Use of Dental Implants
The use of dental implants to provide support for replacement of missing teeth has become an important component of modern dentistry. As a result of advances in research on implant design, materials, and techniques the use of these devices has increased dramatically in the past 10 years and is expected to expand further in the future. Many types of implants are now available for restoring different clinical cases, and an increasing number of dentist have become involved in this form of treatment. It has been estimated that the overall number of dental implants inserted in the United States has increased fourfold and the number of practitioners who perform implant therapy has increased tenfold. It is estimated that more than 500,000 dental implants are used annually in the United States. Growth in dental implant utilization also is evident in Europe, Mexico, South America and Asia.

Rate of Edentulism
The rate of edentulism in the United States adult population remains considerable. Although there has been a tremendous reduction in coronal dental caries during the past several decades, this improvement is evident mainly in the younger segments of the population, with individuals over 35 years of age still showing a significant prevalence of full or partial edentulism. According to the National Institute of Dental Research’s (NIDR) national survey of oral health conducted on U.S. employed adults and seniors attending multipurpose senior centers, approximately 42 percent of Americans over 65 years of age and 4 percent of those 35 to 64 years of age are totally edentulous. Moreover, those over 65 years with teeth have lost an average of more than 10 of 28 teeth, and employed dentate persons ages 55 to 64 have lost an average of 9 of 28 teeth. Thus, there are many individuals in this country who could conceivably benefit from dental implant therapy.

Beneficial Alternative
Many edentulous individuals can be treated with partial or complete traditional removable dentures or fixed bridges. However, these prostheses are not satisfactory for a significant number of individuals who have lost the tooth-bearing portions of the bone and simply cannot manage removable prosthesis, or are medically compromised and cannot properly masticate food. Moreover, there is strong evidence that a substantial number of patients prefer implant-supported prosthesis over soft tissue supported prosthesis.

Research Advances
Research advances in dental implantology have led to the development of several different types of implants, and it is anticipated that continued research will lead to improved devices. At present, continued evaluation is necessary to determine that appropriate implant devices are available to meet the partially and fully edentulous needs of patients.
What is the evidence that implants are effective for the long term?

Criteria of success vary with different implant systems. Therefore, it is difficult to compare certain types of implants for which success criteria and indications may be different. Furthermore, for implants that are comparable, proper research designs for comparison (randomized, controlled trials) have not been used. Thus, the panel could only conclude that there is evidence from a number of case series studies that when specific types of dental implants are inserted by clinicians experienced with the respective techniques, a large proportion of implants remain in place for periods of 10 years or more.

Future case series studies should conform to the following principles:

A. A prospective statement of study aims, with clear definitions of success and failure for all measures.
B. A description of the study populations and criteria for patient selection.
C. Standardization to the extent possible of treatment outcome measures, with presentation of data on reliability. Use of independent examiners is desirable.
D. Adequate sample size adjusted for the expected attrition the length of the study.
E. Concise reporting of reasons for attrition.
F. Reporting of all failures from time of insertion of the implant.
G. Documentation and follow up of each failure.
H. Use of standardized reporting methods, including life tables.
I. Limiting extrapolation of results to populations similar to that of the study under similar experimental conditions.

What are the indications and contraindications of various dental implants?

Dental implants may be classified by type as endosseous, subperiosteal, transosteal, intramucosal, endodontic and bone substitutes. The data presented will be on the first three types. These implants are subdivided as follows:

A. **Endosseous:**
   - Root Form
   - Blade (plate) form
   - Ramus Frame

B. **Subperiosteal:**
   - Complete
   - Unilateral
   - Circumferential

C. **Transosteal:**
   - Staple
   - Single Pin
   - Multiple pin

For long-term successful performance of all dental implant types the following general factors should be considered:

A. Biomaterials
B. Biomechanics
C. Dental evaluation
D. Medical evaluation
E. Surgical requirements
F. Healing processes
G. Prosthodontics
H. Laboratory fabrication
I. Post insertion maintenance
Contraindications:

All practitioners involved in patient care should be knowledgeable regarding these factors and their inter-relationships. Standards of dental practice would suggest the following general contraindications for the above three categories of dental implants:

A. Debilitating or uncontrolled disease
B. Pregnancy
C. Lack of adequate training of practitioner
D. Conditions, diseases or treatment that severely compromise healing, e.g., including radiation therapy
E. Poor patient motivation
F. Psychiatric disorders that interfere with patient understanding and compliance with necessary procedures
G. Unrealistic patient expectations
H. Unattainable prosthodontic reconstruction
I. Inability of patient to manage oral hygiene
J. Patient hypersensitivity to specific components of the implant

Indications:

With regard to indications for a specific implant type, the bone available to support the implant is the primary factor after prosthodontic diagnosis and treatment plan. This bone is measured in width, height, length, anatomical contour and density. These physiological and anatomical factors may be altered by either osteoplasty or augmentation of the bone. In addition, other factors affecting indications for implant type are the degree and location of the edentulous areas.

Indications for each implant type are specified below:

A. ENDOSEOUS, Root Form:
   - Adequate bone to support the implant with width and height being the primary dimensions of concern
   - Maxillary and mandibular arch locations
   - Completely or partially edentulous patients

B. ENDOSEOUS, Blade (plate) form:
   - Adequate bone to support the implant with width and length being the primary concern
   - Mandibular arch location
   - Completely edentulous patients

C. ENDOSEOUS, Ramus frame:
   - Adequate anterior bone to support the implant with width and height being the primary dimensions of concern
   - Mandibular arch location
   - Completely edentulous patients

D. SUBPERIOSTEAL, Complete, unilateral, circumferential:
   - Atrophy of bone but with adequate bone support for the implant
   - Maxillary and mandibular arch locations
   - Completely and partially edentulous patients
   - Stable bone for support

E. TRANSOSTEAL, Staple, single pin, multiple pin:
   - Adequate anterior bone to support the implant with width and height being the primary dimensions of concern
   - Anterior mandibular arch location
   - Completely and partially edentulous patients
What are the requirements for surgical, restorative and periodontal management of patients with dental implants?

The implant team, implant treatment is delivered in several ways:

A. By multidisciplinary teams of dentist in which one oral surgeon or periodontist performs the surgical component of the implant and a prosthodontist and a qualified dental technician performs the prosthetics component.

B. By individual implantologist with extensive training in both the surgical and prosthetics components who perform all aspects of the procedure in conjunction with a qualified dental technician.

C. By general dentists who may perform both components or the prosthetics component only and whose training in implant techniques may vary widely. The prosthetic reconstruction should be performed by a qualified dental technician.

Minimal training has not been precisely defined but is recommended that the individual that assumes the surgical treatment phase be well prepared in accepted surgical methodologies. The restorative dentist in all phases of an implant reconstruction and the dental technician in the fabrication of an implant appliance.

What are the health risks of dental implants?

There are at least three areas in which the assessment of patient risk should be considered, including risks associated with the surgery and/or anesthesia, psychological risks and medical risks. Risks associated with the surgical procedure may included inadvertent perforation of the nasal sinus, local and systemic infection and nerve injury. Before surgery a medical history should be taken to evaluate the history of the presenting problem chief complaints. A review of the current status of the patient's organ systems should be made.

Children need special consideration, given long term morbidity concerns, requirements of growth, manual dexterity and coping skills.

Psychological stressors and motivational factors have been shown to influence patient response to surgery and long term compliance with oral hygiene maintenance. These stressors include both familial and social environmental factors such as job satisfaction, financial status and health concerns. Specific mental conditions may require psychological intervention to assist with patient cooperation and satisfaction. Individuals with excessive neurotic concerns, depression, anxiety and specific medical fears or previous negative medical or dental experiences should be appropriately evaluated. Relative contraindications include individuals with psychotic symptomatology, especially requiring psychotropic medication and somatization disorders or chronic pain complaints where medical symptoms are exhibited in the absence of organic evidence. Tobacco use, alcohol or drug dependency may interfere with good nutrition or compliance requirements.

Temporary conditions that may result from implant placement may include pain, swelling, speech problems and gingivitis. Long term problems may include nerve injury, local bone loss exacerbation, hyperplasias, local or systematic bacterial infection and infectious endocarditis in susceptible individuals, including those with body part replacement. Natural dentition may be compromised.

Factors related to prediction of health risks need to be continuously assessed before the surgical decision after implantation, during the temporary waiting period, and at 6-month intervals throughout the follow up period. Reliable and valid standardized measurements sensitive to both psychological and physical factors should be used to enhance comparison across studies.
What are the future directions for research on materials and designs of dental implants and on clinical management?

Material and Designs

Dental implants have many compositions and surface textures. Manufacturing processing techniques affect these surfaces in subtle ways. To better control clinical protocols, characterizations of these surfaces is essential. Ion release from the implant may influence biocompatibility (bioacceptance). To achieve a more complete understanding of tissue response to the implant, basic experiments in host-implant physiology and biology must be continued. Dynamic studies in laboratory animals also should be completed. Other matters that warrant further study are the influence of surface preparation on wettability or bonding of tissues to the implant and the effect of galvanic couples resulting in corrosion. Studies must document the possible release of constituents of implant materials at the trace and subtrace level into other tissues to determine their significance with respect to toxicity, mutagenicity or carcinogenicity.

Basic research should be emphasized to develop materials and methodology to allow for predictable bone augmentation. The implant-host interface should be studied to characterize wound repair and tissue adaptation in the peri-implant region.

Among the factors involved in the design of an implant are the force components produced during loading, the dynamic nature of loading and the mechanical and structural properties of the prosthesis of stress transfer to tissues. Unfortunately, accurate data on such parameters are incomplete. Such information is essential for efficient design of implants.

Patient Considerations

Considering that endentulousness is frequently the result of the patient’s high susceptibility to destructive forms of periodontal disease, the relationship of implant success rates to the patient’s relative susceptibility to periodontitis should be studied. Also, data is needed on both the acute and chronic or long-term morbidity that may result from various types of implants.

The public and patient is entitled to educational materials that enable informed participation in implant treatment decisions.

The information provided is a summary of the Consensus Development Conference conducted by the National Institute of Health.
Clinical & Technical Procedures

The following text should be reviewed prior to beginning implant treatment. This text should be used only as a guideline and other alternatives should be evaluated. It is important that the section on direct vs. indirect method of fixation be reviewed prior to starting the restorative procedures. A successful implant restoration depends on teamwork.

Preliminary Protocol

1. Take a full mouth radiograph, tomograph or Cat-Scan.
2. Take impression, make study models and take a bite registration.
3. Mount the study models. The models should be evaluated by the surgeon, dentist and technician. Factors such as vertical dimension, available bone, bite classification, ridge type, proposed restoration, etc. should be considered to help decide as to the implant type and position. Refer to the Dental Implants-Introduction.

Diagnostic Wax-up

1. A diagnostic wax-up using denture teeth or wax is constructed on the mounted study models.
2. Wax-up is tried in for verification of teeth alignment, occlusion, esthetics, and patient approval.

Radiographic Correction Tray

1. An acrylic baseplate or stent with 5mm ball bearings order number # 40-000050 is used to determine the distortion factor inherent in radiographs. Once the amount of distortion is discerned, an implant of the appropriate length and diameter can be selected.
2. The correction tray may be made of cold cure, light cure or vacuum formed material. The 5mm ball bearings are secured with acrylic, cyanoacrylate or directly vacuum formed into the correction tray. The diagnostic wax-up or the patient's existing denture may be duplicated in clear acrylic and used for this purpose. The ball bearings are retained in the tray directly over the proposed implant site (s).
3. The radiograph is taken and the bearing's image is measured. The discrepancy found is used to compute the distortion factor. The image of the bone is measured and multiplied by the distortion factor. Example: If the actual size of the ball bearing is 5mm, but the image measures 6mm, the distortion factor is 20% in that section of the radiograph.

Stents

1. A clear acrylic stent (drilling guide) can be made to aid the surgeon during implant placement. The clear duplicate denture used for radiographic correction may also be used after the ball bearings have been removed.
2. The lingual portion of the stent is ground away over the implant site (s) leaving the facial shell. The remainder of the stent is left intact. The stent is sterilized and used as a drilling guide.
3. If natural teeth remain, a clear stent can be made that resembles a removable partial denture. The stent may also be made to rest on the occlusals of the remaining teeth to support the facial shell labial to the implant site (s).

Implant Placement

1. Refer to the implant manufactures’ clinical prosthetic manual and recommendations for the first and second stage surgery.

Note: To simplify and to reduce confusion with multiple implant systems you may want to consider the UMA system, a tissue extension with a universal fitting surface, available for many implants. All restorative components and tools are interchangeable, thereby reducing your inventory.