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testing to perfection

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Primate Bites: Force and Fracture

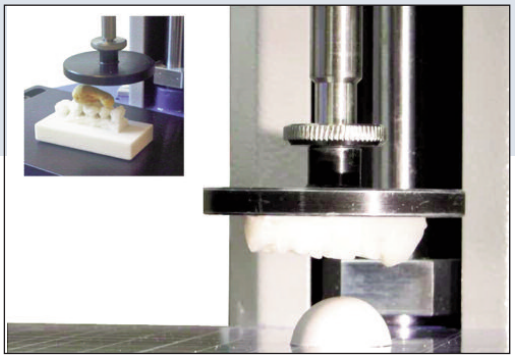
Specification

Mangabey Monkey Skull and Upper Jaw

Hull York Medical School combines research and teaching in human anatomy and evolution at its Centre for Anatomical and Human Sciences. A major strand of research focuses on the impact of diet on the skeletal and dental morphology of humans and primates. Foodstuffs vary in mechanical and material properties; some can be classified as stress-limited, where high compressive occlusal forces are required to induce failure (e.g. hard nuts) or displacement-limited, where more significant deformation occurs before cracking or fracture (e.g. tough plant material). The form and function of teeth and their mechanical performance is being investigated through a combination of virtual dental casting, rapid prototyping and material property testing methodologies to evaluate the influence of dental form and dental wear on the ability to fracture and fragment hard foods. For valid scientific research there is the requirement for repeatable testing techniques and accurate data acquisition for analysis. A solution was needed to carry out controlled bite simulations without, for obvious practical and ethical reasons, the use of live sooty mangabey (*Cercocebus atys*) specimens.

Solution

Mecmesin supplied a MultiTest 2.5-*i* test stand, loadcell and Emperor™ software. The simulation is a compression test and a dental model of the teeth is fixed to the compression plate, which is driven down by the bespoke program. Consistent representation of the hard, brittle dietary item is achieved by means of a plaster of Paris hemispherical dome. The compressive force is recorded until the sample fractures and the software captures the peak at initial crack propagation. The stress-limited nature of the test sample means the curve exhibits very little displacement from the onset of the bite until failure and close clustering of the curves gives confidence in the consistency of the sample and hence confidence that the spread in peak compressive force is a function of the tooth profile. A further factor pertaining to bite efficiency is the number of fragments, which is also recorded by the methodology. The portability of the results format allows study off-site, which provides flexibility for researchers and data input directly to Excel® enables comprehensive scientific analysis of the test.



Compression and Fracture Test by Dental Model and Brittle Plaster of Paris Dome

System

- MultiTest 2.5-*i* test stand
- 2.5 kN intelligent loadcell
- Compression plate, 70mm diameter

Testimonial

“Over the course of my PhD I have developed a new methodology to physically test the mechanical performance of teeth using the Mecmesin MultiTest 2.5-*i*. At the start of my project I needed a small, low cost, but accurate materials testing machine which could be programmed, and fitted, to run a large number of different test programs. The easy-to-use interface, accuracy and reliability of the MultiTest 2.5-*i* and the excellent service from Mecmesin has made my project run smoothly and has produced highly publishable results.”

Karen Swan, PhD Research Student, Centre for Anatomical and Human Sciences, Hull York Medical School

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