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Renishaw incise™ - clinical accuracy

The current standards describing performance levels for impression and die stone materials bear little relevance to clinical practice. A bridge preparation of 33 mm span impressed with a material that satisfies the standard maximum 1.5% dimensional change would exhibit a length error of 0.5 mm, even before die stone errors are introduced!

Master aluminium artefact with precision ruby spheres

Diagram 1 - Errors of 7 die stone materials

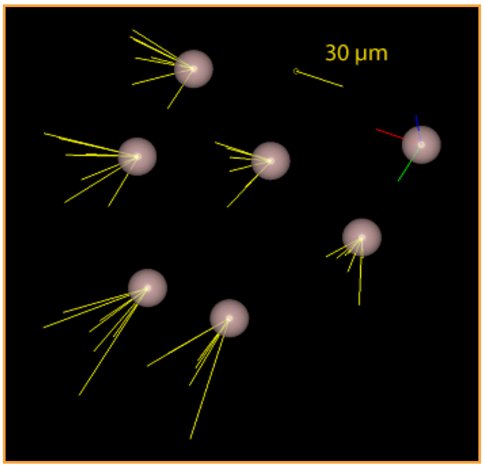
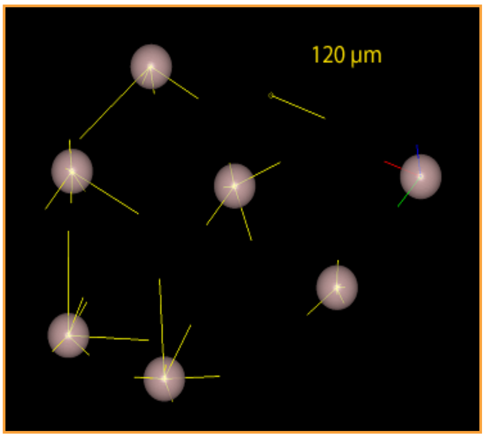


Diagram 2 - Errors of 6 impression materials



The Renishaw incise™ system is grounded on an impression and model combination where distortion errors are truly minimised – in 3D.

incise™ impression and die materials were selected after three stages of rigorous testing.

1. Evaluation of long-scale accuracy based on measurements of precision spheres on a master artefact.
2. Form reproduction accuracy analysed by scanning a reproduced prep model and comparing this with a scan of the original tooth preparation.
3. In vivo trials and evaluation by dentists to ensure good performance under clinical conditions.

The result is a combination of materials and techniques with outstanding long scale and spatial replication abilities, together with ease of handling in a clinical situation.

The key to identifying complimentary materials is to first assess their performance individually. A novel method has been developed to visualise the distortion of impression and die stone materials, giving a clear understanding of their unique behaviour.

Diagram 1 shows errors of stone models poured directly from a master aluminium artefact with no undercuts. Diagram 2 shows errors of impressions, with die stone error removed. The lines show the positions of spheres on the replica compared to the master artefact (shown by balls in the diagrams). Each line represents one material.

The polymeric nature of impression materials gives rise to an unpredictable distortion on curing, while the die stone materials

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exhibit a smaller, isotropic expansion. The best accuracy is obtained by matching the impression and die materials, which alone exhibit the smallest volumetric change, and the smallest deformation.

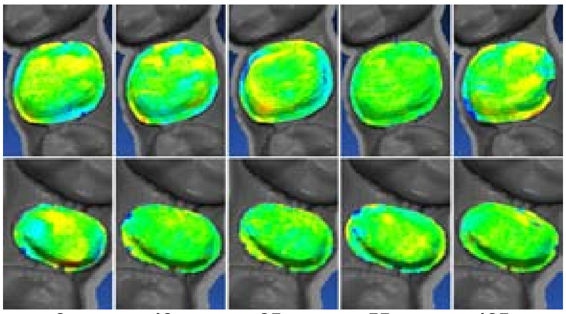
Attempting to compensate for a large impression 'shrinkage' with a high-expansion stone will lead to a greater spread in errors. As we move away from dated 2-dimensional measurement techniques, we can see precisely what these are.

Once long scale accuracy has been determined, the next stage is fine detail reproduction capability. Current standards require a material to reproduce a line of given thickness, which is clearly unrepresentative of the complexities of fine margins and contours of clinical preparations.

The diagrams opposite show error analyses of impression and die stone model combinations. Scans of stone preparations were compared to scans of their plastic originals. Red shows areas where the stone is larger than the original, blue shows where the stone is smaller.

Diagram 3, picture 4 of the bad impression shows large blue areas where the stone model is 90 µm smaller than the master preparation, so the whole model is 180 µm narrower than the original. This will be particularly noticeable when fitting the final restoration.

Diagram 5 - Impression stability with time



Time left before pouring model (minutes)

Ignoring localised defects, errors on the best preps are within ±25 µm. The excellent form reproduction and long scale accuracy capabilities, along with its ease of handling and repeatability, make this impression technique superior to all others tested.

The materials used to obtain these good impressions have been slightly modified by the manufacturer especially to suit the incise™ process.

For more information about Renishaw's dental products and software visit **www.renishaw.com/dental**

Diagram 3 - Typical bad impression

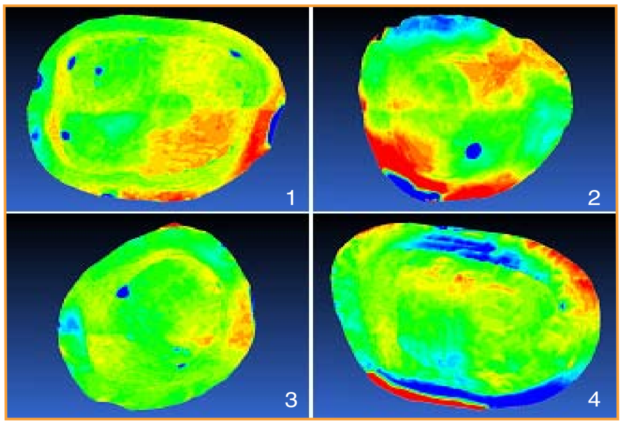


Diagram 4 - Best performing impression

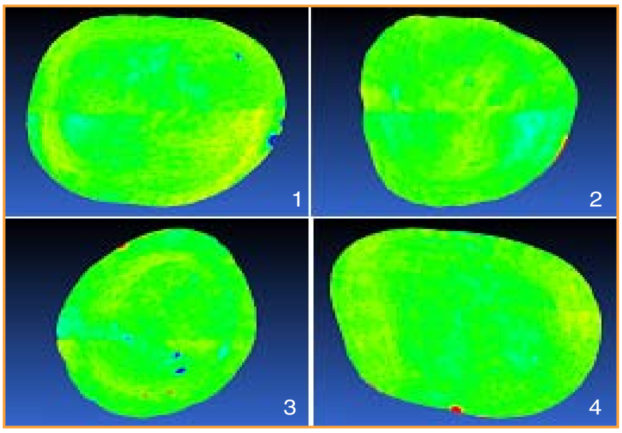
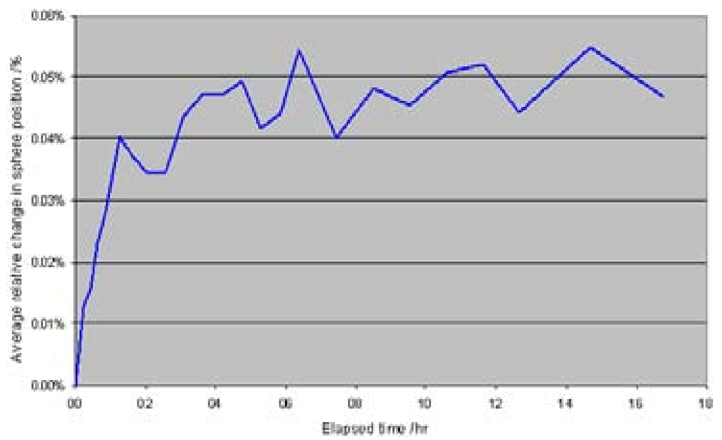


Diagram 6 - Die stone model stability with time



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