was 80.54%, after 24hrs was 75.50%, after 36hrs was 66.35% for latex intramaxillary elastics (A1). At the same time for non-latex intramaxillary elastic (B1) was 75.49%, 69.50% and 58.35% respectively. Non-latex intramaxillary elastics shows more force loss than the latex groups over the period of time, there is a remarkable more force loss of 5.05% at 12hr, 6% at 24hr and 8.04% at 36hr.

There is significant difference between subgroup A2 and B2 at time interval 12hr, 24hr and 36hr (p≤0.0001). The percentage of initial force remaining after 12hrs was 79.99%, after 24hrs was around 75.36%, after 36hrs was 65.42%for latex intermaxillary elastics (A2). At the same time for non-latex intermaxillary elastic (B2) was 74.75%, 68.47% and 57.68% respectively. Non-latex intermaxillary elastics shows more force loss than the latex groups over the period of time, there is a remarkable more force loss of 5.24% at 12hr, 6.89% at 24hr and 7.74% at 36hr.

There was no significant difference in force decay between latex intramaxillary and intermaxillary traction and for non-latex intramaxillary and intermaxillary traction in vitro study, as the span of both elastics were same (25mm).

There is significant difference in force decay between latex and non-latex elastics, and it was more obvious in non-latex orthodontic elastics than in latex elastics. This indicates that the latex elastics can be used for one day, but non-latex elastics can replace latex elastics if they are changed frequently. There is significant force decay in magnitude of latex and non-latex elastics in vitro study.

According to the findings of force decay clinician is suggested to choose between an initial force much higher than the desired and force near the desired amount that will decay to below the level required for the desired effects. This emphasizes the importance of choosing elastics based on the clinical situations as well as the mechanical properties of the elastics that have been shown to vary with material and manufacturer.

Further in vitro study as well as clinical study is needed using different brands of latex and Non-latex elastics along with different sizes and force level. This would help to determine whether the result of this study are comparable to what might be seen on a larger scale among different manufacturer.

References

[1]. **Allen K. Wong**. Orthodontic Elastic Materials. The Angle's orthodontist. April 1976:46; 196-205.
[2]. **Nikolai RJ and Crouthers RC**. On The Relaxation And Recovery Of Orthodontic Traction Elements Under Interrupted Loading. J Dent RES 1980; 59: 1071.
[3]. **Huget E, Patrick K, Nunez L**. Observations On The Elastics Behavior Of A Synthetic Orthodontic Elastomer. J Dent Res 1990; 69; 496-501.
[4]. **Ferriter JP, Meyers CE Jr and Lorton L.** The Effect of Hydrogen Ion Concentration On The Force Degradation Of Orthodontic Polyurethane Chain Plastics. Am J Orthod 1990; 98:404- 410.
[5]. **Liu CC, Wataha JC And Craig RG, Whiteknight**. The Effect Of Repeated Stretching On The Force Decay And Compliance Of Vulcanized Cis-Polyisoprene Orthodontic Elastics. Dent Mater 1993; 9:37-40.
[6]. **Kanchana P And Godfrey K**. Caliberation Of Force Extension And Force Degradation Characteristics Of Orthodontic Latex Elastics. Am J Orthod Dentofacial Orthop 2000; 118:280-287.
[7]. **K. A. Russell, A. D. Milne, R. A. Khanna and J. M. Lee.** In Vitro Assessment Of The Mechanical Properties Of Latex And Non-Latex Orthodontic Elastics. American J Orthod Dentofacial Orthop 2001;120:36-44.
[8]. **Kersey ML, Glover K, Heo G, Rabound D And Major PW**. An In Vitro Comparison Of 4 Brands Of Non Latex Orthodontic Elastics. Am J Orthod Dentofacial Orthop 2003;123: 401-407.
[9]. **Hwang CJ, Cha JY.** Mechanical And Biological Comparison Of Latex And Silicone Rubber Bands, Am J Orthod Dentofacial Orthop 2003; 124: 379-86.
[10]. **Michael L. Kersey, Kenneth Glover, Giseon Heo Don Rabound And Paul W. Major**. A Comparison Of Dynamic And Static Testing Of Latex And Nonlatex Orthodontic Elastics. Angle Orthod 2003;73:181-186.
[11]. **Henson M, Lobner D**. In Vitro Neuronal Cytotoxicity Of Latex And Nonlatex Orthodontic Elastics. Am J Orthod Dentofacial Orthop 2004; 126:65-70.
[12]. **Christiana Gioka, Spiros Zinelis, Theodore Eliades, George Eliades** Orthodontic Latex Elastics: A Force Relaxation Study. Angle Orthod 2006; 76: 475-479.
[13]. **Bertoncini C, Cioni E, Grampi B, Gandini P.** In Vitro Properties' Changes Of Latex And Non-Latex Orthodontic Elastics. Prog orthod, 2006; 7(1):76-84.
[14]. **Tong Wang; Gang Zhou; Xianfeng Tan; Yaojun Dong**. Evaluation Of Force Degradation Characteristics Of Orthodontic Latex Elastics In Vitro And In Vivo. The Angle's Orthodontist 2007, 77; 688-693.
[15]. **Daniel J. Fernandes, Gisele M.A. Fernandes, Flavia Artese, Carlos N. Elias, Alvaro M. Mendes**. Force Extension Relaxation Of Medium Force Orthodontic Elastics. Angle Orthod. 2011;81:812-819.
[16]. **Aljhani AS And Aldrees AA.** The Effect Of Static And Dynamic Testing On Orthodontic Latex And Non-Latex Elastics. Orthodontic Waves 2010; 69:117-122.
[17]. **Oesterie LJ, Owens JM, Newman SM And Shellhar JW**. Perceived Vs Measured Force Interarch Elastics. Am J Orthod Dentofacial Orthop 2012; 141:298-306.