Comparison of force generation and force decay of non-latex elastics from different manufacturers: an *in-vitro* study

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INTRODUCTION

Elastics are an integral part of orthodontic treatment because they facilitate various tooth movements needed to achieve desired goals. There is no standardization in the composition of elastics, resulting in products with different properties.[1,3] Variations also arise because the processing of elastics differs between manufacturers.[2,6] If the elastic force is lower than advertised, the effectiveness of the elastics will be diminished.

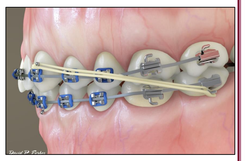

Fig. 1 Inter-arch elastics to correct Sagittal discrepancies

IMPLICATIONS

An increase in latex allergies has significant implications for the dental/ orthodontic profession due to the ubiquitous use of latex in elastics, elastomeric chains, gloves, etc. Alternatives to natural rubber are in high demand. [5]

This study benefits clinicians as well as patients by providing necessary insight and understanding into the ability and limitations of forces delivered by synthetic rubber as an alternative to natural latex rubber, used in orthodontic elastics.

OBJECTIVE

1. The purpose of this study was to assess whether the force level delivered by a given non-latex elastic matches the manufacturer's stated force level.
2. This study also compared the force levels generated by different manufacturer's non-latex elastics of the same size and weight.

NULL HYPOTHESES

1. There is no variation in the delivered force to the advertised force.
2. There is no variation in force delivery among different manufacturers' non-latex elastics of comparable size.

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RESEARCH DESIGN AND SAMPLE

- Prospective *in vitro laboratory* study
- Manufacturers: American Orthodontics (AO), Rocky Mountain Orthodontics (RMO)
- Three sizes for AO (3/16", 1/4", 5/16")
- Two sizes for RMO (3/16", 1/4") – note: 5/16" size no longer available from RMO
- 4 ½ oz (medium weight)
- n= 20, non-latex elastics per manufacturer, per size = 100 total

AO 'Sea Life Series' Non-Latex elastics:

- Jellyfish - 4 ½ oz or 125 grams or 1.23 N (Medium); Size 3/16"; n=20
- Sand Dollar - 4 ½ oz or 125 grams or 1.23 N (Medium); Size 1/4"; n=20
- Angelfish - 4 ½ oz or 125 grams or 1.23 N (Medium); Size 5/16"; n=20

Rocky Mountain Orthodontics (RMO) – Latex Free (LF):

- Snowboard - 4 ½ oz or 128 grams or 1.26 N (Medium); Size 3/16"; n=20
- Van - 4 ½ oz or 128 grams or 1.26 N (Medium); Size 1/4"; n=20

METHODS

Static, dry testing was performed to measure the force level. Each non-latex elastic was extended to 3x ID on two metal posts embedded in an acrylic block jig.

After 5 seconds, the Lutron FG 5005 Digital Force Tester was used to measure initial (baseline) force level. Each elastic was then stretched for 4 hours on the metal posts, and the 4-hour (post-stretch) force level was recorded in grams.

Fig. 2 RMO non-latex elastics

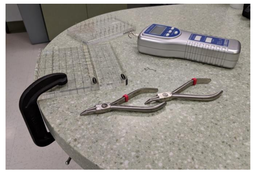

Fig. 3 Acrylic block jig holding elastics apart at a length of 3x ID

Fig. 4 Lutron Fg 5005 gauge for force measurement

RESULTS

Comparison of AO vs RMO Non-Latex 4 ½ oz Elastics, sizes 3/16" & 1/4"

	AO Jellyfish Non-Latex **3/16"**; n=20	RMO Snowboard Non-Latex **3/16"**; n=20	T-Test P-Value (p<.05) 3/16"	AO Sand Dollar Non-Latex **1/4"**; n=20	RMO Van Non-Latex **1/4"**; n=20	T-Test P-Value (p<.05) 1/4"
Manufacturers claimed Force (g)	125g	128g		125g	128g	
Baseline Force (g) (Mean ± SD)	109.75 g (± 5.98)	115.95 g (± 4.08)	< 0.001*	122.20 g (± 7.27)	113.00 g (± 7.2)	< 0.001*
Post-stretch Force (g) (Mean ± SD)	97.10 g (± 3.99)	99.15 g (± 3.96)	0.111	109.45 g (± 5.09)	97.25 g (± 5.67)	< 0.001*
Mean Force Decay (g) and %	12.65 g 11.53%	16.8 g 14.49%	0.037*	12.75g 10.40%	15.75 g 13.94%	0.280
P-value (Baseline & Manuf. Force)	<0.001	<0.001		<0.101	<0.001	

- The mean initial and final force values for almost all elastic sizes and manufacturers were significantly different from the manufacturer-advertised force value. (Exception: initial force for ¼" AO Non-Latex elastics).
- The mean Force Decay for RMO non-latex elastics of sizes 3/16" and ¼" was greater than the force decay experienced by AO elastics of the same size & weight.

CONCLUSION

The mean initial and final force values for almost all elastic sizes and manufacturers were significantly different from the manufacturer-advertised force value.
The mean Force Decay for RMO non-latex elastics of sizes 3/16" and ¼" was greater than the force decay experienced by AO elastics of the same size & weight.

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