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Original Research Article

In vitro comparison of the force degradation of orthodontic intraoral elastics from different compositions

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Abstract

Introduction: The synthetic intermaxillary elastic emerged as an alternative for clinical use in patients with latex sensitivity. However, there are disagreements about this elastic protocol use according to the force degradation. **Objective:** The aim of this study was to evaluate, *in vitro*, the forces generated by latex and synthetic elastics over time. **Material and methods:** Sample size of 840 elastics were used (420 latex and 420 synthetic), delivering medium strength (Dental Morelli®) with internal diameter of 1/8", 3/16", 1/4" and 5/16". The elastics were randomly divided into 6 groups according to the time of the force measuring and immersed into distilled water at 37°C. To measure the force in each group, the elastics were stretched in six progressive increases of 100% of its internal diameter with the aid of a testing machine Emic and measured up to 72 hours. Data were analyzed with SPSS 16.0, using one-way analysis of variance (ANOVA). **Results:** Immediate force level of synthetic elastics was statistically higher than latex elastics in all strains, for the same size. However, the latex elastics mean force slightly decreased over time, while the synthetic elastics presented an abrupt decrease. **Conclusion:** The synthetic elastic presented high force degradation, decreasing the cost-benefit ratio due to the high frequency of exchange of elastic. The latex elastic showed better mechanical performance in comparison to synthetic ones.

Introduction

Intraoral latex elastics have been used since the beginning of Orthodontics and help the orthodontic mechanics in the force delivering to the teeth [6]. Over the years, there is an increase in the cases of latex sensitivity, and consequently this demands the production and commercialization of latex-free products [15].

In the 1960s an alternative synthetic material, or latex-free, was disseminated in Orthodontics. However, for its clinical indication, this material should exhibit mechanical properties similar to or higher than latex elastics [7].

A study [8] compared the force degradation produced by latex and synthetic elastics when submitted to the stretching of three to five times their initial internal diameter. The results suggested that the synthetic elastic should be replaced more frequently than the conventional ones because they suffered more force degradation in addition to the increase of the initial internal diameter.

However, there is not a consensus in literature regarding the frequency of the synthetic elastic changes. The authors reported that only with the mandibular movement they lose 30% of their elasticity and recommended their daily change [5] or even twice changes per day [10]. On the other hand, other authors cited a fast decrease of the initial force, followed by a gentle reduction over three days, which would justify their maintenance for more time [14].

Taking into consideration these different approaches, it is important to conduct complementary studies on the degradation of latex and synthetic elastics. Therefore, the aim of this study was to evaluate the amount of force generated by latex and synthetic elastics over time until their degradation for up to 72 hours, when they were stretched six times their internal diameter.

Material and methods

Eight hundred and forty intraoral latex and synthetic elastics were used with different sizes (1/8”, 1/4”, 3/16”, 5/16”) and of medium force (Dental Morelli, Sorocaba, Brazil), divided according to table I.

Table I – Sample division in relation to the size, material composition, time of force measurement and number of elastics

		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Elastic	**Composition**	**Immediate**	**1 h**	**12 h**	**24 h**	**48 h**	**72 h**
1/8”	Latex	10	10	10	10	10	10
	Synthetic	10	10	10	10	10	10
3/16”	Latex	10	10	10	10	10	10
	Synthetic	10	10	10	10	10	10
1/4”	Latex	10	10	10	10	10	10
	Synthetic	10	10	10	10	10	10
5/16”	Latex	10	10	10	10	10	10
	Synthetic	10	10	10	10	10	10

During the study's pilot procedure, it was verified the rupture of some elastics for the evaluation time determined. To avoid that some groups exhibited a small sample size because of this fact, 15 different elastic per group were randomly used. The final number of elastics was ten per group.

The elastics were randomly divided into 6 groups according to the evaluation time. In group 1, the force was immediately measured prior to any stretching, as received by the manufacturer. In the other groups (2 to 6) the elastics were stretched with the aid of two metallic pins placed at a distance of six times of the initial internal diameter of the elastics (table II). Then, they were distributed into a plate and adapted into plastic flasks to enable the immersion in distilled water. Aiming to use the same set for both elastic types, the synthetic elastics were adapted in the bottom part of the metallic pins and the latex elastics in the upper part. The sets were placed into a bacteriological oven at 37°C, removed only at the moments of force mensuration according to the aforementioned periods.

Table II – Distribution of the elastics according to the initial internal diameter and post-stretching length of 600%

Elastic	Initial internal diameter	Stretching of 600%
1/8"	3.17 mm	19 mm
3/16"	4.76 mm	28.5 mm
1/4"	6.35 mm	38 mm
5/16"	7.93 mm	47.6 mm

The mechanical tests followed an increasing order: the elastics were stretched up to 100% of its initial size, the force was measured and they returned to its original position. This cycle was repeated twice, in an attempt to produce a dynamics cycle to simulate the oral cavity conditions. The test was then performed with the force measurements at 200%, 300%, 400%, 500% e 600% of the original size of the elastics. During the tests at the different times, the elastics were removed from the sets and taken to the testing machine with the aid of pliers (without pressure) since the pliers enable the adaptation of the elastics through its internal diameter.

The force released by the elastics was measured in a universal testing machine Emic DL2000 (Emic, São José dos Pinhais, Brasil). Two hooks were coupled to the machine, one at its upper part (mobile) and other at its bottom part (fixed to the base), aiming to the insertion of the elastics for their stretching. The force required for the test was obtained with the aid of a load cell of 0.1kN, at crosshead speed of 100 mm/min during rising and 300 mm/min during falling. Aiming to control the temperature, a glass aquarium containing distilled water, a heater of 30W (Termodelfim, São Paulo, Brazil) and a thermostat (Alife, São Paulo, Brazil) was coupled to the machine to keep all test at 37°C ± 1°C, simulating the oral temperature [3].

Statistical analysis

The data were collected and tabulated in Excel 2007 software (Office 2007, Microsoft, USA). The descriptive statistics comprised mean and standard deviation values for the forces released by the elastics of each group. One-way ANOVA was used to compare the elastic type (latex and synthetic) at the different time measurements (immediate to 72 h) for each percentage of stretching (100% – 600%), followed by Tukey test. Consequently, for each elastic size (1/8", 3/16", 1/4" e 5/16") six analyses of variances were performed. All statistical analyses were performed in SPSS software version 16.0 (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL, USA). The level of significance was set at 5%.

Results

The data are shown in tables III to VI and in figures 1 to 4 and exhibited the force degradation of the latex and synthetic elastics over time.

All synthetic elastics of sizes 3/16", 1/4" and 5/16" broke at 72 hours of stretching in distilled water at 37°C, consequently, the force measurement at this moment was not possible. The mean force of the latex elastics gradually decreased over time, while the synthetic elastics exhibited a higher immediate mean force, followed by an abrupt decrease of this value.

Table III – Force degradation over time, expressed by the force mean and standard deviation values (gf) of size 1/8 latex and synthetic elastic

Internal diameter stretching	Elastic type	Immediate		1 hour		12 hours		24 hours		48 hours		72 hours		Anova
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p
F 100%	Latex	67.6^{C}	5.4	70.5^{C}	1	51.0^{D}	4.1	51.0^{D}	3.5	49.3^{D}	3.3	39,3^{E}	3.14	$p < 0.01$
	Synthetic	91.5^{A}	5.1	79.0^{B}	4.2	21.8^{F}	3.5	6.3^{G}	1.7	3.6^{G,H}	0.8	1,6^{H}	0.3	
F 200%	Latex	140.3^{C}	9.2	133.2^{D}	1.5	126.6^{E}	7.5	125.7^{E}	5.7	122.0^{E}	6.4	111,9^{F}	3.6	$P < 0.01$
	Synthetic	169.9^{A}	3.7	147.5^{B}	6.3	76.5^{G}	6.9	26.1^{H}	5.2	12.5^{I}	3.2	3,5^{J}	0.7	
F 300%	Latex	191.8^{B}	11.5	180.0^{C}	2.1	177.9^{C,D}	9.6	176.4^{C,D}	8.1	172.1^{D}	8.8	163,1^{E}	5.2	$p < 0.01$
	Synthetic	223.6^{A}	4.5	193.7^{B}	7.7	132.8^{F}	8.2	73.2^{G}	4.5	43.8^{H}	6.4	9,5^{I}	3.4	
F 400%	Latex	234.4^{B}	13.3	220.1^{C,D}	2.6	218.8^{D}	11.3	217.7^{D}	10.1	212.5^{D,E}	10.6	203,9^{E}	6.6	$P < 0.01$
	Synthetic	261.9^{A}	5.3	228.5^{B,C}	8.8	172.5^{F}	9.9	120.7^{G}	5.3	91.4^{H}	9.5	32,4^{I}	8.3	
F 500%	Latex	273.9^{B}	14.8	258.2^{C}	3.4	256.2^{C}	13	255.2^{C}	12	249.2^{C,D}	12.4	240,2^{D}	7.9	$P < 0.01$
	Synthetic	294.0^{A}	6.5	258.9^{C}	10.4	203.3^{E}	11.3	156.8^{F}	6.5	128.4^{G}	11.7	71,6^{H}	9.4	
F 600%	Latex	313.7^{A}	16.8	296.9^{B}	4.2	293.5^{B}	14.9	292,3^{B}	13.8	285.6^{B,C}	14.1	275,6^{C}	9.1	$P < 0.01$
	Synthetic	324.8^{A}	8.2	289.9^{B}	11.1	231.5^{D}	12.5	186.6^{E}	7.5	158.2^{F}	13.4	105,1^{G}	8.7	

Different letters mean significant statistically differences $p < 0.01$

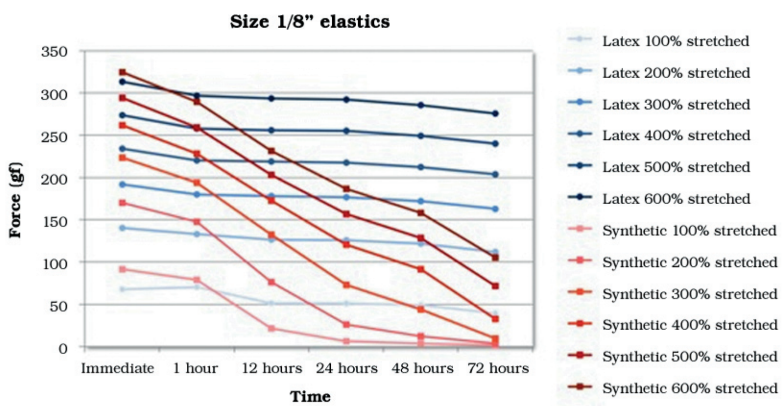

Figure 1 – Biomechanical dynamic behavior of the latex and synthetic size 1/8'' elastic over time, through the variation of the immediate mensuration up to 72 hours

Table IV – Force degradation over time, expressed by the force mean and standard deviation values (gf) of size 3/16 synthetic and latex elastics

Internal diameter stretching	Elastic type	Immediate		1 hour		12 hours		24 hours		48 hours		72 hours		Anova
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p
F 100%	Latex	61.25^{C}	4.6	52.83^{D}	3.8	52.09^{D}	3.6	42.72^{E}	3.7	38.72^{E}	3.6	33.93^{F}	4.2	$p < 0.01$
	Synthetic	88.3^{A}	7.2	70.8^{B}	6.2	13.9^{G}	3.2	2.5^{H}	0.4	1.7^{H}	0.3	*	*	
F 200%	Latex	135.63^{C}	7.1	127.02^{D}	6.7	126.03^{D}	4.4	119.93^{E}	4.7	114.92^{F}	3.9	107.59^{G}	4.6	$p < 0.01$
	Synthetic	180.6^{A}	6.0	166.1^{B}	3	70.0^{H}	3.5	11.5^{I}	3.8	4.9^{J}	0.9	*	*	
F 300%	Latex	182.86^{C}	8.2	175.05^{D}	8.4	173.17^{D,E}	5.4	168.72^{E,F}	5.8	163.94^{F}	5.1	156.53^{G}	5.7	$p < 0.01$
	Synthetic	233.7^{A}	6.7	219.4^{B}	3.8	129.4^{H}	2.9	55.6^{I}	2.4	21.4^{J}	3.5	*	*	
F 400%	Latex	221.92^{C}	8.9	214.5^{C,D}	9.8	211.68^{C,D}	6.4	207.58^{D,E}	6.9	188.36^{E}	3.5	195.54^{E,F}	7.0	$p < 0.01$
	Synthetic	270.4^{A}	6.6	255,5^{B}	4.1	168.4^{G}	3.4	104.9^{H}	3	67.5^{I}	2.2	*	*	
F 500%	Latex	258.51^{C}	9.2	251.54^{D}	11.3	247.9^{D,E}	7.5	243.57^{E,F}	8.2	239.75^{F}	7.3	231.45^{G}	8.3	$p < 0.01$
	Synthetic	301.3^{A}	6.4	288.4^{B}	5.2	199.6^{H}	3.9	139.1^{I}	3.5	107.4^{J}	2.6	*	*	
F 600%	Latex	295.93^{C}	10.0	287.83^{D}	12.8	283.61^{D,E}	8.8	279.16^{E,F}	9.6	274.9^{F}	8.5	266.32^{G}	9.7	$p < 0.01$
	Synthetic	331.2^{A}	6.6	318.8^{B}	5.8	227.3^{H}	4.2	165.7^{I}	3.8	136.7^{J}	3.2	*	*	

* Elastics ruptured. Different letters mean statistically significant differences $p < 0.01$

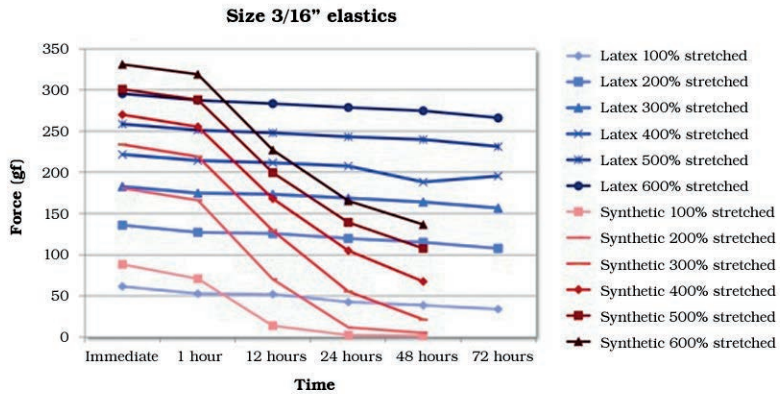

Figure 2 – Biomechanical dynamic behavior of the latex and synthetic size 3/16'' elastic over time, through the variation of the immediate mensuration up to 72 hours

Table V – Force degradation over time, expressed by the force mean and standard deviation values (gf) of size 1/4 synthetic and latex elastics

Internal diameter stretching	Elastic Type	Immediate		1 hour		12 hours		24 hours		48 hours		72 hours		Anova
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p
F 100%	Latex	$63.8^{B,C}$	4.5	$60.2^{C,D}$	1.5	$54.8^{D,E}$	2.5	$50.0^{E,F}$	2.6	46.0^{F}	3.3	36.7^{G}	2.9	$p < 0.01$
	Synthetic	82.1^{A}	9.7	67.5^{B}	5.4	4.7^{H}	0.8	1.9^{H}	0.2	1.5^{H}	0.3	*	*	
F 200%	Latex	143^{C}	5.9	136.2^{D}	2.9	$132.3^{D,E}$	3.6	128.8^{E}	3.3	126.4^{E}	4.7	119.2^{F}	4.7	$p < 0.01$
	Synthetic	184.1^{A}	9.5	163.6^{B}	5.2	31.8^{G}	3.8	5.2^{H}	0.5	3.5^{H}	0.2	*	*	
F 300%	Latex	194.4^{C}	6.3	183.0^{D}	11.4	182.8^{D}	4.5	$179.8^{D,E}$	3.9	$177.2^{D,E}$	5.5	172.2^{E}	6.1	$p < 0.01$
	Synthetic	238.7^{A}	8.8	214.2^{B}	6.7	97.5^{F}	4.6	26.6^{G}	3.6	7.5^{H}	0.4	*	*	
F 400%	Latex	235.1^{C}	6.5	225.3^{D}	4.6	222.9^{D}	5.5	$220.3^{D,E}$	4.4	$217.8^{D,E}$	6.8	213.8^{E}	7.5	$p < 0.01$
	Synthetic	274.5^{A}	8	248.1^{B}	7	142.6^{F}	5.3	77.9^{G}	5.6	28.2^{H}	1.4	*	*	
F 500%	Latex	274.0^{B}	6.7	263.3^{C}	5.2	260.6^{C}	6.5	$257.7^{C,D}$	5.3	$255.8^{C,D}$	7.2	251.1^{D}	8.7	$p < 0.01$
	Synthetic	306.0^{A}	6.8	279.2^{B}	8.7	177.1^{E}	6.3	113.2^{F}	6.2	71.9^{G}	3.7	*	*	
F 600%	Latex	$304.3^{B,C}$	29.2	$302.4^{B,C,D}$	6.2	$299.4^{B,C,D}$	7.8	$295.8^{B,C,D}$	6.3	$293.8^{C,D}$	8.3	289.2^{D}	10.2	$p < 0.01$
	Synthetic	336.3^{A}	6.4	310.3^{B}	9.5	207.1^{E}	7.2	139.0^{F}	6.8	106.1^{G}	5.5	*	*	

* Elastics ruptured. Different letters mean statistically significant differences $p < 0.01$

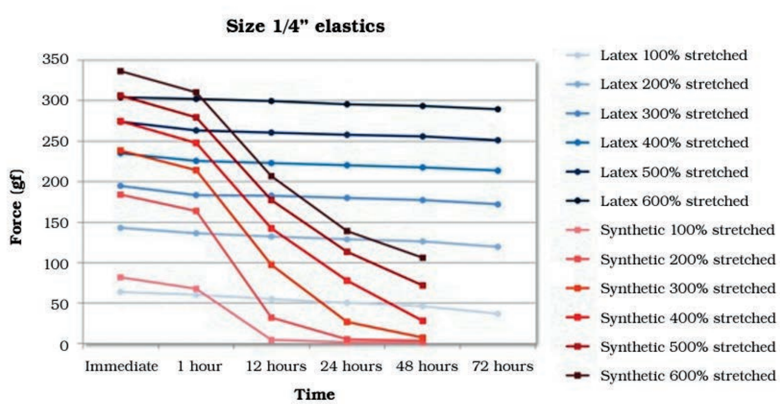

Figure 3 – Biomechanical dynamic behavior of the latex and synthetic size 1/4" elastic over time, through the variation of the immediate mensuration up to 72 hour

Table VI – Force degradation over time, expressed by the force mean and standard deviation values (gf) of size 5/16 synthetic and latex elastics

Internal diameter stretching	Anova	Immediate		1 hour		12 hours		24 hours		48 hours		72 hours		Anova
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p
F 100%	Latex	57.7^{C}	5.1	53.5^{C}	2.7	46.4^{D}	3	45.6^{D}	2.2	31.6^{E}	2.9	35.5^{E}	1.5	$p < 0.01$
	Synthetic	84.2^{A}	8.6	72.9^{B}	5.6	3.8^{F}	0.6	3.7^{F}	0.4	2.4^{F}	0.2	*	*	
F 200%	Latex	133.9^{C}	6.3	125.6^{D}	2.8	123.6^{D}	3.7	121.1^{D}	2.3	109.3^{E}	3.3	112.3^{E}	3	$p < 0.01$
	Synthetic	177.1^{A}	7.8	160.5^{B}	3.1	34.3^{F}	4.4	24.0^{G}	6.4	5.2^{H}	0.4	*	*	
F 300%	Latex	181.3^{C}	6.5	172.2^{D}	2.9	171.6^{D}	4.3	$168.4^{D,E}$	3.3	159.5^{F}	4.4	$161.0^{E,F}$	4.2	$p < 0.01$
	Synthetic	221.0^{A}	7.6	201.6^{B}	2.6	91.5^{G}	3.8	77.9^{H}	17.8	19.4^{I}	2.5	*	*	
F 400%	Latex	220.1^{C}	6.4	$210.0^{C,D}$	3.5	$210.5^{C,D}$	5.2	206.9^{D}	3.6	199.1^{D}	5.8	199.7^{D}	5.6	$p < 0.01$
	Synthetic	253.0^{A}	7.4	232.2^{B}	2.6	128.2^{E}	4	113.1^{F}	26.1	62.8^{G}	3.9	*	*	
F 500%	Latex	$257.2^{B,C}$	6.4	$245.6^{C,D}$	4	$247.3^{C,D}$	6.2	242.7^{D}	4.4	235.2^{D}	7.2	235.9^{D}	6.9	$p < 0.01$
	Synthetic	282.4^{A}	7	261.2^{B}	3	156.0^{F}	4.1	138.2^{G}	32.1	99.1^{H}	3.6	*	*	
F 600%	Latex	295.1^{B}	7	$281.5^{B,C}$	6.5	$284.8^{B,C}$	7.5	$278.8^{B,C}$	5.4	271.9^{C}	8.8	272.5^{C}	8.4	$p < 0.01$
	Synthetic	321.3^{A}	27.3	$290.3^{B,C}$	3.6	180.4^{D}	4.4	159.2^{E}	37	126.4^{F}	3.9	*	*	

* Elastics ruptured. Different letters mean statistically significant differences $p < 0.01$

Figure 4 – Biomechanical dynamic behavior of the latex and synthetic size 5/16'' elastic over time, through the variation of the immediate mensuration up to 72 hour

Discussion

The aim of this study was to compare the force degradation of synthetic and latex intermaxillary elastics to guide the clinical use, which should be differentiated according to the physical properties inherent to each type of material. For this purpose, it was evaluated, *in vitro*, the physical behavior (force) of several sizes of these elastics, through biomechanical tests, over time.

Firstly, it is important to define the amount of ideal force for the intermaxillary mechanics and the measurement of the extension of the elastic required for reaching such magnitude. The force produced by the elastic is directly related to the distance between the fixation points, the size and thickness of the elastic, which have been important bases when one desires to apply a force considered as ideal. According to several authors, the ideal force for intermaxillary mechanics is around 150 to 200 gf [4, 9, 12, 20, 22, 23, 25]. On the other hand, other authors [5] indicated a greater amount of initial force, between 200 and 250 gf, for the mechanics with Class II elastics.

Following this ideal force mean and after the data analysis, it was verified that all synthetic elastics (1/8", 3/16", 1/4" and 5/16") showed an immediate force mean between 200 and 250 gf when they had been stretched at 300% of its initial internal diameter. To obtain similar immediate force values, the latex elastics demanded a stretching of 400%.

Concerning to the distance between the fixation points of the elastic for the intermaxillary mechanics (Class II and III), the extension of 20 mm is normally used, which corresponds to the distance from the canine to the first molar [3]. To reach such measurement, size 1/8'' elastic demands 600% to be stretched (equal to the mean of 313.7 gf for the synthetic and 324.8 gf for the latex elastic); size 3/16'' elastic demands 400% (equal to the mean of 270.4 gf for the synthetic and 234.4 gf for the latex elastic); size 1/4" elastic demands 300% (equal to the mean of 238.7 gf for the synthetic and 194.4 gf for the latex elastic) and size 5/16'' demands only 200% (equal to the mean of 177.1 gf for the synthetic and 133.9 gf for the latex elastic).

In literature, it is recommended an extension of at most three times the internal diameter of the elastic to produce the ideal immediate force [11]; however, in the values previously cited, only the size 1/4'' synthetic elastic showed force values within the ideal measurement for the intermaxillary mechanics. The authors [10] concluded that the empirical rule of "3", that is, the ideal force level would be obtained over the extension of three times the diameter of the elastics, it is not applied for all cases and even shows a notable variation among the forces of the same elastic. Therefore, it is necessary to measure the distance between the points of fixation of the elastics to select them properly according to each clinical situation and the initial force delivered by the elastic selected.

After choosing the size of the elastic which delivers the ideal immediate force according to the extension of the specific clinical case, it is important to know how this force decreases over time for each material, owing to define the frequency of the elastic changes.

During the use of intermaxillary mechanics, the elastics underwent greater variation in its extension because of the movements of opening and closing of the mouth. Several studies observed that the normal interval of sagittal elastics of either Class II or III ranges from 20 to 50 mm during its clinical use [2, 12, 17, 19]. These studies still verified that repeated stretching movements significantly reduced the force magnitude, because this procedure alters the internal structure of the elastics. This supports the methodology used in this present study, which better simulates, *in vitro*, the opening and closing movements of the mouth, promoting the greatest force degradation, reaching force values closer to those found clinically.

The elastics evaluated in this study exhibited a force degradation ranging according to the material and the extension time period. A higher immediate degradation pattern was verified until 24 hours in all sizes of synthetic elastics. After the initial 24 hours, the force decrease significantly continued, but at smaller proportions, reaching up to the rupture of several samples after 48 hours of stretching. Consequently, to overcome this great force amount, it is clinically recommended the application of a high initial force when synthetic elastics are used to deliver ideal forces shortly thereafter [3]. For the latex elastics, the force degradation was expressed in a gradual and smooth form, with a significant degradation in the amount of force delivered by the elastics at 1 hour of constant stretching and relative stabilization of the force after this period of tests.

Through using statistical tests, authors [13] evaluated the mechanical properties of size 1/4'' latex and synthetic elastics stretched at 300% in the period of 24 hours. The results demonstrated a deterioration of 23% and 27% for latex and synthetic elastics, respectively. Other authors [15] obtained values of degradation of 25% for the latex elastics and 47% for the synthetic elastics for 24 hours and 300% of stretching. Other researchers [21] reported force degradation similar to the previous study, with mean of 25% for the latex elastics and 40% for the synthetic elastics, under the same period and extension percentage. In this present study, a different pattern of force degradation was found because of the extension of the elastics (600%), with a very higher mean for the synthetic elastics (88%) than latex elastics (8%) in the first 24 hours of extension.

This pattern of force reduction for the synthetic elastics when compared with the good force maintenance of the latex elastics was also observed in another study [24], in which the authors concluded that the latex elastics should be used whenever possible; however, when synthetic elastics are necessary, the clinician should take into account their higher initial force, significant force stretching and variability among the commercial brands.

The difference in the degradation of both materials (latex and synthetic) may be justified by the structural difference they exhibit. Authors [21] believed that the poor mechanical performance of the synthetic elastics is because they rely on entanglements, rather than covalent crosslinks present in the latex elastics, which resulted in a better bonding and resistance to deformation.

The different degradations observed influenced this controversial issue in another point: the frequency of change of the intermaxillary elastics. Authors [16] established a protocol of change of 6 to 8 hours of use for the synthetic elastics. On the other hand, other researchers [1] indicated the change of the latex elastics of Morelli®, Ormco and GAC at every three days, because they did not found statistical difference in the force releasing between 24 hours and 72 hours, differently from those of TP Orthodontics and 3M Unitek, whose change prescription was every two days. Other authors [18] recommended the replacement of the size 1/8" latex elastics at every 24 hours and sizes 3/16" and 5/16" at every 72 hours when they had been stretched at 26 mm.

For the results of this research, which evaluated the elastics of Morelli®, the change of size 1/8", 3/16", 1/4" and 5/16" latex elastics could be indicated at every 72 hours of use when stretched to reach between 200 and 250 gf, once these ideal force intervals are maintained over this time period. On the other hand, for size 1/8", 3/16", 1/4" and 5/16" synthetic elastics the change of every 12 hours should be more favorable to maintain the intermaxillary therapy, because after this time, the forces were much lower to the desired ones.

This variation in the force degradation and consequently in the frequency of change of the intermaxillary elastics can be explained by the distinct behavior of the several commercial brands available, which makes difficult to establish a general rule of time for the replacement of either latex or synthetic elastics.

Although *in vitro* studies are important to provide an initial idea of the properties of the elastics, *in vivo* studies are necessary to establish the protocol of elastic changes because they would promote the real degradation by aggregating all environmental factors, such as the opening and closing movements of the mouth, pH and temperature of the foods and biofilm presence.

Conclusion

- The synthetic elastics studied need to improve their mechanical properties because of the great force degradation undergone by the material, resulting in a poor cost-benefit ratio owing to the high frequency of changes;
- The latex elastics studied showed a good mechanical performance when compared with the synthetic elastics.

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