BIOSCIENCE JOURNAL

MECHANICAL AND PHYSICAL PROPERTIES OF DENTAL FLOSS: A COMPARATIVE COST ANALYSIS

Thiago Silva PERES[1], Izabela Batista CORDEIRO[2], Ianca Daniele Oliveira de JESUS[1], Roberta de Oliveira ALVES[1], Carlos José SOARES[2], Priscilla Barbosa Ferreira SOARES[3]

[1]Postgraduate Program in Dentistry, School of Dentistry, Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil.
[2]Department of Operative Dentistry and Dental Materials, School of Dentistry, Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil.
[3]Department of Periodontology and Implantology, School of Dentistry, Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil.

How to cite: PERES, T.S., et al. Mechanical and physical properties of dental floss: a comparative cost analysis. *Bioscience Journal*. 2025, **41**, e41007. https://doi.org/10.14393/BJ-v41n0a2025-75422

Abstract

The aim of this study was to measure the mechanical and physical properties of 18 commercially available dental flosses produced by global and Brazilian manufacturing and to correlate these parameters with their cost. Eighteen dental flosses available were tested: Bianco Delicare, Colgate, Colgate Menta, Colgate Total, Dauf Oral Care, Hillo, Jade Pro, Johnson and Johnson Essencial, Johnson and Johnson Expansion Plus, Kess, Needs Oral Care, Oral Nexter, Oral-B Essential Floss, Oral-B Pro Saúde, Power Dent Classic Floss, Power Dent Classic Floss Extra Fino, Sanifill Clássico, and Sanifill Infinite. The maximum load (N) and elongation (mm) were measured using a universal testing machine (Instron EL3000). The dental floss width (µm) and filament diameter (µm) were measured using a scanning electron microscope. The cost of each dental floss was correlated with the mechanical and physical properties. The results showed that there was no correlation between the cost of the dental floss and the maximum load (R^2 = 0.04) or the filament diameter (R^2 = 0.08). There was a moderate negative correlation between the cost of dental floss and the capacity of elongation (R^2 = 0.46) and moderate positive correlation between the price and dental floss width (R^2 = 0.43). It can be concluded that the dental tapes generally cost more per meter and have the lowest elongation capacity. Dental flosses with low cost presented good values for maximum load and elongation, making them suitable for dental hygiene protocols in developing countries.

Keywords: Comparative study. Costs and cost analysis. Mechanical tests. Oral hygiene.

Corresponding author:
Priscilla Barbosa Ferreira Soares
pbfsoares@yahoo.com.br

Received: 23 September 2024
Accepted: 17 February 2025
Published: 02 April 2025

1. Introduction

Periodontal diseases affect approximately 1 billion people in the world and are prevalent in developed and developing nations (Chen et al. 2021). Dental plaque, if not regularly cleaned, can lead to the development of caries, gingivitis, and periodontal disease (Cwik et al. 2021). Brushing the teeth helps to minimize plaque accumulation, improving gum health, especially in adults who do not have any loss of interdental attachment (Shamsoddin 2022). Dental floss, when used in association with toothbrushing, is crucial to enhance oral health benefits (Shamsoddin 2022; Xu et al. 2023). Dental floss must have adequate mechanical and physical characteristics to be easily used and present accessible costs for populations with different socioeconomic profiles.

The fear of gingival bleeding and pain are the main concerns cited by individuals who do not regularly incorporate dental floss into their oral hygiene routine despite being aware of the benefits of regular flossing and mouth rinsing (Rotella et al. 2022). Dental floss is a collection of tightly woven filaments made from synthetic fibers, which can be in the form of threads, yarn, single filaments, or tapes and may or may not have a coating (ISO 2018). Currently, the market offers various dental flosses, each with different characteristics (Supanitayanon et al. 2017; Huang, Broadbent, and Choi 2023). However, information about ideal properties (maximum load and percentage of elongation supported) and the of dental flosses available in the market is scarce (Huang et al. 2023). These mechanical characteristics are essential to understanding their behavior during use (Supanitayanon et al. 2017; Huang, Broadbent, and Choi 2023). Maximum load measures the force dental floss can withstand when passing between teeth, while the elongation percentage indicates how far it can stretch before breaking (Supanitayanon et al. 2017). The physical and mechanical characteristics of dental floss are crucial for providing information about the products. This information can assist manufacturers in improving their products and help clinicians and users identify cost-effective dental floss based on their characteristics. Additionally, it can enhance the user's experience when the correct technique and appropriate dental floss are selected based on individual characteristics, such as interdental contact strength points (Huang et al. 2023).

Poverty in the world is often associated with limited access to health care (Kumar, Crall and Holt 2023). Traditional treatment of oral diseases, which is costly in industrialized countries, is beyond the reach of most low-income and middle-income countries (Petersen 2003). In this context, the cost of access and the knowledge of how to use the toothbrush and dental floss are essential factors to reduce the interdental plaque (Reiniger et al. 2024). However, to the best of the authors' knowledge, no study has correlated the cost of the different dental flosses with their physical-mechanical qualities. This critical factor can determine or contribute to increasing access to these products and reducing the impact of the most common oral diseases. Therefore, this study aimed to measure the mechanical and physical properties of 18 commercially available dental flosses and to correlate these parameters with their cost. The null hypotheses for this study are: 1. There are no differences in the mechanical and physical characteristics of the dental flosses; 2. Dental floss costs do not correlate with their mechanical properties and physical characteristics.

2. Material and Methods

Were selected the most sold eighteen dental flosses produced by global and Brazilian manufacturing (Figure1) available in Brazilian market: Bianco Delicare (Bianco, Uberlândia, Minas Gerais, Brazil), Colgate (Colgate, São Bernardo do Campo, São Paulo, Brazil), Colgate Menta (Colgate, São Bernardo do Campo, São Paulo, Brazil), Colgate Total (Colgate, São Bernardo do Campo, São Paulo, Brazil), Dauf Oral Care (Higimarcas do Brasil, Japeri, Rio de Janeiro, Brazil), Hillo (Aperifio, Aperibé, Rio de Janeiro, Brazil), Jade Pro (Jade, Londrina, Paraná, Brazil), Johnson and Johnson Essencial (Johnson and Johnson, São José dos Campos, São Paulo, Brazil), Johnson and Johnson Expansion Plus (Johnson and Johnson, São José dos Campos, São Paulo, Brazil), Kess (Belliz, Serra, Espírito Santo, Brazil), Needs Oral Care (PDHB, Santana de Parnaíba, São Paulo, Brazil), Oral Nexter (Jade, Londrina, Paraná, Brazil), Oral-B Essential Floss (Procter and Gamble, Seropédica, Rio de Janeiro, Brazil), Oral-B Pro Saúde (Procter and Gamble, Seropédica, Rio de Janeiro, Brazil), Power Dent Classic Floss (TIG, Barueri, São Paulo, Brazil), Power Dent Classic Floss Extra Fino (TIG, Barueri, São Paulo, Brazil), Sanifill Clássico (Coty, Goiânia, Goiás, Brazil), and Sanifill Infinite (Coty, Goiânia, Goiás, Brazil). The

composition of each dental floss tested are shown in Table 1. The cost per meter of each dental floss was calculated by searching the cost in three different online Brazilian dental product stores, and the mean cost was determined. The price was divided by the total length of the dental floss to obtain the cost per 10 meters (US$/10m).

For the scanning electron microscopy (SEM) analysis, a 1 cm filament from each dental floss was obtained, fixed on a metal stub, and coated with a thin layer of gold (QR 150ES, Quorum T Technologies, Lewes, United Kingdom). The SEM analysis was performed using a VEGA 3 LMU (Tescan, Kohoutovice, Czech Republic) with magnifications of 100x and 1000x. The images with scales were then exported to Image J software (public domain, National Institute of Health Bethesda, MD, USA). The width of the dental floss and their filaments diameter were measured in 10 different locations for each SEM image.

Table 1. Composition of each dental floss tested

Dental Floss	Type	Batch Number	Composition
Bianco Delicare	Floss	L-0820/X009BC	Nylon-66, beeswax, and aroma (d-Limonene)
Colgate	Floss	150824BR1213	Polypropylene, beeswax, and microcrystalline wax
Colgate Menta	Floss	101121BR1233	Polypropylene, microcrystalline wax, aroma, and sucralose
Colgate Total	Tape	170624BR1211	Polytetrafluoroethylene and microcrystalline wax
Dauf Oral Care	Floss	FD031221	Synthetic fibers (polyester/nylon) petrolatum, paraffin, menthol, and alcohol
Hillo	Floss	40803/3	Thermoplastic resin, paraffin, paraffinum liquidum, aroma, Butylated Hydroxytoluene and menthol
Jade Pro	Floss	1117F012	Paraffin, paraffin liquidum, mentha arvensis leaf oil and thermoplastic resin
Johnson & J. Essencial	Floss	25421B	Polypropylene, microcrystalline wax, aroma (d-limonene) and Phthalocyanine Green G
Johnson & J. Expansion Plus	Floss	26521B	Polypropylene, microcrystalline wax, aroma, and Phthalocyanine Green G
Kess	Floss	300424	Polypropylene, microcrystalline wax, aroma, and beeswax
Needs Oral Care	Floss	2112715F	Polypropylene 790 DTEX, microcrystalline wax, aroma, and propylene glycol
Oral Nexter	Floss	1127F1450	Paraffin, paraffinum liquidum, mentha arvensis leaf oil and thermoplastic resin
Oral-B Essential Floss	Floss	41787910F0	Nylon-6, microcrystalline wax, glyceryl oleate, saccharin, Butylated Hydroxytoluene and Aroma
Oral-B Pro Saúde	Tape	4093652650	Polytetrafluoroethylene, aroma, acacia Senegal gum, beeswax, potassium acesulfame, aqua, sodium lauryl sulfate, glycerin, d-limonene and linalool
Power Dent Classic Floss	Floss	2111411	Polypropylene 900 DTEX, microcrystalline wax, menthol, and propylene glycol
Power Dent Classic Floss Extra Fino	Floss	2111916	Polypropylene 790 DTEX, microcrystalline wax, menthol, and propylene glycol
Sanifill Clássico	Floss	1200AY	Nylon-66, microcrystalline wax, aroma, beeswax, d-limonene, linalool, eugenol, and cinnamon
Sanifill Infinite	Tape	0225AY	Polytetrafluoroethylene and ethylene/VA copolymer

To calculate the maximum load (N) and elongation (mm), the specimens were cut to a length of 30 cm (n = 30) (Supanitayanon et al. 2017). Then, 5 cm from each extremity was attached to two pneumatic clamps (2712 Series Pneumatic Action Grips, Instron Corporation, Norwood, MA, USA) (Supanitayanon et al. 2017). These specimens were subjected to a maximum load test using a crosshead speed of 100 mm/min (Supanitayanon et al. 2017), on a universal testing machine (ElectroPuls® E3000, Instron) with 1kN load cell (Figure 2). The data were recorded using the dedicated software Bluehill 2 (Instron).

The maximum load (N) and elongation (mm) data were tested for normal distribution (Shapiro-Wilk) and homogeneity of variation (Levene's Test). Kruskal-Wallis then analyzed them. The linear correlation test was used to check the correlation between each dental floss's maximum load, elongation, and market cost. All statistical tests used a significance level of $\alpha = 0.05$. All analyses were performed using Jamovi software, version 1.6 (Jamovi, Sydney, Australia).

Figure 1. Dental flosses and dental tapes tested.

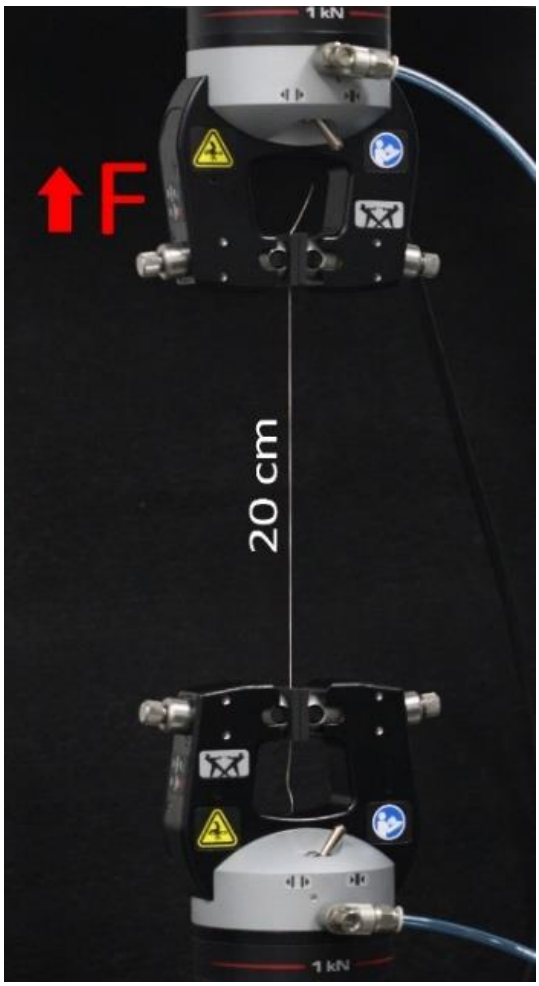

Figure 2. Maximum load test on a universal testing machine using 30cm specimens.

3. Results

The composition and the mean cost/meter of each dental floss tested are shown in Table 1. The cost ranged from 0.12 to 1.53 US$/10m. Dental tapes had a higher cost: Colgate Total (1.53 US$/10m), Oral-B Pro Saúde (1.46 US$/10m), and Sanifill Infinite (0.97 US$/10m). Dental floss had a lower cost, ranging from 0.12 to 0.54 US$/10m.

Table 2. Cost per meter of each dental floss tested and composition.

Dental Floss	Type	Price (US$)	Length (m)	US$/10m
Bianco Delicare	Floss	2.20	100	0.22
Colgate	Floss	2.56	50	0.51
Colgate Menta	Floss	2.44	50	0.49
Colgate Total	Tape	3.82	25	1.53
Dauf Oral Care	Floss	1.83	150	0.12
Hillo	Floss	1.18	100	0.12
Jade Pro	Floss	1.48	100	0.15
Johnson & J. Essencial	Floss	2.46	100	0.25
Johnson & J. Expansion Plus	Floss	2.22	50	0.44
Kess	Floss	1.22	50	0.24
Needs Oral Care	Floss	2.75	100	0.28
Oral Nexter	Floss	1.81	100	0.18
Oral-B Essential Floss	Floss	2.70	50	0.54
Oral-B Pro Saúde	Tape	7.30	50	1.46
Power Dent Classic Floss	Floss	1.46	90	0.16
Power Dent Classic Floss Extra Fino	Floss	1.50	125	0.12
Sanifill Clássico	Floss	2.32	125	0.19
Sanifill Infinite	Tape	2.42	25	0.97

The mean and standard deviation of the width (mm) of dental flosses and the diameter (mm) of filaments are shown in Table 3. The width of dental floss ranged from 458.1 to 2079.1 µm. Dental tape Oral-B Pro Saúde had the highest width, 2079.1 µm, and Bianco Delicare had the lowest 458.1 µm width. The filament's diameter ranged from 16.8 to 30.2 µm. Dental tapes Oral-B Pro Saúde, Colgate Total, and Sanifill Infinite do not have filaments.

Table 3. Dental floss and filaments size of each group.

Dental Floss	Dental floss width (µm)	Filament diameter (µm)
Bianco Delicare	458.1 ±12.2	18.9 ± 3.1
Colgate	666.0 ± 19.5	21.1 ± 1.3
Colgate Menta	560.0 ±17.9	23.1 ± 1.2
Colgate Total	1188.4 ± 10.1	-
Dauf Oral Care	586.0 ± 25.2	19.1 ± 2.6
Hillo	669.0 ± 26.2	20.1 ± 2.1
Jade Pro	1194.7 ± 17.3	20.6 ± 2.0
Johnson & J. Essencial	941.9 ± 17.4	19.7 ± 0.8
Johnson & J. Expansion Plus	904.0 ± 18.5	18.6 ± 1.2
Kess	699.3 ± 26.7	30.1 ± 2.0
Needs Oral Care	688.0 ± 22.2	25.3 ± 1.7
Oral Nexter	943.7 ± 18.3	21.2 ± 3.2
Oral-B Essential Floss	680.6 ± 7.2	16.8 ±2.3
Oral-B Pro Saúde	2079.1 ± 10.4	-
Power Dent Classic Floss	818.9 ± 59.4	21.0 ± 1.8
Power Dent Classic Floss Extra Fino	833.2 ± 10.2	30.2 ± 4.1
Sanifill Clássico	660.5 ± 22.0	25.9 ± 0.7
Sanifill Infinite	868.8 ± 5.5	-

The median value of maximum rupture load (N) for all tested dental flosses is shown in Figure 3. Kruskal-Wallis test showed significant differences among the dental flosses ($p < .001$). The maximum rupture load median value of tested dental flosses ranged from 15.0 to 30.8 N. Power Dent Classic Floss had the highest, and Johnson and Johnson had the lowest values.

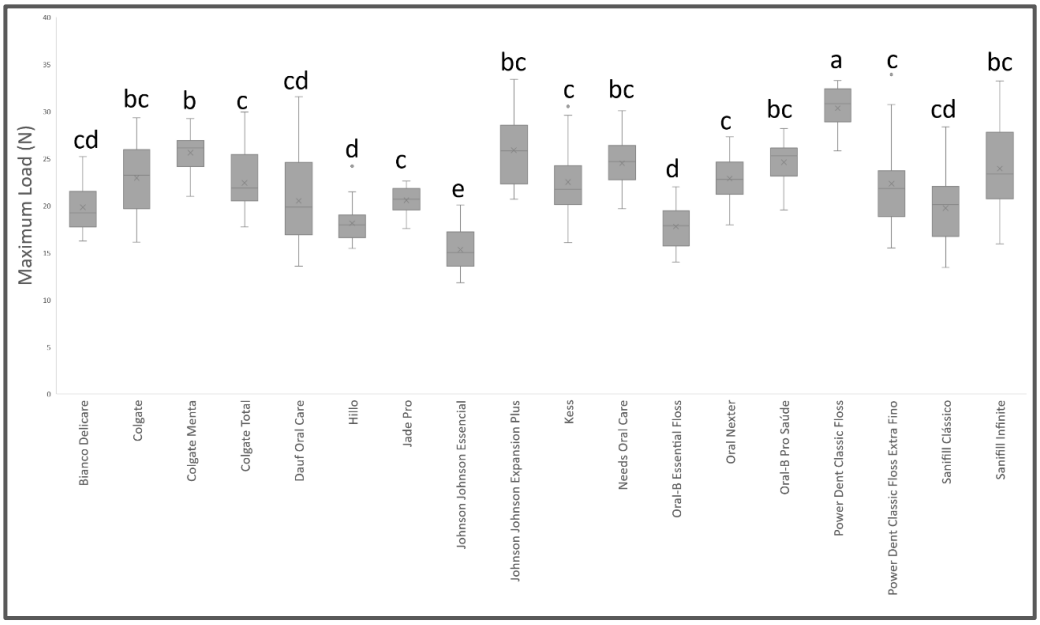

Figure 3. Maximum load (N) of each dental floss tested. Different letters mean significant difference among tested groups.

The median elongation (mm) values of all tested dental flosses are shown in Figure 4. Kruskal-Wallis test showed significant differences between the groups ($p < .001$). The median of all groups tested ranged from 3.8 to 33.1mm. Oral-B Essential Floss and Jade Pro had the highest elongation values, and the Dental tapes Oral-B Pro Saúde, Colgate Total, and Sanifill Infinite had the lowest elongation values.

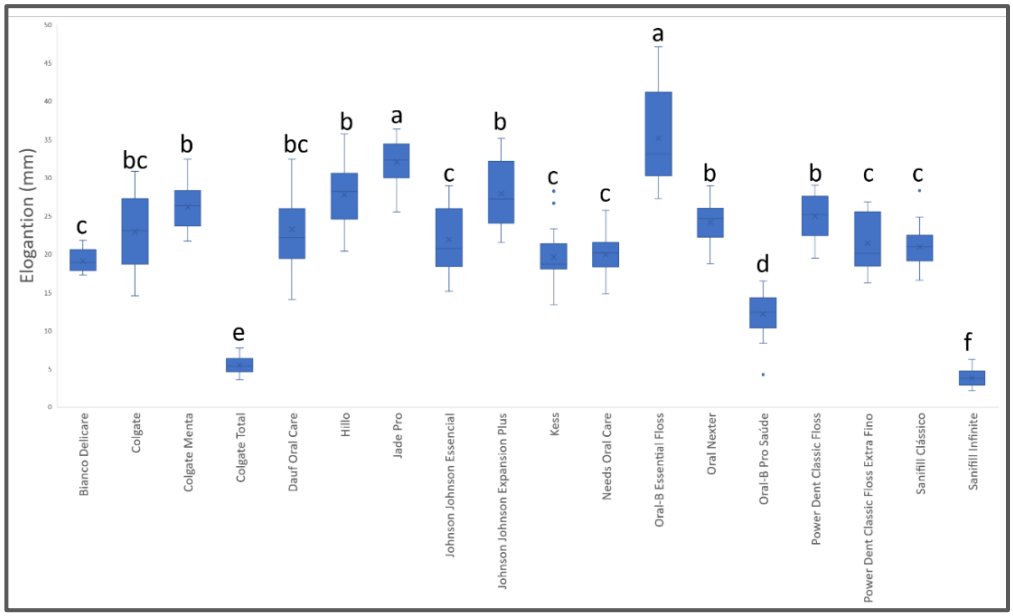

Figure 4. Elongation (mm) of each dental floss tested. Different letters mean significant difference among tested groups.

The linear correlations between dental floss cost per 10 meters, the maximum load, and elongation parameters are shown in Figure 5. There was a moderate negative correlation between the cost of dental floss and the elongation ($p < .001$, $R^2 = 0.46$). However, no correlation was found between the price and the maximum load ($p = 0.41$, $R^2 = 0.04$). No correlation was found between the elongation (mm) and cost (US$)

when the elongation of dental tapes ($p = 0.86$, $R^2 = 0.29$) and dental flosses ($p < 0.001$, $R^2 = 0.09$) was analyzed separately.

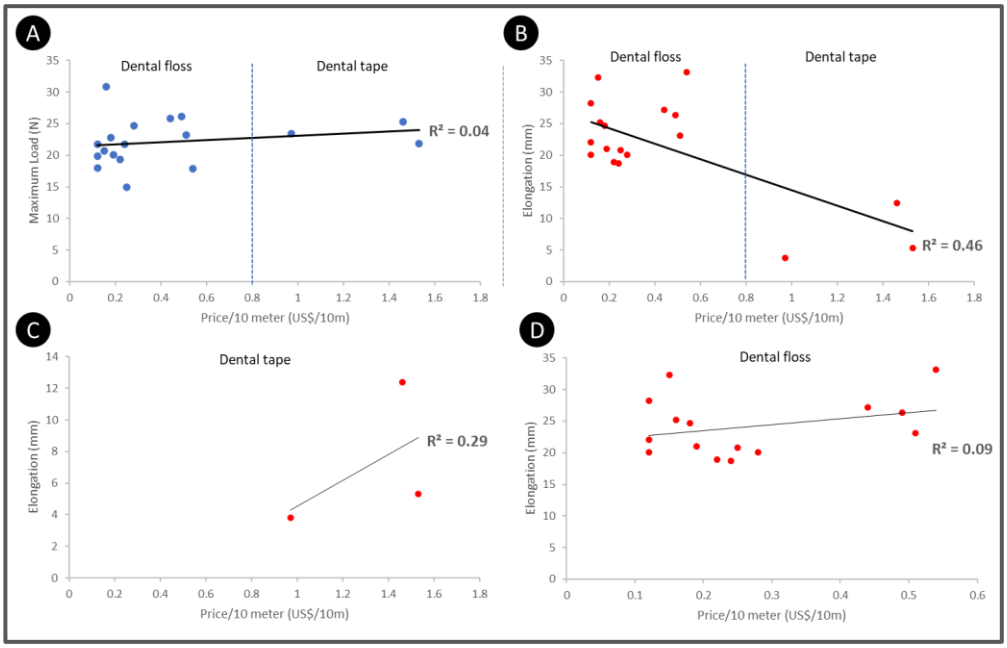

Figure 5. Linear correlations for cost and median of maximum load (N), and median of elongation (mm) of the dental floss tested. (A): Correlation between median of maximum load (N) and cost (U$/10m) of the dental floss with dental tape (p = 0.41, $R^2 = 0.04$). (B): Correlation between median of elongation (mm) and cost (U$/10m) of the dental floss with dental tape (p < 0.001, $R^2 = 0.46$).(C): Correlation between median of elongation (mm) and cost (U$/10m) of the dental tape (p = 0.86, $R^2 = 0.29$). (D): Correlation between median of elongation (mm) and cost (U$/10m) of the dental floss (p < 0.001, $R^2 = 0.09$).

The linear correlations between dental floss cost per meter with the dental floss width and filament diameter are shown in Figure 6. There was a moderate negative correlation between the width (µm) and cost (US$/10m) of the dental floss with dental tape ($p < 0.001$, $R^2 = 0.43$). No correlation was found between the cost and the filament diameter of the dental floss ($p < 0.001$, $R^2 = 0.08$)

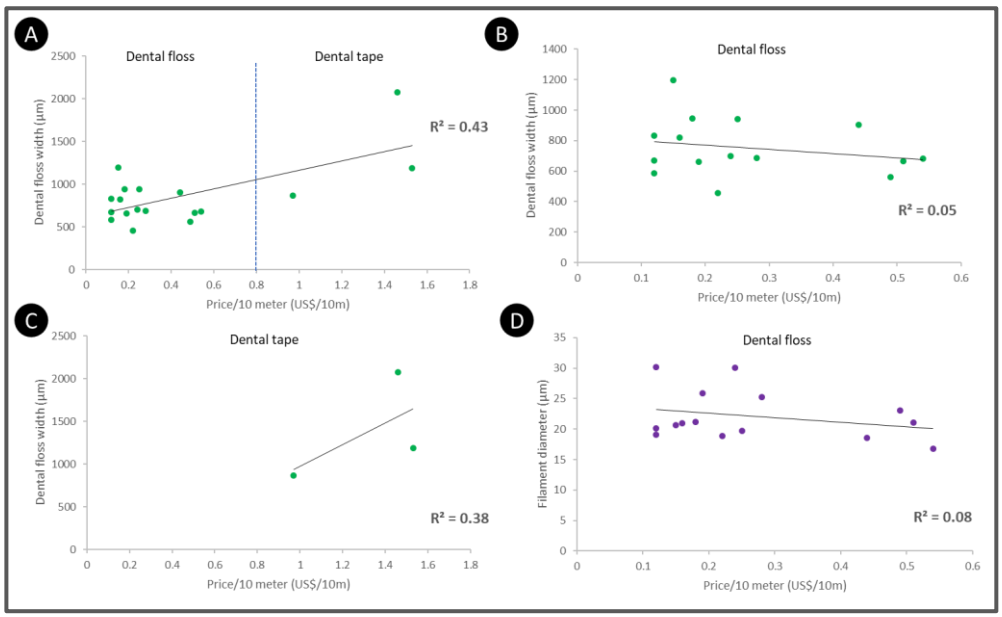

Figure 6. Linear correlations for cost and dental floss width (µm), and their filament diameter (µm). (A): Correlation between mean of the width (µm) and cost (U$/10m) of the dental floss with dental tape (p < 0.001, $R^2 = 0.43$). (B): Correlation between mean of width (µm) and cost (U$/10m) of the dental floss (p = 0.91, $R^2 = 0.38$).(C): Correlation between mean of the width (µm) and cost (U$/10m) of the dental tape (p = 0.86, $R^2 = 0.29$). (D): Correlation between mean of the filament diameter (µm) and cost (U$/10m) of the dental dental floss (p < 0.001, $R^2 = 0.08$)

The representative SEM images of the dental floss tested are shown in Figures 7 and 8. From the observations made from the magnified images, dental tapes Oral-B Pro Saúde, Colgate Total, and Sanifill Infinite do not have any visible filaments. Oral-B Essential Floss has a diagonal filament organization compared to other groups.

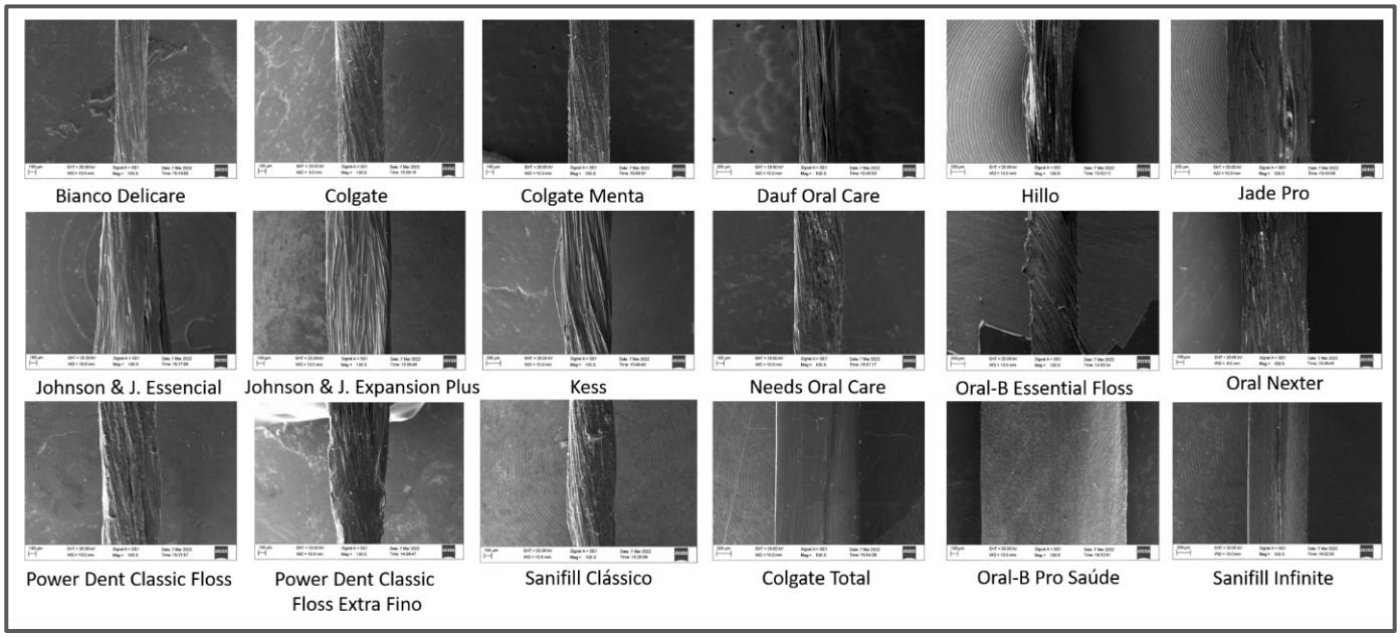

Figure 7. Scanning electron microscopy surface images of all tested groups. Images with 100× magnification.

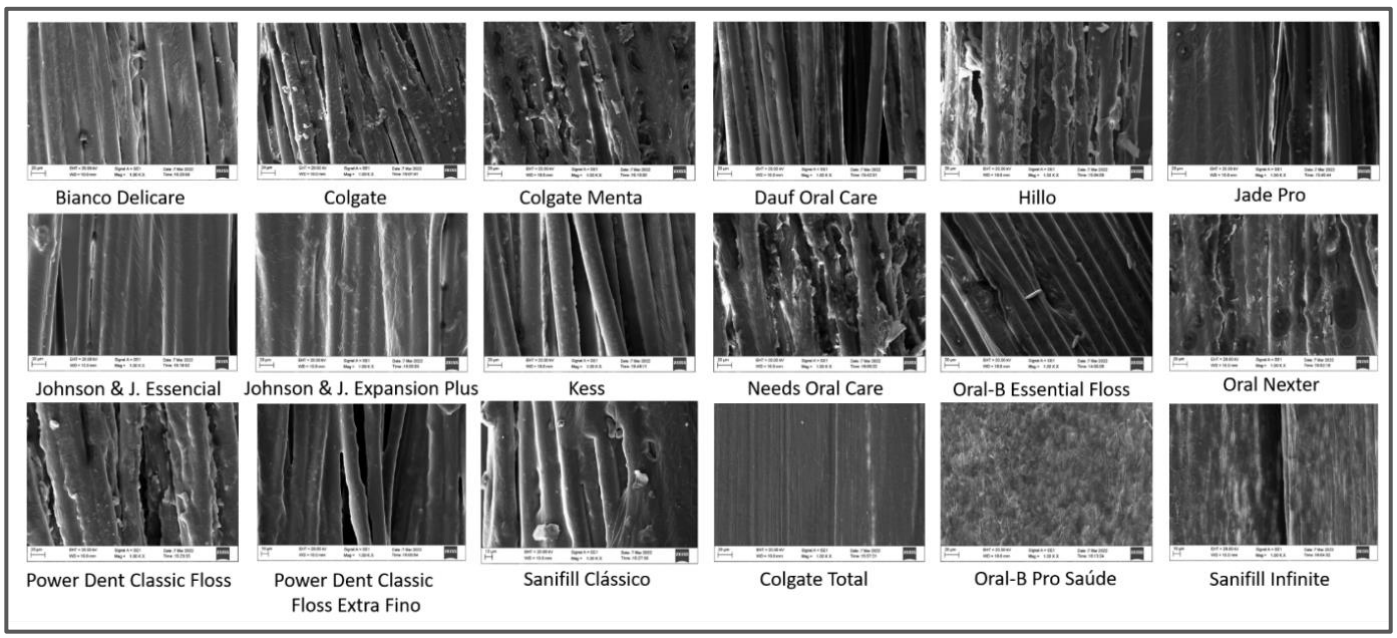

Figure 8. Scanning electron microscopy surface images of all tested groups. Images with 1000× Magnification.

4. Discussion

This study was designed to evaluate the mechanical properties (maximum load and maximum elongation) and physical characteristics (width and diameter of the filaments) and to determine the correlation of these properties with the cost of dental flosses and dental tapes. The 18 dental flosses evaluated in this study exhibited a wide range of maximum load and elongation values. The SEM analysis demonstrated that the tested dental flosses displayed different physical characteristics in terms of the width and diameter of the filaments.

The results obtained regarding the maximum load of dental floss are similar to those reported in a

previous study (Supanitayanon et al. 2017), although that study evaluated only four types of dental floss. The variability in maximum load observed in our study has also been described in the literature, being attributed to differences in material composition (Supanitayanon et al. 2017). Although no specific regulation exists for the maximum load dental floss must withstand, the products available demonstrate a satisfactory range of load-bearing capacity (Figure 3). Maximum load is a crucial mechanical property that directly impacts the floss's effectiveness in removing dental plaque from interproximal surfaces.

If dental floss breaks easily during use, patients may be discouraged from regular flossing. Additionally, the maximum load supported influences a patient's ability to efficiently remove interproximal plaque, as this property determines the force the floss can withstand during use to dislodge plaque from dental surfaces.

Dental floss exhibits a wide range of values regarding the elongation capacity. These values vary because, three dental flosses evaluated are dental tapes. Upon examining the SEM (Figures 7 and 8) of the dental flosses, it can be seen that Colgate Total, Oral-B Pro Saúde, and Sanifill Infinite, which are dental tapes, do not have any filaments. These three dental tapes are composed of polytetrafluoroethylene (PTFE), and the absence of filaments is a crucial factor in their inability to support higher elongation values. This same effect is observed in polyester woven; when the number of filaments increased, the elongation capacity was higher (Petersen 2003). Elongation is crucial for traversing tight interproximal spaces, as it allows the floss to reduce its width and pass more easily without breaking. However, when identifying a patient with a particularly tight contact point between teeth, recommending dental floss with higher values of both elongation and maximum load could be an excellent option.

Different filament compositions were found in the dental floss investigated, including nylon, polypropylene, and unspecified synthetic fibers, as well as dental tapes composed of PTFE. It has been reported that dental tape made of PTFE could offer more comfort during use; however, the study evaluated only one dental tape (Colgate Total) (Huang et al. 2023). Within the PTFE group, a wide range of widths was observed (868.8-2079.1 µm). This variability could impact product acceptability, as a greater width may hinder passage through proximal contacts between teeth. The heterogeneous composition of the dental flosses and the wide range of values found for maximum load and elongation do not allow for direct correlation.

Wax is another essential component used in dental flosses. Different types of wax are used in the tested dental flosses (beeswax, microcrystalline wax, paraffin, and paraffinum liquidum), except Sanifil Infinite. The presence of wax tends not to interfere with plaque removal (AL-ansary 2012). However, it has been demonstrated to have a notable capacity to enhance elongation (Supanitayanon et al. 2017). This observation could explain the lower elongation values observed in unwaxed dental tape (Sanifill Infinite).

The second null hypothesis tested in this study was rejected. The cost of the dental floss tested did not correlate with the maximum load values; however, moderate negative correlation was found between the elongation values and the cost of the dental flosses. The cost of dental flosses ranged from 0.06 to 0.27 US$. The dental tapes are more expensive, costing from 0.97 to 1.53 US$, and they exhibited a lower capacity for elongation. The physical characteristics of the dental floss could be another factor observed by patients when considering a purchase. The dental flosses evaluated have a wide range of sizes, from 458.1 to 2079.1 µm, and their filament sizes varied from 16.8 to 30.1 µm. In a previous analysis by the authors, no correlation was found with the physical and mechanical properties. However, when analyzing separate dental floss and dental tape, the correlation was not observed, and the cost of the dental tapes was higher than that of dental floss.

The availability of oral health services, particularly in low-income countries, needs to be increased for the population that perceives a need for them; this cost should be evaluated (Bastani et al. 2021). When patients or public oral health services consider purchasing essential products for improving oral health care, their use must be recommended for patients irrespective of social level. There are few studies in the literature about the mechanical performance of dental floss and no minimum parameters that regulate these products were found (Supanitayanon et al. 2017; Huang et al. 2022). Despite this study being an in vitro study, it could serve as a parameter for the selection of appropriate dental floss for each patient. However, clinical studies with a wide range of dental flosses are necessary to investigate the efficacy of these dental flosses and the satisfaction of patients with their use. Given that the mechanical and physical

properties of different dental flosses were not directly influenced by their cost, excepted elongation of the dental flosses composed of PFTE, the price should not be the main factor in the selection process. The more critical factor is encouraging patients to use dental floss or interdental brushes daily, as these tools have been shown to be effective in removing interdental plaque (Worthington et al. 2019; Bosma et al. 2024). However, it is vital to choose a product that meets their personal preferences and has an adequate cost for acquisition.

5. Conclusions

Within the limitations of the study design, the following conclusions can be drawn:

The dental flosses tested in this study exhibited a high variability of the maximum load (N) and elongation (mm) values.

There is no correlation between the maximum load, filament diameter, and the cost of dental floss.

The dental tapes evaluated in this study (Colgate Total, Oral-B Pro Saúde, and Sanifill Infinite) are composed of PTFE, have a higher cost, and lower elongation capacity.

Authors' Contributions: PERES, T.S.: acquisition of data, analysis and interpretation of data, drafting the article, final approval of the version to be published; CORDEIRO, I.B.: acquisition of data, drafting the article, final approval of the version to be published; JESUS, I.D.O.: drafting the article, final approval of the version to be published; ALVES, R.O.: drafting the article, final approval of the version to be published; SOARES, C.J: conception and design, critical review of important intellectual content, final approval of the version to be published; SOARES, P.B.F.: conception and design, critical review of important intellectual content, final approval of the version to be published.

Conflicts of Interest: The authors confirm that they have no conflict of interest.

Ethics Approval: Not applicable.

Acknowledgments: This study was supported by the Research Foundation of the State of Minas Gerais (FAPEMIG, Grants APQ-03238-24; RED-00204-23), the Brazilian Coordination of Higher Education, Ministry of Education (CAPES, Finance code 001), and the National Council for Scientific and Technological Development (CNPQ, INCT# 406840/2022–9; MAI/DAI CNPq), Brazil. This study was carried out at the Biomechanics, Biomaterials and Cell Biology Research Centre — CPBIO UFU."

References

AL-ANSARY, M. A. R. The influence of number of filaments on physical and mechanical characteristics of polyester woven fabrics. *Life Science Journal*, 2012, **9**(3), 79-83. https://www.lifesciencesite.com/lsj/life0903/012_9161life0903_79_83.pdf

BASTANI, P. et al.. What makes inequality in the area of dental and oral health in developing countries? A scoping review. *Cost Effectiveness and Resource Allocation*, 2021, **19**, 1-12. https://doi.org/10.1186/s12962-021-00309-0

BOSMA, M. L., et al.. Efficacy of flossing and mouth rinsing regimens on plaque and gingivitis: a randomized clinical trial. *BMC Oral Health*, 2024, **24**(1), 178. https://doi.org/10.1186/s12903-024-03924-4

CHEN, M. X. et al.. Global, regional, and national burden of severe periodontitis, 1990–2019: An analysis of the Global Burden of Disease Study 2019. *Journal of clinical periodontology*, 2021, **48**(9), 1165-1188. https://doi.org/10.1111/jcpe.13506

CWIK, J. et al.. Plaque reduction and tensile strength evaluations of three dental floss products. *American Journal of Dentistry*, 2021, **34**(3), 123-126.

HUANG, Z., BROADBENT, J. M. and CHOI, J. J. E. Comparison of dental flosses–an investigation of subjective preference and mechanical properties. *Biomaterial investigations in dentistry*, 2023, **10**(1), 2258919. https://doi.org/10.1080/26415275.2023.2258919

ISO, *28158:2018;* Integrated Dental Floss and Handles International Organization for Standardization: Geneva, Switzerland, 2018. https://cdn.standards.iteh.ai/samples/69904/ce164ef851e3429ebc26c3b3300ae2e6/ISO-28158-2018.pdf

KUMAR, J., CRALL, J. J. and HOLT, K. Oral Health of Women and Children: Progress, Challenges, and Priorities. *Maternal and child health journal*, 2023, 27(11), 1930-1942. https://doi.org/10.1007/s10995-023-03757-7

PETERSEN, P. E. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century–the approach of the WHO Global Oral Health Programme. *Community Dentistry and oral epidemiology*, 2003, **31**, 3-24. https://doi.org/10.1046/j..2003.com122.x

REINIGER, A. P. P. et al.. Effectiveness of dental floss in the management of gingival health: A 6-month follow-up of a randomized controlled clinical trial. *Clinical Oral Investigations*, 2024, **28**(6), 1-9. https://doi.org/10.1007/s00784-024-05693-4

ROTELLA, K. et al.. Habits, practices and beliefs regarding floss and mouthrinse among habitual and non-habitual users. *American Dental Hygienists' Association*, 2022, **96**(3), 46-58. https://jdh.adha.org/content/jdenthyg/96/3/46.full.pdf

SHAMSODDIN, E. Dental floss as an adjuvant of the toothbrush helps gingival health. *Evidence-Based Dentistry*, 2022, **23**(3), 94-96. https://doi.org/10.1038/s41432-022-0818-x

SUPANITAYANON, L., S. et al.. Mechanical and physical properties of various types of dental floss. *Key Engineering Materials*, 2017, **730**, 155-160. https://doi.org/10.4028/www.scientific.net/KEM.730.155

XU, X., et al.. Effects of water flossing on gingival inflammation and supragingival plaque microbiota: a 12-week randomized controlled trial. *Clinical oral investigations*, 2023, **27**(8), 4567–4577. https://doi.org/10.1007/s00784-023-05081-4

WORTHINGTON, H. V. et al.. Home use of interdental cleaning devices, in addition to toothbrushing, for preventing and controlling periodontal diseases and dental caries. *Cochrane Database of Systematic Reviews*, 2019, (4). https://doi.org/10.1002/14651858.CD012018.pub2