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Biomaterials Research Report

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Non-Latex Dental Dam Tear Testing Comparison

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Introduction:

Dental dam isolation of clinical procedures can be a critical step in preventing ingestion/aspiration of instruments and saliva contamination of restorations. One of the common complications with dental dam placement is tearing initiated from the punched hole as the dental dam may need to stretch to over 30 mm in some cases. Previous obsolete tests of dental dams primarily focused on tensile properties with dubious clinical relevance as they were not found to be sensitive to aging, material thickness or tear resistance. As there are no standard clinically relevant tear tests currently in use, DENTAL ADVISOR developed a test to stretch the dental dam material from within a punched hole until failure. In this test, the total elongation of the hole before tearing is the critical factor in determining how far the material can stretch before failure, while the force required to stretch gives an idea of the resistance to stretching or modulus of the material. In this study, we tested the claims of high tear resistance of the cost-effective latex-free polyisoprene ***ISODAM™*** from 4D Rubber compared to competitor materials.

Conclusion:

For clinical procedures where dental dam stretch over 30 mm is required, the 4D Rubber ***ISODAM™*** has best-in-class tear resistance among the non-latex dental dams tested.

Experimental Design:

MATERIALS:

Latex-Free ***ISODAM™***(4D Rubber) medium and heavy gauge, ***Hygenic® Flexi Dam® Non-Latex*** (Coltene) medium gauge, ***Non-Latex Teal Green Dental Dam*** (Coltene) medium gauge, ***Latex-Free Dental Dam*** (Crosstex) medium gauge, ***Polyisoprene Latex-Free Dental Dam*** (Hedy) medium gauge. All products were ordered independently by DENTAL ADVISOR from Benco Dental.

Test Methods: Five units of each of the test products were cut with scissors to produce 25 mm squares from each product. A rubber dam punch was used to make a 2.2 mm diameter hole in the center of the square. A custom test jig composed of two 4.8 mm diameter "L" shaped legs with each leg attached to a universal test machine was used to stretch the material from inside the punched hole until failure. The maximum force and elongation at failure were recorded. The initial 9.6 mm of linear stretch was added to the elongation at failure to give a final elongation value. The load at failure was divided by the thickness of the material to give a normalized load per mm thickness.

Product	Average Thickness, mm	Load at Failure, N	Normalized Load, N/mm
4D ISODAM Heavy	0.25	5.6 (0.4)	22.4 (1.4)
4D ISODAM Medium	0.21	4.6 (0.2)	21.9 (1.1)
Crosstex Dental Dam	0.26	5.5 (0.3)	21.3 (1.2)
Hedy Polyisoprene Dental Dam	0.26	5.1 (0.3)	19.5 (1.2)
Coltene Dental Dam	0.25	4.7 (0.2)	18.9 (0.8)
Coltene Flexi Dam	0.50	4.0 (0.5)	8.0 (1.0)

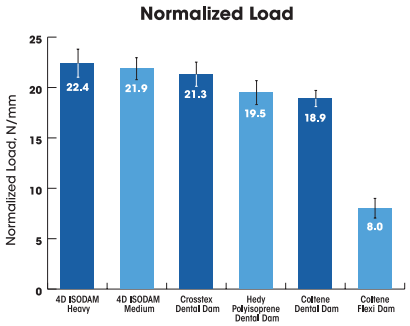

Fig 1. The normalized load which is the load at failure divided by the thickness, shows the amount of load each material could withstand before failure. A lower value can imply either a lower resistance to stretching (pliability) or failure occurs at a lower overall load.

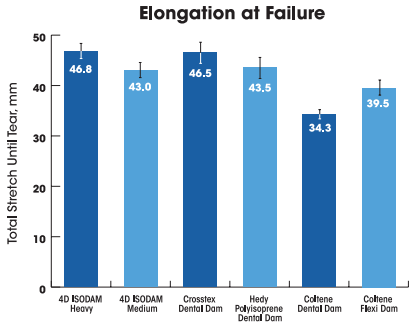

Fig 2. Elongation at Failure shows the total linear stretch the punched hole could withstand before tearing. Higher is better.

ISODAM heavy gauge which has a similar thickness at 0.25 mm as the rest of the materials in the sample, performed slightly better than the next closest dam from Crosstex in both elongation and total load. The normalized load of the same material at different thicknesses is well within the standard deviation of the medium and heavy gauge materials, giving a thickness independent comparison of the flexibility and load bearing capacity of the material while stretching.

ISODAM medium gauge performed within 8% of the next leading medium gauge latex-free dental dam in total elongation before tearing, and within 16% of the maximum load. However, this is primarily due to the medium gauge ***ISODAM*** being the thinnest material tested among medium gauge dental dams for increased ease of access to interproximal spaces and patient comfort. Most dams failed by tearing without significant other deformation with the exception of the green ***Coltene Dental Dam,*** which underwent significant deformation before and after tearing in addition to having the least tear resistance. This could potentially lead to leaking due to the poor elastic recovery and permanent deformation from stretching. ***Flexi Dam*** with around twice the thickness of the other medium gauge dams tested had a low 39.5 mm of stretching before failure, with the lowest resistance to stretching.

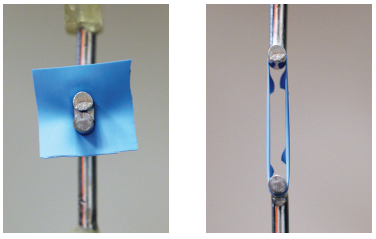

Fig 3. ISODAM heavy initial condition (left) stretched to 40 mm (right)