After almost fifty years, acrylic occlusal splints have now ‘gone digital’. Great Lakes Orthodontics, Tonawanda, NY, recently unveiled a digital process for designing and producing flat plane and centric relation occlusal splints. The process provides precise and consistent control over articulation and design parameters.

Current laboratory methods for producing splints utilize a variety of articulation and manual trimming methods. The functional or contact surface is the result of a technician’s subjective determination of smoothness and the absence of tooth impressions. This essentially guarantees that the same splint will never be made twice for the same case, even by the same technician.

The Digital Process

The process can be considered in four main steps: 1) model scanning, 2) articulation, 3) design, and 4) fabrication.

Model Scanning

Upper and lower stone models are laser scanned to produce a 3D model in a computer. Six individual scans are combined into a single object.

Articulation

Mounted and unmounted cases can be processed. Mounted cases are articulated in a pc by modeling commercial articulators in software.

Unmounted cases use the lower arch to locate a centric axis using established average values for the lower occlusal plane angle, axis-incisal distance, and vertical height. Patient-specific values (when available) can also be used to articulate cases.

Anticipated improvements to the system include the use of published articulation values related to race, age, and sex. In all cases, condylar inclination, eminence curves, and the Bennett angle are under software control which provides highly accurate design of the ramps needed for centric relation splints.

Splint Design

Customized software is used to design the splints. First, the opening is adjusted to an appropriate setting. A CR bite record at the desired opening should be taken to avoid having to change the opening.

Contact points are then defined by clicking on the 3D model surface. Software automatically relocates the points to ideal positions. For cases with relatively normal curves of Spee, contact points are optimized based on the contact model’s occlusal plane. For cases with large curves of Spee, the arc of closure is used to optimize the contact points.

As contact points are defined, a smooth plane is passed through them to form the main functional contact surface of the splint. Centric relation splints are designed with anterior and cuspid ramps that provide gentle posterior discusion when the patient protrudes or moves laterally. The length and angle of each ramp is independently controlled.

The width of horizontal shelves adjacent to the ramps can also be specified.

Fabrication

The designed splint is saved as a 3D file which is imported into CAM software. The splint model is then covered with the appropriate splint material which is milled-down to the final splint surface with an accuracy of less than 0.001 in. The high speed machining process produces a perfectly smooth contact surface which does not undergo any additional finishing.

Important Features

An important feature of digital splints is the smoothness of the contact surface. While conventionally produced splints have indexing impressions that can inhibit the free movement needed to deprogram muscles, digital splints are completely smooth.

Digital splints can be produced from all materials commonly used to make splints, including: cold-cure acrylic, thermoformable materials, hard/soft materials, heat-softening acrylics, and light cure materials.

The arc of closure used to design the splint influences the location of initial contacts.