1 Why Dental Implants?

Why dental implants? There is one simple answer: there is an overwhelming need. Within the last one to two generations, there have been vast societal changes, including the fact that people are now living longer with greater motivation to maintain the function and esthetics of their natural teeth. It was common for people just 60 or so years ago to lose most, if not all, of their teeth well before retirement age. As a result, dentistry prior to the 1960s was largely focused on providing restorations for carious teeth and fabricating removable appliances such as removable partial dentures (RPDs) and complete dentures (CDs) as the final dental solutions for missing teeth.

Partial and Complete Edentulism in the Twenty-First Century

The population is aging and, by 2030, more that 20% of the U. S. population will be aged 65 years or older, Fig. 1.1 [1].

These projected data indicate that within 10–12 years, about 20% of the population will be "senior citizens," namely 65 years or older [1]. Although advances in medicine and pharmacology, together with improved nutrition, dietary awareness and exercise, have significantly improved the average life expectancy, the outlook for maintained and even improved dental hygiene as well as overall oral health still looks bleak. In fact, partial or complete edentulism is increasing. Whereas fluoridation has markedly reduced dental caries [2, 3], the prevalence of tooth loss through periodontal disease, enamel erosion, wear, trauma and disease (e.g., cancer) is growing [4–7].

The ADA Practical Guide to Dental Implants, First Edition. Luigi O. Massa and J. Anthony von Fraunhofer.

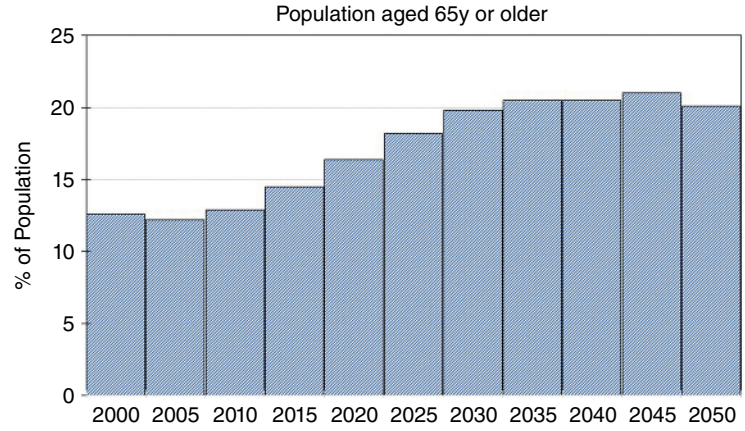

Figure 1.1 Projected aging of the United States. (*Source*: Based on United States Census Bureau. Release Number CB20-99: 65 and Older Population Grows Rapidly as Baby Boomers Age. Washington, DC, June 25, 2020).

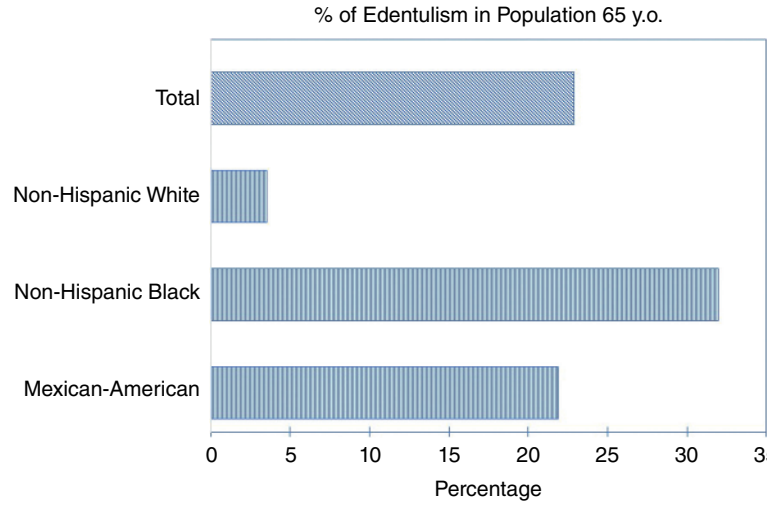

Figure 1.2 Prevalence of edentulism by race and ethnicity in adults ≥65 years [9]. (*Source*: Based on Centers for Disease Control and Prevention. Edentulism and tooth retention. Atlanta, Ga., September 10, 2019).

According to the American College of Prosthodontics, more than 35 million Americans are edentulous, and 178 million people are missing at least one tooth and these numbers are expected to grow over the next two decades [8].

What is distressing about these statistics is that edentulism affects our most vulnerable populations – the aging and the economically disadvantaged, Fig. 1.2. In the geriatric population, for example, the ratio of edentulous to dentate individuals is 2 : 1, with about 23 million being completely edentulous and some 12 million are edentulous in one arch. About 90% of edentulous patients have dentures and some 15% of edentulous patients will have dentures made each year [8].

The consequences of partial or complete edentulism are well-known and include many facets of the quality of life (QoL) as well as facial appearance, self-image and self-confidence. Overall, health consequences of edentulism encompass significant nutritional changes, digestive issues, obesity, diabetes, and coronary artery disease to name but a few.

The Reality of Dental Implants

Although there have been minor variations over the past few years, the current life expectancy for the U.S. population in 2020 is 78.93 years [10], and we can anticipate increases in tooth failures. Vertical root fractures, endodontic failures, restorative failures, and periodontal disease may result in tooth loss. In contrast to the practice of dentistry in the nineteenth and twentieth centuries, modern dentistry focuses on the replacement of lost teeth utilizing implants, combined with comprehensive analysis of function and esthetics.

In modern dentistry, the dental implant is the best tooth replacement option for nearly all situations where a tooth is missing or is failing. The primary reason for this is the extremely high success rate achieved with dental implants. Saving teeth at all costs is no longer the norm because of the unpredictability of the longevity of heroic dentistry. In other words, preserving bone and tissue regeneration are now considered to be more important than trying to prolong tooth retention. This approach not only promotes bone healing and preservation but ensures that implants are placed in a predictable and solid bony environment with a high rate of success.

The consensus regarding dental implants within the international dental community can be summarized in Table 1.1. Whereas the order of the comments may vary with the individual clinician, most would agree that these comments are valid and pertinent.

Implants and the Edentulous Patient

Over 32 million people in the U.S. wear partial or CDs [11] and approximately 33% of these patients complain that their dentures fit poorly, tend to loosen or dislodge during activities such as chewing and laughing, and/or there is pain on mastication. Flat ridges and/or shallow palatal vaults add to denture retention and instability problems and most dentists are aware that the mandibular CD presents retention issues.

Table 1.1 Advantages of dental implants.

• Implant dentistry is the future of dentistry.
• There is copious scientific literature on dental implantology.
• The 95–97% success rate of dental implants makes them an extremely predictable treatment.
• There is an overwhelming need for tooth replacement and predictable treatment of failing teeth.
• Implant-retained prosthetics are a very satisfactory solution to the growing prevalence of edentulism in our aging population.

Limitations and/or restrictions on diet, especially which foods can or cannot be eaten, also play a major role in the decision to seek dental implants. It is likely that a significant percentage of those patients experiencing pain or discomfort on chewing will not use their dentures during eating. Due to the decreased mastication forces associated with dentures, edentulous patients have been found to consume less food and have lower intakes of protein, intrinsic and milk sugars, non-starch polysaccharides (fibrous matter), calcium, non-heme iron, niacin and vitamin C than dentate people [12]. These dietary deficiencies often have significant adverse effects on overall health and wellbeing, as well as their QoL.

Many patients will resort to utilizing denture adhesives to aid in retention. These adhesives may lead to further problems as they are extremely difficult to remove from the tissues. Impaired speech patterns as well as halitosis (oral malodor or "denture breath") are frequent complaints among denture wearers, even when the fit of the denture is not a significant issue.

It follows from the above, that patients seek dental implant therapy for a number of reasons, including the following:

- Function
- Esthetics
- Comfort
- Confidence
- Facial appearance

General dental practitioners can address these issues and assist the patient in achieving oral health and functionality lost through missing teeth.

There are two major implant treatment modalities for the edentulous patient:

1. Implant over-dentures. Implant overdentures are removable appliances which are both implant and tissue-borne prostheses. They utilize an abutment and a denture attachment for the retention (Fig. 1.3). These appliances solve several major problems with traditional dentures by allowing:
   - Increased masticatory forces
   - Increased retention to potentially eliminate the need for denture adhesives
   - Removal of palatal coverage for patients who cannot tolerate the denture due to their gag reflex

   An implant-supported denture is a satisfactory and viable economic alternative to the traditional CD.
   - Screw-retained fixed implant bridges. Fixed implant bridges are implant-borne prostheses which are not removable by the patient. They are manufactured in zirconia or in acrylic overlaying a chrome-cobalt or titanium bar. These appliances give patients the greatest masticatory forces and are more appealing to most patients because they are fixed in place.

Implants for Single Crowns and Bridgework

As stated above, 178 million people in the U.S. are missing at least one tooth [11]. Before the use of dental implants, fixed partial dentures (bridges) or RPDs were utilized. One major problem with these treatment modalities is that fewer teeth

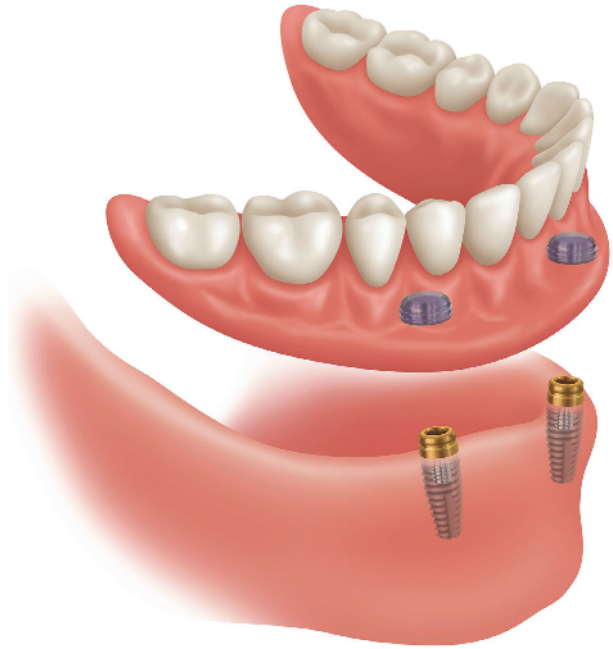

Figure 1.3 Implant-supported overdenture. *Source*: Courtesy of Zest Anchor.

are taking the load. For example, in the case of a four-unit fixed bridge, only two teeth are carrying the load of the four teeth it restores because the pontics provide no functional support.

The advantages for placing an implant and restoring it to replace a missing, free-standing tooth are summarized in Table 1.2.

Table 1.2 Advantages of implants replacing individual teeth.

No unnecessary preparation of adjacent teeth for a traditional bridge
Long-term prognosis better than for a traditional bridge [13, 14]
Long-term cost is less than for a traditional bridge
Significantly better retention of prostheses, including RPD's
In the authors' opinion, ease of dental hygiene is improved with implants as opposed to a traditional bridge
Greater long-term patient satisfaction

Dentists are accustomed to replacing multiple missing teeth with a RPD. In fact, RPDs have been a viable treatment option for decades. While they serve a recognizable and useful purpose, they do require some skill and much experience in regard to their design and fabrication.

Despite their many advantages, which include relatively low cost, RPDs have some major drawbacks. In particular, they can lead to increased ridge resorption, especially with appliances fabricated with non-metallic bases, i.e., what are commonly known as "flippers."

Whereas RPDs with polymeric (usually acrylic) clasps are somewhat "kinder" to supporting teeth, metallic clasps and rests will commonly traumatize the

clasped teeth over time, notably causing wear and abrasion. This destructive action is due to clasps riding up and down the anchor teeth due to flexure of the RPD during mastication or parafunctional activities. Poor fit and/or repetitive vertical (and lateral) movements due to cyclic loading will not only exacerbate wear and abrasion of the abutment teeth but increase ridge resorption.

Another problem with RPDs, especially those with polymeric bases and poorly-fitting appliances, is that food particles may often be trapped beneath the denture. This can lead to mucosal irritation, periodontal problems and, possibly, to decay of the supporting teeth. Further, staining of the acrylic "gum work" of the RPD as well as odor necessitates repeated and careful cleaning of the RPD on at least a daily basis to ensure a hygienic appliance and absence of halitosis. Depending upon diet and beverage consumption as well as smoking, there is often the need for more frequent cleaning of the RPD. Failure to remove the RPD and clean teeth and RPD separately compromises effective hygiene of both teeth and RPD.

There are, of course, some disadvantages to the use of implants to replace multiple teeth, Table 1.3.

Table 1.3 Disadvantages of implants vs traditional bridgework and RPDs.

Short-term cost is higher than for a traditional bridge or RPD
Surgery is required
Generally, treatment time is longer – 4–8 months.

Implants vs Endodontic Treatment

Although general dentists receive training in endodontics during their education, many prefer not to provide root canal therapy, particularly when surgical intervention is required. There are several reasons for this reluctance to perform surgical endodontics, not the least is the general perception of patients that "root canal therapy" is an unpleasant, long-drawn out procedure that can be uncomfortable at best and at worst is painful. In fact, to a great many patients, the words "root canal therapy" are synonymous with any procedure or experience that is to be avoided at almost any cost.

In contrast, non-surgical endodontic treatment is a predictable treatment choice if certain conditions are met. First, there must remain enough sound tooth structure to achieve a 2mm ferrule effect 360° around the tooth. This will ensure long-term stability of restorative treatments. Secondly, a cause-and-effect should be established when diagnosing a symptomatic tooth. For example, caries approximating a pulp horn with symptoms lead to a clear diagnosis of irreversible pulpitis. Conversely, a symptomatic tooth with no caries present leads to a less predictable treatment outcome until and unless a definitive diagnosis can be achieved.

When there is need for "root canal therapy," the operator must have available a specialized armamentarium of instruments and restorative materials. However, it must be stated that the available instrumentation and endodontic sealer cements have improved dramatically over the past 20 or so years. Further, it is generally recognized that the time and expertise required to perform endodontic

surgery increases almost exponentially with the number of tooth roots/canals to be treated. Additionally, when canals are sclerosed or calcified, there is increased difficulty in ensuring a clean and extirpated pulpal chamber and root canals.

Finally, teeth that have received extensive endodontic therapy tend to embrittle over time and are subject to failure under loading. Further, it is difficult to achieve a complete hermetic seal of a root canal so that apical leakage and ingress of bacteria, blood and other matter into the treated canal can occur over time. Coronal migration of tissue fluids and bacteria leaking into the treated root canal over time can have many untoward consequences, including dentinal staining, breakdown of sealer cements and restorations, pain and discomfort as well as infection. Due to risks associated with endodontically treated teeth, dentists are often reluctant to use these teeth as abutments for both FPDs and RPDs.

In contrast, the success rate of dental implants is 95–97%. This is far higher than treatment of symptomatic teeth with marginal ridge fractures and endodontic retreatment. These success rates must be considered when discussing treatment options, particularly when relative costs, patient time-commitment to treatment as well as patient discomfort are considered in addressing the question of root canal therapy vs placement of an implant.

Conclusions

Having presented the overall case for dental implants, specific factors regarding the placement and clinical application of implants will be covered in detail in the following chapters. Nevertheless, modern dentistry now recognizes that dental implants are the standard of care for prosthetic replacement of missing teeth. This is because they can readily and conveniently address some otherwise seemingly intractable problems in traditional restorative dentistry. Further, the advances in implant technology and dental science have progressed so markedly since the first days of the Brånemark concept that the outcome of dental implant placement has a success rate over 95%.

The final word should be that the ground-breaking concept of Per-Ingvar Brånemark has transformed dentistry and dental treatment for even the most challenging cases.

References

1. United States Census Bureau (2020). 65 and Older Population Grows Rapidly as Baby Boomers Age. Release Number CB20-99. https://www.census.gov/newsroom/press-releases/2020/65-older-population-grows.html (accessed 17 December 2020).
2. Medjedovic, E., Medjedovic, S., Deljo, D. et al. (2015). Impact of fluoride on dental health quality. *Mater. Sociomed.* 27 (6): 395–398.
3. Centers for Disease Control and Prevention (2001). Recommendations for using fluoride to prevent and control dental caries in the United States. *MMWR Recomm. Rep.* 50 (RR-14): 1–42.
4. Martinez-Canut, P. (2015). Predictors of tooth loss due to periodontal disease in patients following long-term periodontal maintenance. *J. Clin. Periodontol.* 42 (12): 1115–1125.
5. Loomansa, B., Opdamb, N., Attinc, T. et al. (2017). Severe tooth wear: European consensus statement on management guidelines. *J. Adhes. Dent.* 19: 111–119.

6. Bartlett, D.A. (2005). The role of erosion in tooth wear: etiology, prevention and management. *Int. Dent. J.* 55: 277–284.
7. Michaud, D.S., Fu, Z., Jian Shi, J. et al. (2017). Periodontal disease, tooth loss, and cancer risk. *Epidemiol. Rev.* 39 (1): 49–58.
8. American College of Prosthodontists (2020). Facts and figures. https://www.gotoapro.org/facts-figures (accessed 31 July 2020).
9. Centers for Disease Control and Prevention (2019). Edentulism and tooth retention. September 10. https://www.cdc.gov/oralhealth/publications/OHSR-2019-edentulism-tooth-retention.html (accessed 27 December 2020).
10. Macrotrends (2020). U.S. Life Expectancy 1950–2020. https://www.macrotrends.net/countries/USA/united-states/life-expectancy (accessed 31 July 2020).
11. Statista Research Department (2020). Usage of dentures in the U.S. http://www.statista.com/statistics/275484/us-households-usage-of-dentures (accessed 31 July 2020).
12. Jauhiainen, L., Männistö, S., Ylöstalo, P. et al. (2017). Food consumption and nutrient intake in relation to denture use in 55- to 84-year-old men and women — results of a population based survey. *J. Nutr. Health Aging* 21: 492–500.
13. Ravidà, A., Tattan, M., Askar, H. et al. (2019). Comparison of three different types of implant-supported fixed dental prostheses: a long-term retrospective study of clinical outcomes and cost-effectiveness. *Clin. Oral Implants Res.* 30 (4): 295–305.
14. Oh, S.-H., Kim, Y., Park, J.-Y. et al. (2016). Comparison of fixed implant-supported prostheses, removable implant-supported prostheses, and complete dentures: patient satisfaction and oral health-related quality of life. *Clin. Oral Implants Res.* 27 (2): e31–e37.