3-D CAD/CAM Facilitated Custom Silicone Implants For Facial Contouring

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About the Author:

Dr. Binder obtained his pre-medical education at Syracuse University with a B.A. degree in Biology and earned his M.D. degree at the University of Medicine and Dentistry of New Jersey. He then spent five years of post graduate Internship and Residency training. Three years were devoted to Head and Neck and Facial Plastic and Reconstructive Surgery at the Mt. Sinai School of Medicine in New York City, where he became Board Certified and also secured a teaching position.

After taking advanced training in Facial Plastic and Reconstructive Surgery, Dr. Binder established his practice in Los Angeles, California in 1979.

The correction of facial contour defects has always posed a challenge to the reconstructive surgeon. Traditionally, severe deformities have been successfully treated with orthognathic surgical approaches, including osteotomies and bone grafting. However, the use of orthognathic surgery for the resolution of mild to moderate facial defects without functional impairment requires a relatively large surgical procedure with its attendant complications and usually expensive hospitalization. Carving and modifying autogenous bone or cartilage grafts or "off-the-shelf" alloplastic onlay implants for the correction of many specific facial contour defects, particularly post-traumatic deformities, may be equally unsatisfactory due to their failure to conform precisely to the underlying surface.

Advances in the areas of computer imaging and computer-aided design/computer-aided manufacture (CAD/CAM) have recently enabled the production of custom alloplastic implants which solve many of the problems associated with the correction of most contour defects. The process begins with a computerized tomographic (CT) scan of the anatomical area encompassing the defect. Appropriate scanning protocols have been developed which permit complete CT assessment of a facial defect with minimal radiation exposure. Next, the CT scan data is reformatted into a three dimensional (3-D) computer image linked to a CAD/CAM milling machine, which in turn produces a 3-D physical model of the anatomical area scanned. The resulting life-size anatomical model is then used as a template from which an extremely precise silicone implant can be cast.

The computerized process eliminates the need for invasive bone impression surgery or indirect, external facial moulage methods that use the outer surface of the skin and do not accurately reflect the bony skeletal structure underneath. Moulage-derived implants fall to conform to the contours of the defect site, and cannot produce a stable implant. However, the posterior surface of an implant designed utilizing the computerized 3-D process and anatomical model is able to fit the skeletal defect exactly. This facilitates correct implant placement and imparts stability. The custom implants conform to irregular bony surfaces so precisely that they usually require no internal or external means of fixation.

Custom implants can also be used to treat soft tissue deformities. By configuring the implant with extended anterior dimensions that approximate the volume normal soft tissue contour, the implants can also replace deficient volume and simulate soft tissue replacement.

CAD/CAM facilitated custom implants are commercially produced and fabricated from medical grade silicone elastomer. At this time, silicone rubber is the biomaterial that possesses the characteristics that best satisfies all of the requirements necessary for this process to manufacture customized implants.

Each year comprehensive health care continues to become more difficult to obtain and facial disfigurement is often excluded from coverage as a "pre-existing" condition. In the majority of cases, the insertion of custom implants can be performed on a more cost-effective outpatient basis requiring less operative time.

The application of computer technology to assist in the production of custom onlay implants provides the reconstructive surgeon with a new, more accurate means of correcting facial contour defects. ■