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Dent Traumatol. 2010 Feb;26(1):23-9.

Impact energy absorption of three mouthguard materials in three environments.

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Abstract

The objective of this study was to compare the impact energy absorption of three mouthguard materials in three environments. Thirty specimens with 12.7 cm x 12.7 cm x 4 mm dimensions were prepared for each material: ethylene vinyl acetate (EVA, T&S Dental and Plastics), Pro-form (Dental Resources Inc), and PolyShok (Sportsguard Laboratories). Ten specimens of each material were conditioned for 1 h at 37 degrees C in three environments: dry (ambient) condition, deionized water and artificial saliva. Specimens were impacted at 20 mph by a 0.5-inch diameter indenter containing a force transducer (Dynatup Model 9250 HV, Instron Corp), based upon ASTM Standard D3763. Energy absorption was determined from the area under the force-time curve during impact (approximately 5 or 7 ms depending on the material). Groups were compared using anova and the Tukey test. Energy absorption values, normalized to specimen thickness (mean +/- SD in J mm⁻¹), were: (i) Dry: EVA 4.73 +/- 0.27, Pro-form 3.55 +/- 0.25, PolyShok 6.32 +/- 0.24; (ii) DI water: EVA 4.82 +/- 0.40, Pro-form 3.78 +/- 0.33, PolyShok 5.87 +/- 0.38; (iii) Artificial saliva: EVA 5.63 +/- 0.49, Pro-form 4.01 +/- 0.54, PolyShok 6.37 +/- 0.55. PolyShok was the most energy-absorbent material in all three environments. EVA was significantly more impact resistant than Pro-form in all three environments. EVA and Pro-form performed significantly better after saliva conditioning than dry or water conditioned, but PolyShok did not show any difference in energy absorption when conditioned in any of the three environments. Characteristic deformation patterns from impact loading were observed with an SEM for each material. The superior energy absorption for PolyShok is attributed to the polyurethane additive.

PMID: 20089058 [PubMed - indexed for MEDLINE]

Publication Types, MeSH Terms, Substances

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