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History of Dental Implants

The concept of dental implants dates as far back as 2000 BC when carved bamboo pegs were originally used to replace missing teeth. A dental implant is a prosthetic device made of alloplastic material implanted either into the oral tissues beneath the mucosal and/or the periosteal layer and/or within the bone to provide retention and support for a fixed or removable prosthesis. When inserted into the bone, the implants are called endo-osseous implants.

Around 3000 years ago, Egyptians used metal pegs to replace teeth, and it was not until the 1930s the concept of modern implantology came into existence with progressive development of methods used to replace missing teeth (Table 1.1). The materials from which dental implants are made should be biocompatible, corrosion resistant, and encourage bone ingrowth and biofunctionality.

During 1939–60s the concept of the 'in the bone' (endosteal) implant arose with the first cylindrical endo-osseous solid screw implant with threads both internally and externally with a smooth gingival collar and healing cap being placed. Following this during the 1940s, a spiral stainless steel post type endosseous implant with a design that allowed bone to grow into the implant emerged and Dahl in Germany, around the same time, introduced the concept of the subperiosteal implant with mucosal inserts (Figure 1.1). This implant was made of cobalt-chromium molybedenum with a direct impression of the struts on the ridge crest taken to construct the denture. Throughout the 1940s–50s variations on the original Dahl design emerged in an attempt to make the provision of implants simpler and included the use of vitallium implants in 1948, the Linkow endo-osseous blade vent implant in 1966 with different designs for the maxilla and mandible (Figure 1.2), the ramus frame implant in 1970, made of stainless steel (Figure 1.3) and mandibular transossteal implant which engaged the lower border of the mandible with inserts projecting into the mouth to support a prosthesis (Figure 1.4). The ramus frame and tranossteal implants were predominantly designed for patients with atrophic mandibles who had difficulties wearing dentures and were used to aide denture retention to improve function.

The key challenge with these older implant systems was biocompatibility, the lack of fusion to the jawbone resulting in recurring infections after a period of time and the complex surgical techniques needed to insert the implants leading to limited use aimed at

Dental Implants for Hygienists and Therapists, First Edition. Ulpee Darbar.

Table 1.1 Progressive Development of Methods used for Tooth Replacement.

500–2500 BC	300–600 AD	800 AD	1500–1800s	1809	1913
– Egyptians tried splinting teeth using gold ligature wires – Eustracians used customised soldered gold bands from animals and oxen bone	– Phoenicians used Ivory to carve teeth used as bridge replacements – Mayans introduced the concept of implants when they tried to use 'Pieces of Shells' as implants to replace mandibular teeth; Radiographs taken in the 1970s of such mandibles show compact bone formation around the implants (bone similar to that around blade implants)	Hondurans used a stone implant and placed this in the mandible	Europeans used cadaver teeth for allotrans-plantation	J Maggiolo inserted a gold implant tube into a fresh extraction socket and after healing a crown was added; other materials used were silver capsules, corrugated porcelain	Dr Greenfield placed a '24-gauge hollow latticed cylinder of iridio-platinum soldered with 24-karat gold' as an artificial root to 'fit exactly the circular incision made for it in the jawbone of the patient'

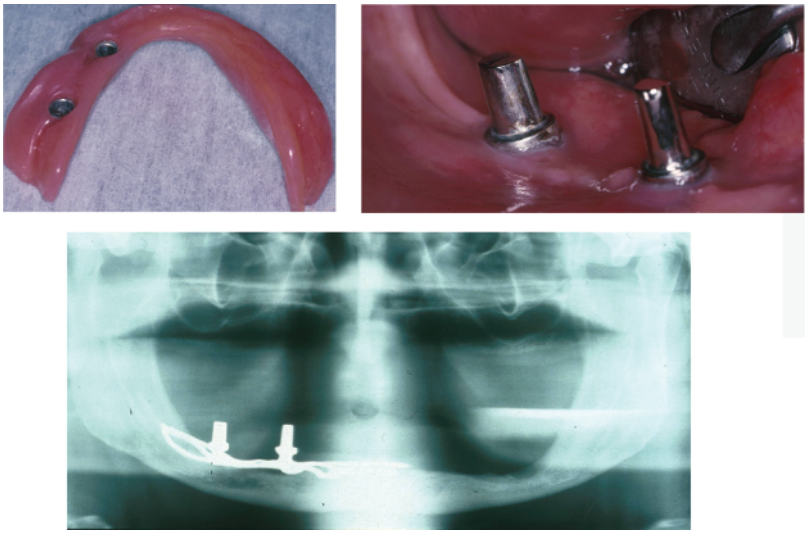


Figure 1.1 Subperiosteal implants in the mouth.

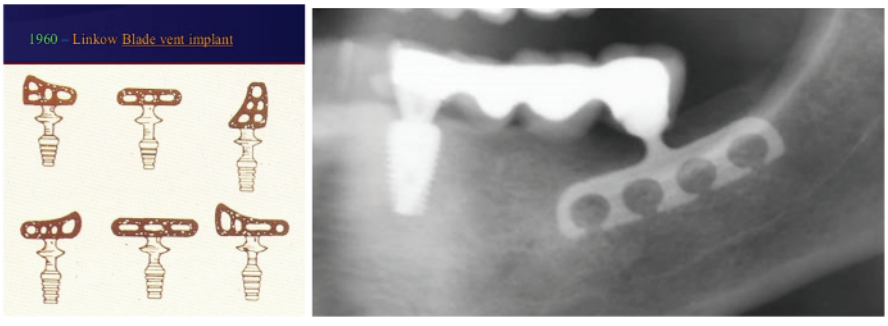
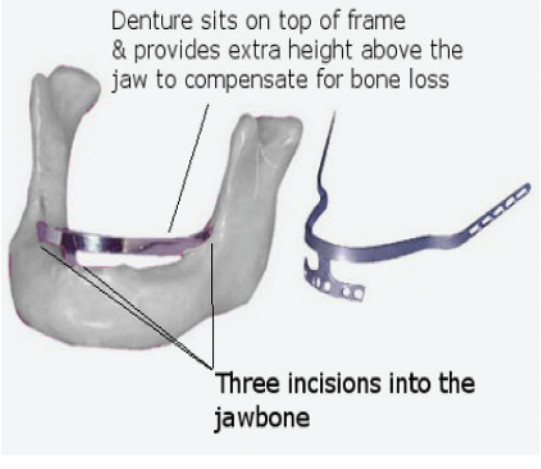


Figure 1.2 Blade vent implants.



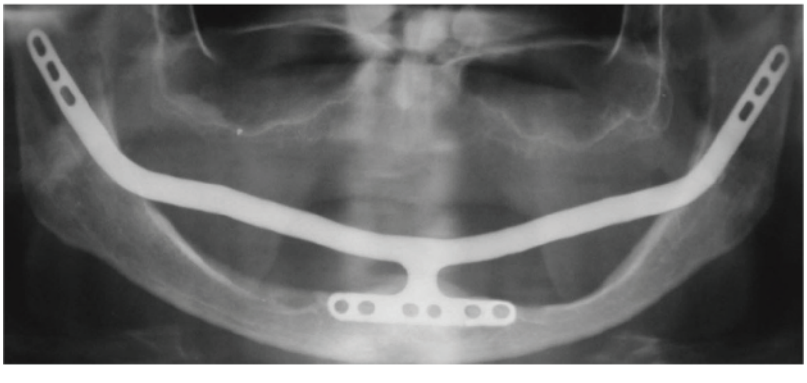


Figure 1.3 Ramus implants.

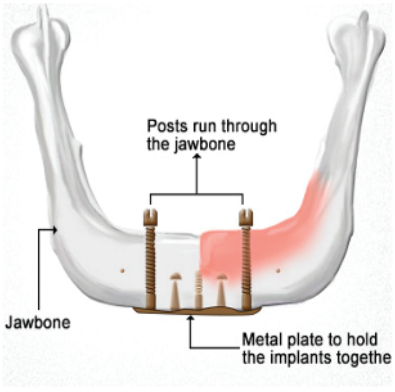


Figure 1.4 Mandibular tranossteal implant.

specific patient groups. Additionally, the infections led to secondary issues with bone resorption compounding the existing issues.

In the 1950s, an orthopaedic surgeon, Per Ingvar Branemark, accidentally found, during the study of bone healing and regeneration, that a titanium cylinder fused together with the bone in the femur of a rabbit. He hypothesised that this fusion could be utilised in field of dental implants and placed the first dental implant made of commercially pure titanium in a human volunteer in 1965. This finding introduced the concept of osseointegration which forms the basis of today's endo-osseous dental implants. Osseointegration became accepted as a worldwide phenomenon when the concept was launched at the Toronto World Conference in 1982. At around the same time, whilst Branemark was looking at a two-stage threaded implant, Schroeder and his group were independently evaluating the use of a one-piece root form implant made with a hollow design and a roughened surface (Figure 1.5a, b).

Since the introduction of osseointegration, in the late 1980s, as a predictable method of tooth replacement, growing confidence and predictability has led to the widespread use of dental implants moving from edentulism to partial edentulism including single teeth and those with extensive tissue and tooth loss usually seen in patients who have suffered traumatic injuries and congenital anomalies (e.g. Hypodontia). This progressive change has led to the focus changing from improving function to include aesthetics and psychological well-being alongside the need to address patient expectations.

Dental implantology continues to evolve with concomitant modification of implant screw designs, surfaces and techniques used for implant placement and restoration aimed at reducing integration healing times, optimising function and aesthetics alongside predictability. These changes have led to newer concepts for tooth replacement being considered which include the use of zygomatic implants in those with atrophic maxillae, the mini implants and the 'All-on-Four' concept whereby the teeth are extracted and implants placed and restored all on the same day. Additionally, the advent

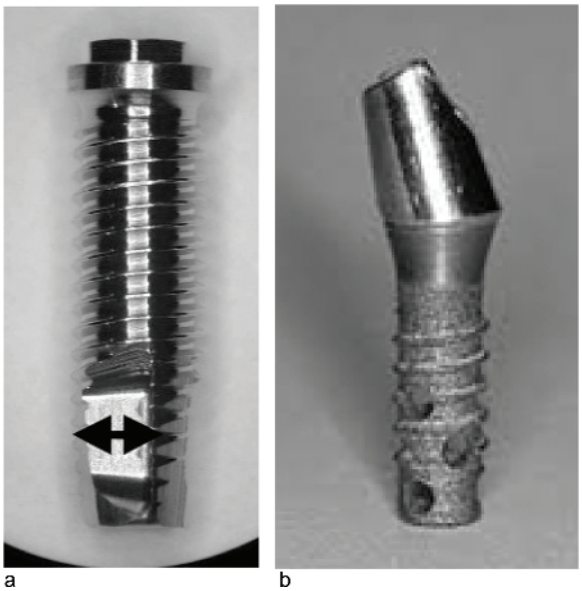


Figure 1.5 a, b: The Branemark two-piece implant fixture and the Shroeder one-piece hollow cylinder implant.

of digital technology has enabled clinicians and technicians to push this clinical envelop even further with digital systems being used for planning, surgical placement and restoration without any analogue interfaces being used. Whilst, we live in a fast-moving world driven by technology and systems geared to meet patient demands, the biological envelop in which we as clinicians have to work has seen little change and as clinicians we need to be cognizant of this challenge commonly referred to as 'patient and site' related factors.

Today there are in excess of 250 implant systems on the market with varying design features, many of which resemble either one or more features of the eight mainstream implant systems. Table 1.2 shows the development of different key implant systems since 1982.

Key Learning Points

- Be able to describe the older systems, as patients may attend for treatment with these systems
- Being able to recognise the older systems to assist with management
- Be able to explain to patients possible problems and issues with infections
- Be aware of challenges associated with evolution of the concept of dental implants

Table 1.2 Some of the Mainstream Dental Implant Systems.

1977	Branemark Implants
1982	Launch of Osseointegration
1982	Non-submerged implant system: ITI Corevent implant system
1985	Biocon
1987	IMZ
1989	3i
1990	Astra
1999	Straumann Synocta
Late 1990s	Frident (Frialit 2, Xive)
Early 2000	Ankylos and similar
Mid-2000 onwards	Modification of the earlier implant systems with newer surfaces, shapes and designs

References

1 Abraham, C. (2014). A brief historical perspectice on dental implants, their surface coatings and their treatments. *Open Dentistry Journal* 8: 50–55.

2 Branemark, P.I. and Zarb, G. (1985). *Tissue Integrated Prosthesis: Osseointegration in Clinical Dentistry*. Quintessence Publishing.

3 Rajput, R., Chouhan, Z., Sindhu, M., Sundararajan, S., and Chouhan, R. (2016). A brief chronological review of dental implant history. *International Dental Journal of Student's Research* 4 (3): 105–107.