

# Dental Implants in Patients With Ectodermal Dysplasias

The use of dental implants to replace missing teeth has become a standard of care in treating patients. Following the introduction of dental implant to replace missing teeth, dental implants have assumed a major role in oral rehabilitation. Crucial to the predictable esthetic and functional outcome is the complete diagnostic evaluation and discussion of the range of treatment options open to you. This should be done by a trained prosthodontist (a specialist in dentistry that has advanced training in the replacement of teeth).

Alternatively, you can seek dental care from a general dentist but be sure he or she has extensive experience in managing the somewhat unique aspects of patients affected with the ectodermal dysplasias. This overview is being presented based on a publication that appeared in the Journal of the American Dental Association authored by Clark Stanford, D.D.S., Ph.D.

## This article addresses the following topics:

- Growth of the face and head with the eruption of teeth and the consequences of when teeth do not form,
- Age assessment for when to consider a reconstruction of the missing teeth,
- Role of diagnostic steps, questions to ask in evaluating the background of a treating dentist
- Nature of the referral team, experience in managing complex dental needs in an interdisciplinary manner,
- Assessment of various approaches to replacement of teeth including crowns, dental bridgework (on teeth or implants), removable partial dentures as well as “overdentures” (dental that go over and rest or attach to natural teeth or dental implants).
- A discussion on what are dental implants, steps in how they are used (e.g., healing time) and a discussion on questions to ask about the products being used or proposed in your care or the care of your child.

## Oral or “Dental” Implants

Oral implants are typically screw-shaped devices placed surgically in the bone of the jaws and used, once they heal, to support crowns, bridges, dentures etc. They are most often made of

a medical grade titanium metal. Titanium is used because research has shown that it is well accepted by the body. There are multiple approaches to their use and you should always ask for a range of options since each option has specific advantages and specific challenges.

In addition to cost, ask about maintenance issues long-term that you will need to anticipate. For instance, dentures that connect to the implants will wear (much like your car tires do) and will need to be replaced. Porcelain teeth connected to the implants can chip and the porcelain can break necessitating the crowns to be remade.

Implants work by a process known as “Osseointegration.” Osseointegration occurs when bone cells attach themselves directly to the titanium surface, essentially fusing with the implant. This process of osseointegration was first discovered by a Swedish researcher, Per-Ingvar Bränemark and others in the 1960s. Placing dental implants into the jaw bones by controlled surgical procedures allows them to connect directly to the bone in a rigid and stable fashion.

Osseointegrated implants can then be used to support prosthetic tooth replacements of various designs and functionality replacing from a single missing tooth to a full arch, i.e. all the teeth in upper or lower jaw. These teeth can usually be made to match your natural teeth or, indeed, provide you with a whole new smile.

## Surgery

Dental implant surgery is mostly performed in an out-patient basis at an oral surgeon



or periodontists office. It may be undertaken in a hospital setting when appropriate. Local anesthesia is often adequate for this surgery; various forms of anxiety control, such as oral, nitrous oxide and/or intravenous sedation may be used in addition. Additional surgical procedures, such as bone or soft tissue augmentations, may be performed as separate procedures or at the same time as implant placement, depending on the clinical situation, and to some extent the preferences of the doctor or patient.

## Diagnostic Procedures

How do you know if you are a suitable candidate for oral implants? It is not acceptable to proceed with implant treatment if there are areas of untreated disease of your teeth, gums or bone as these can affect the success of your implant surgery and/or the integration and maintenance of the implant itself.

Therefore, a thorough full mouth examination, including examination of your teeth and gums should be performed. This allows the dentist to also assess your bite or occlusion, which is important to the success of your implant restoration. Your dentist and/or implant surgeon will need to take some x-rays of your jaw, with emphasis on the area to be treated.

Generally speaking, a recent full mouth series of x-rays is needed so that your dentist can be certain that there are no other teeth or areas in the bone that need treatment, whether for implants or otherwise. Many dentists will use a panoramic radiograph, which shows all of your upper and lower jaws and teeth, to diagnose other dental and bone pathology.

These can also be used to assess the height of available bone, and relation and position of some important anatomic structures, as part of their analysis for implants. The most accurate form of x-ray imaging currently available is the CT scan, commonly known as a CAT scan.

While medical CT scanners were used by dentists to diagnose, analyze and treatment plan implant surgery this has evolved to the routine use of a modified CT scanner called Cone-Beam CT Scanner or CBCT that has reduced exposure with similar information needed for safe treatment planning.

CBCT's use significantly less radiation, and may be available to you at an imaging center or in

your surgeon's office. Either form of CT scan provides very detailed, 3-dimensional images that can accurately measure the height and width of available bone, as well as location of the many nearby anatomic structures, such as your upper jaw (maxillary) sinuses and lower jaw (mandibular) nerves, both of which are important to be mindful of during your surgery.

Because all radiation dosages are cumulative and the potentially harmful effects of excessive radiation are well documented, the benefits of improved diagnostic imaging must be weighed against the risks of radiation exposure for your particular needs and circumstances.

Other diagnostic studies are also required to properly proceed with implant treatment. These include a full periodontal gum examination to rule out, or enable proper treatment of, gum disease. A complete, tooth-by-tooth examination also needs to be performed to rule out and properly treat any active cavities or other dental pathology.

Impressions of your teeth will be needed at various points of your treatment to assess the status of your bite and proceed with proper restoration of the implant(s) in coordination with the rest of your entire dentition. Photographs may also be used to help plan out your treatment, as well as to record your condition along the way.

## Healing Times

Healing times for implants vary to a certain extent depending on bone quality, and are often extended when performing adjunctive procedures. In general, dental implants require 2-4 months healing time in the bone, without being exposed to biting forces.

Research into the mechanisms of bone attachment to titanium has improved this process to the point that some manufacturers can claim greatly shortened healing times, but this is not generally accepted in the care of patients with ectodermal dysplasia. In general, it is safer to wait a little longer than to load your implants too soon.

## “Staged Surgery” May Be Recommended.

Why? The classic approach to oral implants has been to place them and cover them with gum tissue during the healing process. This protects the implant from force while it is healing. At the end of the healing phase the implant needs to be surgically exposed, removing some of

the overlying gum, checking the implant for its successful integration, and connecting some form of post which penetrates through the gum into the mouth. This is called the "abutment" by dentists.

The "abutments" come in many forms and choices and this should be discussed with you during the planning phase. Some implants have these abutments designed to allow your dentist to connect the teeth by small screws (allowing easy removal of the denture or teeth if maintenance is needed in the future).

An alternative approach is to cement the teeth to these abutments using common dental cement. The cemented approach has less retrievable but can be useful, especially in highly esthetic areas of your mouth. These abutments can either come premade by the implant manufacturer or can be custom designed in a computer and milled as a "custom" abutment. The abutments can be made out of titanium, gold alloys typically used in dental crowns or out of high strength white ceramic materials (e.g., Zirconia).

The abutment protrudes through the gum, allowing the gum to heal around it and form a cuff or collar through which the dentist can have ready access to the implant when preparing the final restoration to provide you with the prosthetic tooth or teeth. Once again, research has shown that it is often possible to place a suitable abutment at the same time as the implant.

This has certain limitations but can eliminate the need for a second surgery to expose the implant. However, the implant still requires adequate healing time for the bone to heal around the implant (osseointegration). The abutments must also be protected from chewing forces while healing or bony integration may not work or healing may be compromised.

## Restoration

Once the implant or implants have had a chance to heal and have been tested for successful integration you can proceed with a restoration. This means fabricating and placing a prosthetic tooth or teeth, connected to the implant(s) by various methods to replace your missing teeth.

## Failure

Despite decades of clinical and scientific research oral implants do not have a 100% success rate. However, the success rates have

improved dramatically since the early days of osseointegration and the dental profession can proudly point to success rates in the mid- to high 90 % range for most patients and most implant placement situations.

Similarly, long-term success rates are in the high 90% range and are likewise improving. When a oral implant is not successfully integrated it must be removed. There are no current treatments that can predictably restore lost bone around an implant. Likewise, an unsuccessfully integrated implant cannot be "converted" to a state of osseointegration and must be removed. A replacement implant can be placed, though it may require some months of healing time and possibly bone augmentation (repair by means of grafting). It is unusual for a patient to have unsuccessful oral implant treatment.

## Tooth Loss

Tooth loss can occur for a variety of reasons-congenital absence, trauma, dental disease, e.g. caries or periodontal disease, as well as mechanical failure.

## Congenital Absence

It is not uncommon for a tooth or teeth to be congenitally absent. Most commonly the primary, or baby, tooth is present, but there is no successor, or permanent, adult tooth to replace it. Frequently this will be apparent when the baby tooth exfoliates, or falls out, as it's supposed to do during adolescence.

Oftentimes, though, the baby tooth will remain in place, sometimes because it is ankylosed, or fused with the bone. This can create problems for the adjacent teeth depending on positioning. Other times, baby teeth remain in place and in function and will need to be removed when they fail due to loss of root support or other dental disease.

Before placing an implant in the site of a congenitally absent tooth it is important that your doctor verify that there is not a tooth bud or cyst-like structure in the jawbone in that area. The most commonly missing teeth are maxillary (upper jaw) lateral incisors and premolars.

## Replacing Missing Teeth

The loss of teeth places increased force on the remaining teeth that can contribute to loosening and deterioration of these teeth. Implant restorations restore support to the dental arches

and reduce loads on the remaining teeth. Missing teeth can be replaced in a variety of ways. You may be a candidate for any one or all of them, depending on the circumstances.

Implants are becoming the treatment of choice for a variety of reasons. Most significant among these is the expected longevity, strength and stability offered by current implant treatment, as well as the predictability of implant treatment with current technologies.

Teeth can also be replaced with a fixed bridge if there are teeth in the area that are adequate in number and sufficiently healthy and strong to support the fake teeth. A conventional dental bridge is fabricated when the adjacent teeth are “prepared”, i.e. cut down using diamond burs to remove all the enamel and make room for the prosthetic tooth restoration.

A prosthetic tooth or teeth can be suspended between adjacent teeth in this way to provide a functional and cosmetic replacement for the missing tooth. The limitations of this modality of treatment have to do with the irreversible preparation of the adjacent, or abutment, teeth for support. This exposes them to the risk of trauma to their nerves, raising the risk of requiring root canal treatment.

Long-term, fixed bridges between natural teeth have an average life expectancy of 10-12 years before requiring replacement. Replacement of fixed bridges oftentimes entails further treatment as the abutment or supporting teeth have been further compromised over time by advancing dental disease, such as cavities or periodontal bone loss.

Removable partial or full dentures can replace a single missing tooth, or all of the teeth in a patient’s upper and/or lower jaw. So called, “partial dentures” rely on support by the other teeth in the jaw and from mechanical support by the remaining ridge of gum and underlying bone

Maxillary, or upper jaw full dentures also may be helped by suction between the denture and the underlying gum of your palate, or roof of mouth. If there are teeth present, even primary teeth, the reasons for replacing a missing tooth or teeth vary and should be weighed against the risks of leaving the space and resultant changes that may take place in the rest of your dentition.

## Bone Loss

When teeth are removed from the jaw the bone that supports the teeth tends to shrink over time. This process is called resorption and is a natural consequence of the loss of stimulation to the bone from the forces placed on the teeth. Resorption of the alveolar bone (bone that supports the teeth) commences almost as soon as the tooth is removed and proceeds over time. The bone will lose both height and width from resorption.

When multiple teeth are lost, with or without prosthesis to replace them, significant loss of jaw bone can take place, sometimes leading to difficulty wearing a removable denture due to lack of an adequate “ridge” upon which the denture can obtain stability. In the so-called “esthetic zone” of the mouth, where loss of ridge volume can be visibly apparent to the naked eye, this can lead to a cosmetic defect. As the bone resorbs the gum covering it also shrinks away, creating a concavity or depression in height and width that, in addition to promoting food to impact under adjacent teeth, can be unsightly.

## Adjunctive Procedures

There are many circumstances where implants can be placed but to do so properly, and with the best chances for long-term success, requires additional procedures before, during or after the implant treatment.

Some of these are absolutely necessary in order to place implants, while others are indicated to provide a better functional and/or cosmetic result. As with all of the issues it is best for you to discuss your particular treatment options and alternatives with your dentist or implant surgeon for a full understanding of your particular choices.

## Bone Augmentation

When teeth are lost, the underlying bone, known as alveolar bone (bone that is formed when the teeth form and erupt), is likely to resorb, or shrink, both vertically and horizontally. The alveolar bone supports the teeth and when it no longer receives stimulation from forces on the teeth it tends to melt away.

Areas with teeth that have been missing for a long time, and/or have been replaced with removable dentures, may have so much bone resorption that there is not enough remaining to be able to place implants of adequate size. Similarly, teeth that have been lost due to advanced periodontal, or

gum, disease will often experience so much bone loss that there is not enough bone remaining for implants to be placed.

Bone defects resulting from root canal infection, fractured teeth, trauma, or difficult tooth removal also present situations where bone needs to be augmented (replaced by means of grafting) for implant placement to be accomplished.

## Bone Grafting Materials

There are many types of bone graft material currently available, and research promises more to come.

## Using Your Own Bone

### (a.k.a., "Autogenous Bone Grafting")

Some surgeons may elect to use your own bone ("Auto" or "Self"), harvesting it from nearby areas, sections of your lower jaw, or harvesting it from your knee or hip, both of which have readily accessible and large amounts of bone available. The advantage here is this is living bone; it is your own but does mean there is a second site the surgeon has to borrow the bone from.

This donor site typically heals quickly and within a few months completely regenerates the borrowed bone. The largest issue with this approach is this living bone is replaced in time and the volume that was intentionally created may shrink and disappear over time. This has led more recently to approaches where living bone derived from a patient is mixed with a more stable inert mineral, such as that from an animal to stabilize and extend the lifespan of the volume of bone created by the grafting procedure.

Other very commonly used types of bone are derived from cow bone that has been processed to remove proteins and acts as a stimulus for your body to replace it with new bone. Bone derived from another species of animal for grafting purposes is referred to a "xenograft" (xeno or different). This is usually animal bone that has been stripped of all organic material and baked at high temperature so that just the mineral phase remains.

Human cadaver, or "allograft", bone can also be used, as well as several forms of synthetics. The term "allograft" refers to graft material derived from one of the same species but not the same individual as the recipient. This is processed similar to cow bone. The goal here is to use

the minimal content of the bone to support the healing process. This type of bone, very commonly used does have the limitation that it is not living and takes longer to heal.

## Sinus Grafting

The upper jaw sinuses are hollow, air-filled spaces in the bone above our upper back teeth, between the teeth and the eye sockets, and are one of five pairs of sinus cavities throughout our skull bones. When the upper back teeth, usually molars and premolars, are lost or don't form, the sinus cavity just above tends to expand and drop down into the jaw bone in the area of the missing teeth, a process called pneumatization.

Sometimes, even if the teeth are still present, there is not enough height of bone between the sinus floor and the gum to allow adequate-sized implants to be placed. Sinus grafting allows your dentist to lift up the floor of the sinus cavity, from surgery within your mouth, and place bone graft materials to stimulate growth of enough bone for implants to be placed. Sinus grafting can be done as a preliminary surgery to prepare the bone to be able to place implants, or can be performed at the same time as the implant placement if there is enough bone to stabilize the implants while they are healing.

As always you need to be comfortable that your surgeon is adequately trained and knowledgeable in this surgery and its potential complications and be sure to discuss with your surgeon the options available to you in your particular circumstances. There are always options!

## How Can My Implants Used To Support Teeth Or Dentures?

The missing teeth may be replaced with multiple, implant single tooth restorations, or, with implant fixed partial dentures (implant bridges). Implant bridges replace the support lost as a result of missing teeth, avoid the need to drill the adjacent teeth and do not require an implant for every missing tooth. The space, gum tissue and underlying bone must be appropriate to place the dental implants. Implants are placed in strategic positions to replace the missing teeth.

When the implants are stable and ready for loading, abutments can be attached to the implants that will connect the final bridge (prosthesis) to the implants. An impression is made recording the contours of the abutments

or the position of the implant tops. The implant bridge is then fabricated and can be retained with cement or screws. An implant bridge is not susceptible to cavities but may develop complications if oral hygiene is not maintained.

This implant restoration should be routinely evaluated - the time interval dependent upon the conditions of the remaining natural teeth and the implant bridge. Restorations using porcelain may be susceptible to porcelain fracture. Patients with large functional forces, including those with hard biting forces (e.g., bruxism), may require stronger, metal, chewing surfaces.

If you are missing, or need to have removed, all the teeth in one or both of your jaws implants may allow you to have a fixed, full-arch bridge fabricated as well. As an alternative to wearing a full denture, if there is adequate bone, or bone augmentation procedures can be performed to grow sufficient bone, multiple implants can be placed, spaced across your jawbone, to provide support for a fixed bridge. The procedures are similar to those described for single implants, or multiple implants, but require careful diagnosis, planning, and coordination before treatment should begin to ensure that an appropriate number of implants can safely be placed in positions that will allow your dentist to fabricate a bridge that meets your needs and expectations.

### **Remember – Ask Questions**

Always feel comfortable asking for a second opinion. Do not rush to a decision.

The number of implants necessary for a full arch fixed bridge varies depending on your particular anatomy, the opposing teeth, the type of bridge you want to have placed and number of teeth you want or need to have replaced by the prosthesis. A full arch of implants can be placed when you are already missing all the teeth in one of your jaws.

If you have teeth remaining, they may need to be removed as a first step before implant surgery can proceed, or sometimes, the teeth may be extracted and implants placed immediately after the teeth have been removed. If there are teeth remaining, you may be able to have a temporary, fixed bridge made by your dentist to help transition from your own teeth to implants. In this scenario, while the implants are healing the temporary bridge stays in place, allowing you to eat, speak and smile without having to wear a removable denture.

If it is not possible to retain enough teeth to support a fixed bridge while the implants are healing then you may need to wear a removable denture as a temporary. Usually, you will be advised by your dentists to not wear the denture for a period of some time, usually a couple of days to weeks, after the implants have been placed to allow the gums to heal without being disturbed.

In recent years, we have learned that it may be possible to place a full arch of implants and connect them to a fixed, usually temporary, bridge in what is known as immediate load, meaning that the implants are receiving "load" from chewing forces as soon as they are placed. This procedure is successful in patients without ectodermal dysplasia but we do not know the outcome of this procedure in patients with it. It is probably obvious that this technique requires careful planning and coordination by your dentist and surgeon.

### **Questions to Ask**

As with all treatment, you should discuss with your dentist just what your options and alternatives are, and what may be the best and most appropriate for you.

- Ask how many cases has she/he done and especially with patients with ectodermal dysplasia?
- What are her/his outcomes?
- What complications have they had?
- How were these managed?
- How many different Prosthetic approaches has he/she used?
- What Dental Implant System does he/she use or is being proposed? Get the name and look it up on the internet. Be careful of implant systems that are small manufacturers since these tend to go off the market and you may have problems finding parts to repair the implants in the future. Remember, the implants are being put in the bone, intentionally for the rest of your life. Major implant system currently in use are: NobelBiocare, Straumann, Dentsply Implant (Astra Tech Implant System, Ankylos, Xiv), BioMet 3i/Zimmer.
- Does she/he work with a close knit team of surgeons, periodontists, orthodontists, prosthodontics and laboratory support. Remember, NO ONE CAN DO IT ALL, or at least well.
- Always ask about advantages and complications with each approach being proposed? If only one approach is proposed,

get a second opinion. There are always options!

## What Are Alternatives To Implants For Replacement Of Teeth?

One approach is removable partial dentures. Replacement with a conventional removable partial denture (RPD) is indicated for patients who can accept having a restoration that is not permanently fastened to teeth or implants. This restoration should be removed on a daily basis by the patient for oral hygiene access to the remaining natural teeth and the prosthesis.

The RPD is made up typically of a cast metal framework, denture teeth and acrylic. This type of denture typically hooks around the adjacent anchor teeth. Some patients may not like the appearance of the clasps (metal arms) that engage the remaining teeth to retain the prosthesis, the display of portions of the metal framework and the movement of the RPD under function. Replacement of worn denture teeth and acrylic, and relining of the prosthesis to maintain adaptation to the gums, will be needed done.

The major advantages of an RPD are minimal preparations of the adjacent teeth-significantly less than a bridge, replacement of missing teeth, as well as cosmetic replacement of the lost volume of gums and bone, reduced expense, and easier access for oral hygiene. With an appropriate design, an RPD may be modified to add any teeth that may require removal in the future. A significant complication with partial dentures is that they cover the natural teeth and can lead to increased risk of tooth decay.

Oral implant-assisted removable partial dentures (IRPD) utilize a few select implants placed in strategic positions and connected to the overlying denture by means of a "stud" screwed into the implant. These implants may eliminate unsightly clasps, reduce the display of metal parts on the RPD and increase the amount of support, stability and retention to the final restoration. With an appropriate design, an IRPD may be modified to add any teeth that may require removal in the future.

When the implants are stable and ready for loading, abutments can be attached to the implants. The abutments may be used individually as stud attachments or as part of a larger, laboratory manufactured, superstructure

with various types of clip-type attachments, or retentive elements, which engage the RPD. An impression of both the teeth and the retentive elements is made so the laboratory can fabricate the final prosthesis.

The retentive elements may be processed in the laboratory or in a clinical procedure performed chair-side. This implant restoration should be routinely evaluated – the time interval dependent upon the conditions of the remaining natural teeth and the implant RPD. The denture teeth and retentive elements will be subject to wear and will need to be replaced when needed. Denture teeth will last for years but most retentive elements need to be replaced on a 6-month or longer basis.

Implant "Overdentures" may be recommended to you. What are these? An implant overdenture fits over an oral dental implant with various types of attachments providing excellent stability and retention of your complete dentures. The implant overdenture is a full denture used to replace the teeth in a full arch where all the teeth are missing.

The denture can "snap" into place to afford you more comfort, and improved eating ability. Implant overdentures are held in place by various dental attachments decided by your restorative doctor to provide maximum retention, increase chewing ability, and added health benefits. The implant overdenture is removable to facilitate cleaning of the implant supporting structure. Implant overdentures can be made to look extremely natural and comfortable.

The steps in making overdentures involve making impressions and commonly making a set of dentures before implant placement. This helps to determine the correct positioning of the teeth on the new dentures. This is done for appearance and the bite, and is also necessary to confirm the optimal location for each implant. Occasionally a template produced from the diagnostic impression is provided to the surgeon for guidance during implant placement surgery.

The specific need for an implant overdenture is variable and should be decided with your input with your Prosthodontist. Many patients can benefit from the facial support provided by the extensions of the complete denture design. The number and type of implants are decided following a detailed discussion between you and your restorative doctor. You will be examined thoroughly and asked what you are expecting and

how your experiences with your current dentures have been.

Most often, an upper overdenture will require placement of more implants than a lower overdenture due to the different nature of the anatomy of the upper and lower jaws. It may also be possible to fabricate an upper denture with no palate, (the roof of your mouth) which may be more comfortable to some patients.

## **Maintenance Expectations?**

### **Check-Ups**

Your “new teeth” will require periodic checking by your dentist to ensure that the surrounding gums and bone are maintained and healthy. This also requires periodic x-rays to evaluate the level of bone around your implants. The dental restorations attached to your implants will also require periodic checking by your dentist to be sure that they are secure and functioning as they should be.

It is not uncommon for the screws that attach your restoration to the actual implants or abutments to come loose from time to time. This usually entails just removing the dental restoration, cleaning it and replacing it with new or re-tightened screws. Similarly, if your dental restoration is cemented to the underlying implants abutments may also come loose from time to time. If this is the case, your dentist will need to remove the restoration, clean it, ensure that it is fitting as designed and re-cement it.

While these are minor complications, however inconvenient, they should not be ignored as allowing the restoration to remain in place when it is not properly attached to the implants can create more significant problems.

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*The content of this document is for informational purposes only. Questions regarding specific patient issues should be directed to the appropriate professionals for resolution.*