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The implant system used among Iraqi dentist

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بسم الله الرحمن الرحيم

(رْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ
أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ
خَبِيرٌ)

سورة المجادلة – الآية 11

SUPERVISOR CERTIFICATION

I certify that this project entitled:

“(The implant systems used among Iraqi dentis” prepared by (Aameen alfalluji,Safa bahaa,Amany haider,Hussain mohammed, Yasser amer, Alhussain mohammed kamil) under my supervision at Al- Mustaqbal University, College of dentistry in partial fulfillment of the requirements for the degree of Bachelor in dental and oral

surgery (B.D.S)

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Dedication

“

آخ رُ دَعْو اهُمْ أَنِّ الْحَمْدُ لِلّ ه رَب الْعَالَمِّينَ و ”

We did not take the beginnings except with His facilitation, and we did not achieve the goals except with His grace, so Alhamdulillah. The dream was not close, nor was the road paved with facilities, but I did it and achieved it. You were always the warm embrace and sincere support, your continuous support and smiles in difficult times were the greatest consolation for us in moments of exhaustion and fatigue, I dedicate this work to you (the honorable doctors).

To the one who adorned my name with the most beautiful titles, that great man who taught me that the world is a struggle and its weapon is knowledge and learning, to the one whose forehead was crowned with sweat and who taught me that success comes only with patience and determination (my father). To my candle in the dark nights, to my pure angel, to the one who embraced me between her hands and paved the way for me to reach it (my mother).

To the companions of the years and the people of hardship and crises... With them I find relief and forget the road and with them the pleasure of arrival is complete (my friends). Here I am now, and words are inadequate when thanking you. Words do not do justice to your action

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the years of studying.

Abstract

Dental implant therapy has become a widely accepted and predictable treatment modality for the replacement of missing teeth. Over the past decades, numerous implant systems with varying designs, surface treatments, and connection types have been introduced into the dental market. In Iraq, the availability of different implant systems has increased significantly; however, data regarding the most commonly used systems among Iraqi dentists remain limited.

Single complete denture construction against a non-modified natural dentition is a very challenging task for the dentist due to certain drawbacks like frequent prosthesis fracture, dislodgement, difficulty to obtain occlusal balance, and achieve satisfactory esthetics (due to fixed position of the natural teeth).(Upadhyay et al, 2012). The fixed positions of the mandibular anterior teeth make the esthetic and phonetic placement of the maxillary teeth difficult without introducing anterior interferences in eccentric functional movements. Another problem with dentures opposing natural teeth is that of abrasion of the artifical teeth if acrylic resin is used or the abrasion of natural teeth if porcelain is used. Although these circumstances make treatment difficult and many times compromised, perhaps the greatest error is to make no attempt to modify the occlusal arrangement of the natural teeth. Failure to diagnose and properly modify the mandibular teeth to achieve occlusal harmony with the denture will result in forces that may exceed the physiologic tolerance of the maxillary residual ridge tissues.(Shroff et al, 2016)

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Introduction

Introduction

The success of dental implant treatment is mainly dependent on the quality of bone holding the implant, and if this could be enhanced locally, the surgical procedure might be simpler and the rehabilitation would be earlier. The aim of this study was to evaluate the changes in the implant stability, marginal bone level, and periimplant bone density in response to local application of alendronate alone or combined with recombinant human bone morphogenetic protein-2 in comparison to a control.

Materials and Methods

71 dental implants …

Background Dental implants are artificial roots that are surgically inserted into the jawbone or upper jaw and become firmly attached to the bone through a process called osseointegration. Objective: This paper was conducted a statistical analysis to assess the health outcomes of dental implants in Iraqi patients. Patients and methods: the study conducted a comparison between delayed and immediate implants in male and female participants aged 27-70, who were collected from different hospitals in Iraq between June 9th, 2022, and March 17th, 2023. The study assessed the demographic outcomes of patients, including age, sex, smoking, causes, and comorbidities. Of the 84 patients who received delayed implants, 50% were under the age of 50, compared to 34% of those who received immediate implants. The SPSS program was used to design and analyse our outcomes. Our findings were established through the database of all participants, which includes the anterior and posterior regions of patients aged over 30 years who underwent treatment for dental implants. Results and discussion Results were determined secondary outcomes of a dental implant in terms of region, the success of treatment, and types. Where we found that the posterior region had higher to compare anterior, which rates of cases were 36 (72%) for delayed implant and 21 (61.76%) for immediate implant. Additionally, we enrolled participants who survived and failed to evaluate the success of treatment. The rate of surviving patients was 40 (80%) for patients after delayed implant surgery and 30 (88.24%) after immediate implant surgery. It was observed that the implant time was longer in Delayed implant surgery compared to Immediate implant surgery. In addition to that, our study showed an increasing mortality rate of patients under delayed implant surgery while found shorter in immediate implant surgery. The analysis of multivariable identified risk factors for delayed implant surgery, including smoking, posterior location, male gender, hypertension, osteoporosis, and heart attack. Conclusion Our study showed that immediate implants are an ideal treatment for patients who have undergone dental implants, as the failure rates for immediate implants are much lower than those for delayed implants.

Aim of the review

Dental implant is considered to be one of the most successful methods for teeth replacement and needs stability for achieving a successful implant such as the primary stability that comes after implant placement and considered as a gold standard for a successful implant. The present review aimed to outline the essential factors impacting the primary stability of dental implants and to show the impact of varied surface treatments on titanium dental implants. The implant stability was measured according to the periotest values and implant stability

Chapter One: The Implant Systems Used among Iraqi Dentists

1.1History and Current Status of Dental Implant Systems Used Among Iraqi Dentists

Introduction

Dental implant therapy has become one of the most significant advancements in modern dentistry. In Iraq, implant dentistry has shown noticeable growth over the last two decades, moving from limited clinical applications to widespread use in private clinics and academic institutions. Several Iraqi studies have evaluated implant success rates, systemic factors, patient satisfaction, and public awareness, reflecting the expanding adoption of implant systems among Iraqi dentists.

Early Adoption of Implant Dentistry in Iraq

Initially, dental rehabilitation in Iraq depended mainly on removable and fixed partial dentures. However, with the global advancement of osseointegration-based implant systems, Iraqi dentists gradually incorporated implant therapy into clinical practice.
According to Jawad et al. (2018) in the Mustansiria Dental Journal, retrospective clinical and radiographic evaluations of dental implants placed in Iraqi patients demonstrated acceptable success rates and stable peri-implant bone levels. This study confirmed that implant therapy was being performed using modern surgical protocols comparable to international standards. The research highlighted that Iraqi clinicians were adopting internationally recognized implant systems and following proper case selection criteria.

This marked an important stage in establishing implant dentistry as a reliable treatment modality in Iraq.

Clinical Outcomes and Systemic Considerations in Iraqi Patients

A retrospective study by Mohammed et al. (2022) evaluated systemic health factors among Iraqi patients receiving dental implants. The study assessed conditions such as diabetes mellitus, hypertension, and smoking habits, and their influence on implant success.

The findings indicated that while systemic diseases may influence healing and osseointegration, proper case management and medical control significantly improved implant outcomes. This reflects the increasing clinical awareness among Iraqi dentists regarding comprehensive patient evaluation before implant placement.

The study confirms that implant systems used in Iraq are applied within evidence-based protocols and that clinicians consider systemic risk factors during treatment planning.

Immediate vs. Delayed Implant Placement in Iraq

Joudah and Jalaawi (2023) evaluated health outcomes of dental implant patients in Iraq, comparing immediate and delayed implant placement protocols. Their results showed satisfactory outcomes in both approaches when proper surgical and prosthetic protocols were followed.

This study demonstrates that Iraqi dentists are not only placing conventional implants but are also implementing advanced treatment protocols such as immediate implant placement, reflecting the modernization of implant practices in Iraq.

Quality of Life and Patient Satisfaction

Fedik et al. (2024) investigated the influence of age and gender on oral health-related quality of life among dental implant patients in Baghdad. The results showed significant improvement in functional, psychological, and social aspects after implant treatment.

These findings indicate that implant systems used among Iraqi dentists are achieving not only clinical success but also high patient satisfaction levels. The improvement in Oral Health Impact Profile (OHIP) scores suggests that implant therapy has become a predictable and beneficial treatment option in Iraqi dental practice.

Public Awareness and Demand for Implant Therapy

A study by Amin (2024) published in BMC Oral Health assessed public awareness and perception of dental implants in Sulaimaniyah City. The results showed increasing awareness among the Iraqi population regarding dental implants as a treatment option for missing teeth.

The study also highlighted that cost remains a major influencing factor in treatment decisions. However, the increasing demand reflects the expansion of implant services in Iraqi dental clinics.

Current Implant Systems in Use

Although national statistical data regarding the exact distribution of implant brands in Iraq is limited, available studies and clinical reports indicate that Iraqi dentists use internationally manufactured implant systems. These systems include titanium-based root-form implants that rely on osseointegration principles.

The presence of clinical research evaluating implant outcomes in Iraqi populations confirms that implant dentistry has become well established in the country. The systems used follow modern surgical guidelines and are applied in both private and academic sectors.

1.2Definition: The Implant Systems Used among Iraqi Dentists

Dental implant systems are clinical devices designed to replace missing teeth by placing a biocompatible implant fixture into the alveolar bone, which acts as an artificial root to support prosthetic restorations such as crowns, bridges, or overdentures. These systems consist of three main components: the implant fixture, the abutment, and the prosthetic superstructure. The long-term success of dental implant therapy is influenced by implant design, surface treatment, implant–abutment connection, surgical protocol, and clinician experience.

In recent years, dental implant therapy has become increasingly popular among Iraqi dentists due to its high success rate and its ability to restore both function and aesthetics. A wide variety of implant systems are currently used in Iraq, differing in brand, material composition, surface characteristics, and cost. The choice of implant system among Iraqi dentists is affected by multiple factors, including availability in the local market, professional training, patient-related factors such as bone quality, and economic considerations.

Understanding the implant systems used among Iraqi dentists provides insight into current clinical practices and trends in implant dentistry within Iraq, and may help improve treatment planning, implant selection, and overall clinical outcomes.

Classification of Dental Implants

1.3 Major Classifications of Dental Implants

Dental implants may be classified according to several important criteria, including anatomical placement, macroscopic design, surface characteristics, biological behavior, materials used, and dimensional features. The major classifications of dental implants include the following (Begum and Peeran, 2015):

1. Classification based on penetration into the tissues

2. Classification based on macroscopic body design of the implant

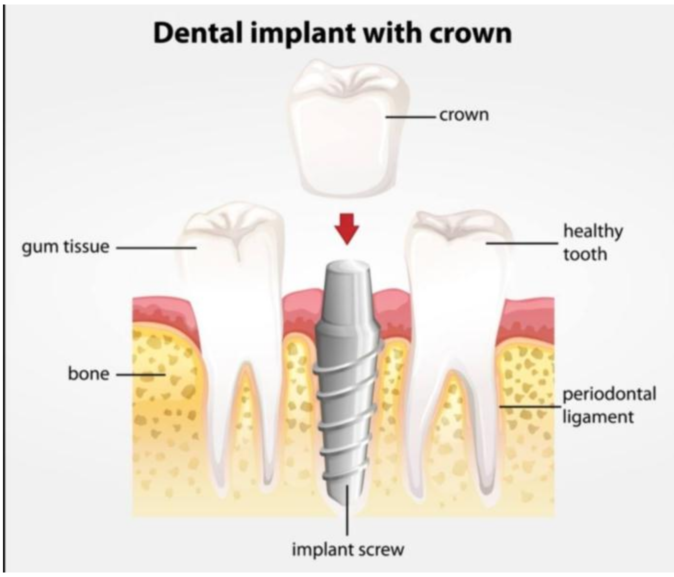
3. Classification based on implant surface characteristics

4. Classification based on implant surface texture and roughness
5. Classification based on implant surface chemical composition
6. Classification based on implant surface energy and charge
7. Classification based on the implant–abutment interface
8. Classification based on the type of biologic response
9. Classification based on implant materials used
10. Classification based on material used for implant production
11. Classification based on implant length
12. Classification based on implant width (diameter)

This classification system is widely accepted and discussed in contemporary implantology textbooks and serves as a fundamental reference for both academic study and clinical practice.

2.2 Classification Based on Penetration into the Tissues

This classification is based on the anatomical relationship of the implant to oral soft tissues and bone. From a clinical point of view, this classification is particularly important because it determines the primary source of implant stability and the biological mechanism through which support is achieved (Begum and Peeran, 2015).



(Figure **1-1)** Classification Based on Penetration into the Tissues

2.2.1 Mucosal Implants (Intramucosal Inserts)

Mucosal implants, also known as intramucosal inserts or palatal inserts, are non-reactive metallic components placed entirely within the oral mucosa, most commonly in the palatal region. These implants do not engage bone and therefore do not undergo osseointegration. Their primary purpose is to enhance the retention and stability of removable dentures through mechanical interlocking between the denture base and the mucosal inserts. Although early studies reported acceptable short-term results, long-term outcomes were limited by soft tissue irritation and lack of true biological integration. As a result, mucosal implants are rarely used in modern implant dentistry (Misch, 2008; Brunski, 2000).

2.2.2 Subperiosteal Implants

Subperiosteal implants are placed directly on the surface of the alveolar bone beneath the periosteum. They consist of a custom-fabricated metal framework designed to closely adapt to the underlying bone contours, with posts extending through the mucosa to support a prosthesis. This implant type was primarily indicated in patients with severe alveolar ridge resorption where endosteal implants could not be placed. However, the absence of osseointegration, combined with higher incidences of infection, bone resorption, and implant instability, led to a decline in their clinical use (Brunski, 2000; Sykaras et al., 2000).

2.2.3 Transosteal (Transmandibular) Implants

Transosteal implants penetrate the entire thickness of the mandible, extending from the inferior border to the oral cavity. These implants were designed to provide rigid fixation in severely atrophic mandibles.

Despite their mechanical stability, transosteal implants require extensive surgical intervention and are associated with increased morbidity. With advances in bone grafting and endosteal implant systems, transosteal implants have become largely obsolete (Misch, 2008).

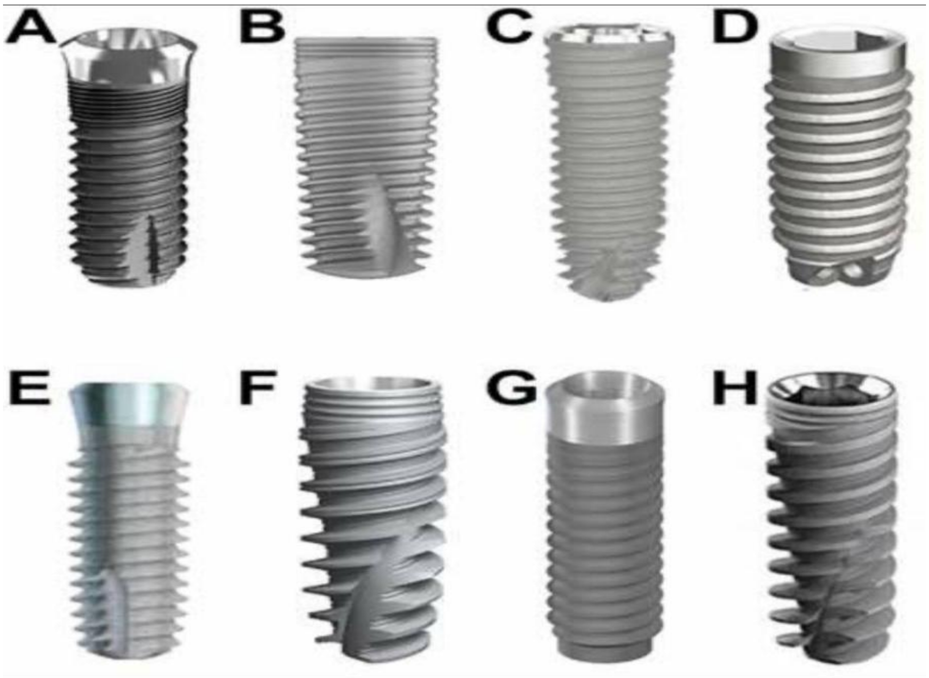
2.2.4 Endosteal Implants

Endosteal implants are placed within the alveolar or basal bone and are the most commonly used implant type in contemporary dentistry. They achieve anchorage through osseointegration, defined as a direct structural and functional connection between living bone and the implant surface. Endosteal implants demonstrate predictable long-term success, excellent load distribution, and broad clinical applicability. Their dominance in modern implantology is supported by extensive scientific evidence (Albrektsson et al., 1981; Misch, 2008).

2.3 Classification Based on Macroscopic Body Design of the Implant

Macroscopic body design refers to the overall shape and geometry of the implant fixture. This design plays a critical role in achieving primary stability and in distributing functional loads to the surrounding bone (Brunski, 2006).

Cylindrical implants have a parallel-walled configuration and rely on close adaptation to the osteotomy walls for stability. In contrast, screw-shaped implants incorporate threads that mechanically engage bone during insertion, thereby improving primary stability, particularly in areas of low bone density (Begum and Peeran, 2015). Blade implants were historically developed for use in narrow alveolar ridges; however, they are rarely used in contemporary practice due to inferior long-term outcomes compared with modern screw-type implants.



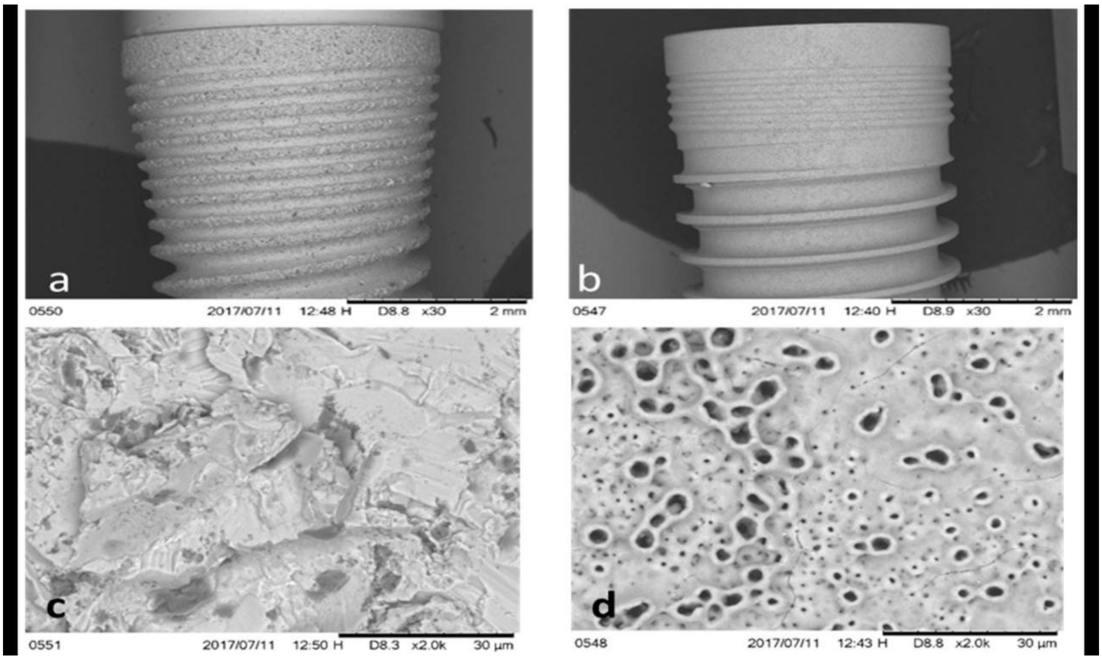
(Figure **2-1)** Classification Based on Macroscopic Body Design of the Implant

2.4 Classification Based on Implant Surface Characteristics

Implant surface characteristics refer to the microtopography and physicochemical properties of the implant surface. These characteristics strongly influence protein adsorption, cellular attachment, and the process of osseointegration (Duraccio et al., 2015). Surface modifications are designed to increase bone-to-implant contact and to enhance both the speed and quality of healing.

2.5 Classification Based on Implant Surface Texture and Roughness

Surface texture and roughness are among the most important determinants of the biological response at the implant–bone interface. Moderately rough surfaces produced by techniques such as sandblasting and acid etching have demonstrated superior osseointegration when compared with smooth, machined surfaces (Begum and Peeran, 2015). Nevertheless, increased surface roughness may also facilitate plaque accumulation, emphasizing the importance of appropriate implant maintenance and optimal oral hygiene (Brunski, 2006).



(Figure **3-1)** Classification Based on Implant Surface Texture and Roughness

2.6 Classification Based on Implant Surface Chemical Composition

The chemical composition of the implant surface plays a vital role in protein adsorption and cellular attachment. Dental implants are commonly manufactured from commercially pure titanium or titanium alloys, which form a biologically stable oxide layer upon exposure to air or biological fluids. This oxide layer exhibits a high dielectric constant and polarizability, enabling strong adsorption of proteins from blood and extracellular fluids. Initial protein adsorption is mediated by weak Van der Waals forces; however, once adsorbed, the interaction becomes stronger, promoting irreversible binding and facilitating cellular attachment and bone formation (Sykaras et al., 2000).

2.7 Classification Based on Implant Surface Energy and Charge

Surface energy, also referred to as wettability, describes the ability of an implant surface to interact with biological fluids. High surface energy surfaces are hydrophilic and promote rapid wetting, which enhances protein adsorption and early cell attachment.

Implants with higher surface energy have been associated with accelerated healing and improved early osseointegration.

Measurement of surface wettability is commonly performed using the sessile drop technique, which evaluates the contact angle formed between a liquid droplet and the implant surface

(Teughels et al., 2006).

2.8 Classification Based on the Implant–Abutment Interface

The implant–abutment interface plays a significant role in mechanical stability, microgap formation, and bacterial leakage. Implant systems are generally classified into external and internal connection designs. Internal connection systems, such as internal hex and conical (Morse taper) designs, provide improved load distribution and reduced micromovement when compared with external hex connections (Brunski, 2006).

2.9 Classification Based on the Type of Biologic Response

Based on their interaction with host tissues, implant materials may be classified as biotolerant, bioinert, or bioactive. Biotolerant materials are typically surrounded by a fibrous connective tissue capsule, whereas bioinert materials allow close bone contact without chemical bonding. Bioactive materials form a direct chemical bond with bone, thereby enhancing the process of osseointegration (Albrektsson and Johansson, 2001).

2.10 Classification Based on Implant Materials Used

Titanium and Titanium Alloys

Titanium remains the gold standard due to excellent biocompatibility, corrosion resistance, and mechanical properties. Titanium alloys such as Ti-6Al-4V provide increased strength (Albrektsson et al., 1981; Osman and Swain, 2015).

Tantalum

Porous tantalum exhibits a trabecular structure allowing bone ingrowth, though its dental application remains limited (Brunski, 2000).

Ceramic Materials (Zirconia)

Zirconia implants offer superior esthetics and low plaque affinity, particularly in anterior regions, but long-term evidence is still limited (Osman and Swain, 2015).

Polymer-Based Materials (PEEK)

PEEK has an elastic modulus similar to cortical bone but lacks osteoconductivity and is mainly used as an adjunct material (Najeeb et al., 2015).

2.11 Classification Based on Implant Dimensions

Implants may be classified according to their length and diameter. Short implants, generally less than 10 mm in length, are used in situations of reduced vertical bone height, such as proximity to the maxillary sinus or the mandibular canal (Begum and Peeran, 2015). Based on diameter, implants are classified as narrow-diameter, conventional-diameter, or wide-diameter implants, depending on bone availability and prosthetic requirements.

1.4 Indications of Dental Implants in Relation to Implant Systems Used Among Iraqi Dentists

Dental implants have become an essential component of modern dental practice due to their high success rates and their ability to restore oral function, esthetics, and patient comfort. The indications for dental implant placement are closely related to the availability, design, and characteristics of different implant systems. Understanding these indications helps explain the preferences and choices of implant systems among Iraqi dentists.

Edentulism whether partial or complete, has always posed great challenges to clinicians. Among the multitude of available replacement options, dental implants have currently gained importance due to well-established and standard protocols. A systematic approach to diagnosis and treatment planning is fundamental to the success of dental implants and their long-term functionality. The success of dental implants treatment is owed to their longevity and biocompatibility Furthermore innovative implant designs can cater to a multitude of patient needs. Thus understanding the clinical indications can be regarded as the deciding factor for the success of osseointegrated dental implants

1.1.4 Replacement of a Single Missing Tooth

Dental implants are indicated for the replacement of a single missing tooth as they provide a fixed restoration without compromising adjacent teeth. Unlike conventional fixed partial dentures, implants preserve the structure of neighboring teeth and help maintain alveolar bone levels. This indication influences Iraqi dentists to select implant systems that offer precise surgical placement, esthetic abutments, and

predictable osseointegration.

Why Implants Are Preferred for Single Missing Teeth Preserves Adjacent Teeth: Implants don't require cutting down healthy neighboring teeth, which is necessary for traditional bridges, preventing decay and sensitivity issues on those teeth.

Maintains Bone Health: The implant acts as a tooth root, stimulating the jawbone and preventing the bone loss (resorption) that occurs when a tooth is missing.

Natural Feel & Function: Implants integrate with the bone, allowing for a fixed, stable replacement that looks, feels, and functions like a natural tooth.

Long-Term Solution: They offer excellent long-term survival rates and stability compared to other options like removable partial dentures

2.1.4 Replacement of Multiple Missing Teeth

Dental implants are indicated for partially edentulous patients requiring replacement of multiple missing teeth. Implant-supported bridges reduce stress on remaining natural teeth and provide improved functional outcomes. Implant systems with strong implant–abutment connections and compatible prosthetic components are commonly preferred for such indications.

Key Benefits

Preserves Natural Teeth: Eliminates the need to alter healthy adjacent teeth, which is required for traditional bridges. Reduces Bone Loss: Implants stimulate the jawbone, preventing the bone shrinkage that occurs with missing teeth. Improved Function: Offers strong chewing ability and stability, allowing for normal eating and speaking. Natural Look & Feel: Restorations are custom-crafted to match your smile.

3.1.4 Completely Edentulous Patients and Full-Arch Rehabilitation

In completely edentulous patients, dental implants are indicated to support overdentures or fixed full-arch prostheses. Implant-supported restorations significantly improve retention, stability, and patient satisfaction compared to conventional complete dentures. This indication requires implant systems capable of achieving high primary stability and supporting immediate or early loading protocols.

Full-arch zirconia restorations on implants have gained popularity due to zirconia's strength and aesthetics, yet they are still associated with challenges like structural fractures, peri-implant complications, and design misfits. Advances in CAD/CAM and digital workflows offer potential improvements, but a technique that consistently addresses these issues in fixed, full-arch, implant-supported prostheses is needed. This novel technique integrates a facially and prosthetically driven treatment approach, which is divided into three phases: data acquisition, restoration design, and manufacturing/delivery. Digital tools, including intraoral scanning and photogrammetry, facilitate accurate implant positioning, while 3D design software enables functional and aesthetic validation before final milling. A dual software approach is used to reverse engineer a titanium bar from the final restoration design, ensuring a superior outcome to other protocols. The restoration incorporates a zirconia–titanium hybrid structure, optimizing strength, flexibility, and weight. The proposed workflow enhances restoration precision and predictability through a prosthetically driven treatment plan, by ensuring passivity and aligning with biological and mechanical principles to promote long-term stability. By starting with the proposed restoration design and reverse engineering the bar, while also allowing for flexibility in material and component choices, this technique accommodates both patient needs and financial considerations. This approach demonstrates potential for improving patient outcomes in full-arch implant restorations by minimizing complications associated with traditional methods. Further research is recommended to validate the technique's efficacy and broaden its clinical applications.

4.1.4 Poor Denture Retention

Dental implants are strongly indicated in patients with poor retention of removable dentures, especially in the mandible. Even a limited number of implants can significantly enhance denture stability. Implant systems offering overdenture attachments such as ball, locator, or bar attachments are commonly selected for

this indication

Stabilize the Denture: Implants provide secure anchor points, preventing the denture from shifting or falling out during eating and talking.

Reduce Bone Loss: Implants integrate with the jawbone, slowing down the natural resorption (loss) of bone that happens with traditional dentures, preserving jaw shape.

Improve Function: Patients can eat a wider variety of foods and speak more clearly with greater confidence.

Common Attachment Types

Ball and Socket

metal bar connects implants, with clips in the denture engaging the bar, providing very strong retention, though potentially with more maintenance.

Key Consensus & Recommendations

Two Implants are Often Enough: Major guidelines (like the McGill and York Consensus) recommend at least two implants in the anterior mandible for excellent stability, making it a cost-effective solution.

Single Implant Option: Even a single implant can dramatically improve life for medically compromised or budget-restricted patients.

Attachment Choice Matters: While bar systems often show higher retention, Locators offer a good balance of retention, simplicity, and minimal maintenance, according to research in Sulaimani Dental Journal

5.1.4 Preservation of Alveolar Bone

Preservation of alveolar bone is a key biological indication for dental implant placement. After tooth loss, bone resorption occurs due to lack of functional loading. Dental implants help transmit occlusal forces to the bone, reducing bone loss. Implant systems with advanced surface treatments are preferred to enhance osseointegration.

6.1.4 Esthetic Indications

Dental implants are indicated in areas with high esthetic demands, particularly the anterior maxilla. Proper implant placement and selection of implant systems with platform switching, conical connections, and esthetic abutments contribute to favorable soft tissue outcomes and natural appearance.

7.1.4 Restoration of Oral Function

Dental implants are indicated to restore masticatory efficiency, phonetics, and occlusal stability. Implant-supported restorations demonstrate superior functional outcomes compared to removable prostheses. Implant systems with mechanically stable connections are essential for long-term functional success.

8.1.4 Bone Quality and Quantity Considerations

Dental implants are indicated in patients with adequate bone volume and density. However, advances in implant design have expanded indications to include patients with compromised bone conditions using

short, narrow, or tapered implants.

Implant systems offering a variety of designs allow flexibility in treatment planning.

Conventional dental implants inserted in the molar region of the maxilla will reach into the sinus maxillaris when alveolar ridge height is limited.

When surgery is performed without prior augmentation of the sinus floor, primary stability of the implant is important for successful osseointegration. This study aimed at identifying the impact of bone quality and quantity at the implantation site on primary implant stability of a simulated bicortical placement.

The main findings were that primary implant stability did not depend on total bone thickness but tended to increase with either increasing bone mineral density or overall cortical bone thickness.

9.1.4 Patient Expectations and Socioeconomic Factors

Patient-related factors such as desire for fixed restorations, improved quality of life, and long-term treatment outcomes are important indications for dental implant therapy. Socioeconomic conditions may influence both the indication for implant treatment and the choice of implant system.

10. Clinician Experience and Training

The indication for dental implant placement is influenced by the clinician’s training and experience with specific implant systems. Dentists tend to indicate implant treatment using systems that are supported by scientific evidence and clinical training programs.

There are few absolute contraindications to dental implant placement. Relative contraindications include cognitive decline, American Society of Anesthesiology patient status IV or higher categories, or medical conditions that may jeopardize the life or lifespan of the patient. Precautions for placing dental implants should be viewed with respect to the evidence-based exposures that can contribute to risk of failure, including but not limited to local, behavioral, and medical factors. Risk for dental implant failure increases in association with (1) past history of periodontal disease, (2) bruxism, (3) smoking, and (4) radiation therapy.

1.5 Absolute Contraindications

1.1 Uncontrolled Systemic Diseases

Patients with uncontrolled systemic conditions are considered poor candidates for dental implant placement. These include:

- Uncontrolled diabetes mellitus
- Severe immunosuppressive conditions
- Uncontrolled bleeding disorders

Such conditions impair wound healing and increase the risk of infection and implant failure.

(Table 1.1) Uncontrolled Systemic Diseases

TABLE 1.

Systemic disorder risk factors and related references[13]

Systemic disorder factors	Common diseases included	Influence on dental implant therapy	Related references
Neuropsychiatric disorders	Epilepsy, dementia, schizophrenia, Parkinson's disease, Alzheimer's disease, Huntington's disease	Damage caused by seizures; having difficulty in understanding and following medical advice	9 , 10 , 11 , 13 ,
Respiratory diseases	Chronic obstructive pulmonary disease (COPD), asthma	Dyspnea	14 , 15
Digestive diseases	Decompensated hepatic disorders, hepatic fibrosis, cystic fibrosis-related cirrhosis	Unmanageable hemorrhage of the surgery wound; accidental hematemesis from an esophageal variceal bleed and portal hypertension	18
Immune system diseases	Rheumatoid arthritis, inflammatory bowel diseases, periodontal infections	Bone loss	22
	AIDS	Bone loss caused by antiretroviral therapy	24
COVID-19	-	Fever; dry cough; myalgia; fatigue	36 , 37 , 38 , 39 , 40
Urinary system diseases	IgA nephropathy, nephrotic syndrome, glomerulonephritis, chronic renal failure	Infection; kidney failure; hyperkalemia; disturbing bone metabolism; administration of steroid may induce potential infection or even death	47 , 48 , 49 , 50 , 51 , 113 , 114
Skeletal diseases	Osteoporosis	Resorption of the alveolar bo[illegible]	[illegible]7 -

		steroid may induce potential infection or even death	
Skeletal diseases	Osteoporosis	Resorption of the alveolar bone	55 , 56 , 57
Cardiovascular diseases	Hypertension, coronary atherosclerotic heart disease, acute myocardial infarction, heart failure, cerebrovascular disease	Raising the risk of bleeding and hematoma; jeopardizing osseointegration	59 , 60
Hematologic diseases	Thrombocytopenic purpura, hemophilia	Unmanageable bleeding	62 , 63 , 64
	Leukemia	Peri-implantitis	67
Endocrine system diseases	Diabetes mellitus	Peri-implantitis; delayed wound healing; repressing bone formation and enhancing bone resorption	69–76
	Hyperthyroidism	Bad effect on cardiovascular system; thyroid storm	80,81
	Hyperparathyroidism	Enhanced bone resorption	84
	Hypothyroidism	Reduced bone metabolic rate	82
	Estrogen deficiency	Osteoporotic jaw	85–87
Cancer	Head-and-neck cancer, lymphoma	High-dose radiation impairing osseointegration	76,90–94
		Chemotherapy jeopardizing bone metabolism	96–98

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1.2 Recent Radiotherapy to the Head and Neck Region

Radiation therapy significantly compromises bone vascularity and healing capacity.

• Implant placement in irradiated bone increases the risk of osteoradionecrosis.

• Implant placement is generally contraindicated if radiotherapy was administered within the past 6–12 months.

Radiation causes injury to the remodeling system by damaging osteoclasts and decreasing the proliferation of bone marrow, collagen, and blood vessels. Vascular injury shows as hyperemia followed by endarteritis and decreasing microcirculation. The bone marrow become hypocellular and hypovascular and shows signs of marked fibrosis and fatty degeneration. It is believed that the irradiated hypocellular, hypovascular and hypoxic tissue is the main cause of failures in dental implants osseointegration

1.3 Incomplete Skeletal Growth

Dental implants are contraindicated in patients who have not completed craniofacial growth.

- Implants behave like ankylosed teeth and do not adapt to jaw growth.
- This may lead to infra-occlusion and esthetic problems.

1.4 Severe Psychiatric Disorders or Poor Patient Cooperation

Patients with uncontrolled psychiatric conditions or poor compliance:

- May not maintain oral hygiene
- May fail to attend follow-up visits

This significantly compromises implant success.

Relative Contraindications

These conditions do not absolutely prohibit implant placement but require careful evaluation and management.

2.1 Smoking

Smoking is a well-documented risk factor for implant failure.

- It reduces blood supply
- Increases peri-implantitis risk

Implant placement may still be considered with smoking cessation or reduction.

2.2 Poor Oral Hygiene and Active Periodontal Disease

- Active periodontal disease increases bacterial load
- Raises the risk of peri-implant infections

Periodontal therapy is required before implant placement.

2.3 Insufficient Bone Quantity or Quality

Lack of adequate alveolar bone:

- Prevents achieving primary stability
- Increases implant failure risk

However, bone augmentation procedures may allow implant placement.

2.4 Parafunctional Habits (e.g., Bruxism)

Excessive occlusal forces:

- Increase mechanical complications
- May cause implant fracture or prosthetic failure

Occlusal guards and careful planning are recommended.

2.5 Pregnancy

Elective implant surgery is generally postponed during pregnancy:

- Due to stress
- Medication concerns
- Radiographic exposure

Implant placement may be considered after delivery.

2.6 Bisphosphonate Therapy

Patients receiving:

- Intravenous bisphosphonates (absolute risk)

• Long-term oral bisphosphonates (relative risk)

Are at increased risk of medication-related osteonecrosis of the jaw (MRONJ).

1.6 Prosthetic Options in implant dentistry

Misch proposed five prosthetic options for implant dentistry. The firstthree options are FPs. These three options may replace partial (one tooth or several) or total dentitions and may be cemented or screw retained. They are used to communicate the appearance of the final prosthesis to all of the implant team members, including the laboratory and patient. These options depend on the amount of hard and soft tissue structures replaced and the aspects of the prosthesis in the esthetic zone.

Common to all fixed options is the inability of the patient to remove the prosthesis.

wo types of final implant restorations are RPs; they depend on the amount of implant support, retention, and stability, not the appearance of theprosthesis. (Misch, 2015).

Table 2.1 Misch's five prosthetic options for implant dentistry.

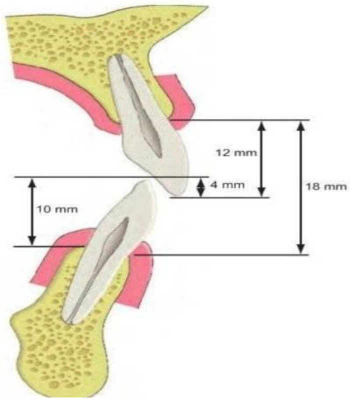
(Misch, 2015).

Type	Definition
FP-1	Fixed prosthesis; replaces only the crown; looks likea natural tooth
FP-2	Fixed prosthesis; replaces the crown and a portion ofthe root; crown contour appears normal in the occlusal half but is elongated or hyper contoured in the gingival half
FP-3	Fixed prosthesis; replaces missing crowns and gingival color and a portion of the edentulous site; prosthesis most often uses denture teeth and acrylicgingiva but may be porcelain to metal
RP-4	Removable prosthesis; overdenture supported completely by implants (usually with a superstructure bar)
RP-5	Removable prosthesis; overdenture supported by both soft tissue and implants (may or may not have a superstructure bar

Fixed Prostheses

FP-1

An FP-1 is a fixed restoration and appears to the patient to replace only the anatomical crowns of the missing natural teeth. To fabricate this restoration type, there must be minimal loss of hard and soft tissues. The volume and position of the residual bone must permit ideal placement of the implant in a location similar to the root of a natural tooth. (Misch, 2005).



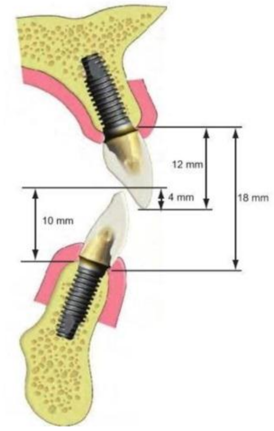
(Figure 4.1) The healthy natural teeth have abundant bone and ideal soft tissue.

The ideal hard and soft tissue allows ideal esthetics. (Misch, 2005).

(Figure 5.1) The bone and soft tissue must be ideal in volume and position to obtain an FP-1 appearance for the final restoration.

When multiple teeth are replaced, bone and tissue augmentation is usually required to obtain an FP-1 prosthesis. (Misch, 2005)

The final restoration appears very similar in size and contour tomost traditional FPs used to restore or replace natural crowns of teeth. The FP-1 prosthesis is most often desired in the maxillary anterior region, especially in the esthetic zone during smiling. (Misch, 2005).



(Figure 6.1)A, An implant is positioned in the maxillary right canine position.

The hard and soft tissue conditions are ideal for a crown of normal contour and size. B, The maxillary right canine implant crown in position. The soft tissue drape is similar to a natural tooth, and the crown contour is similar to the clinical crown contour of a natural tooth. This is the goal of an FP-1 prosthesis. (Misch, 2005).

The final FP-1 restoration appears to the patient to be similar to a crown on a natural tooth. However, the implant abutment can rarely be treated exactly as a natural tooth prepared for a full crown. The cervical diameter of a natural tooth is approximately 6.5 to 10.5 mm with an oval to triangular cross-section. However, the implant abutment is usually 4 to 5 mm in diameter and round in cross-section. In addition, the placement of the implant rarely corresponds exactly to the crown-root position of the

original tooth. The thin labial bone lying over the facial aspect of a maxillary anterior root remodels after tooth loss and the crest width shifts to the palate, decreasing 40% within the first 2 years. The occlusal table of the crown should also be modified in unesthetic regions to conform to the implant size and position and to direct vertical forces to the implant body. For example, posterior mandibular implant-supported prostheses have narrower occlusal tables at the expense of the buccal contour because the implant is smaller in diameter and placed in the central fossa region of the tooth. (Misch, 2005). Maxillary posterior teeth often have reduced occlusal tables from the palatal aspect because the buccal cusp is often within the esthetic zone. (Tjan et al, 1984).

(Figure 7.1) This full-arch prosthesis has posterior crown contours that are narrower than natural teeth because the implant is smaller in diameter than the tooth.

As a general rule, the maxillary arch has reduced lingual contours and the mandibular posterior pros-thesis has reduced buccal contours. (Tjan et al, 1984)

The width or height of the crestal bone is frequently lacking after the loss of multiple adjacent natural teeth; therefore, bone augmentation is often required before implant placement to achieve natural-looking crowns in the cervical region. There are no interdental papillae in edentulous ridges; therefore, soft tissue augmentation also is often required to improve the inter-proximal gingival contour. Ignoring this step causes open “black” triangular spaces (where papillae should usually be present) when the patient smiles. FP-1 prostheses are especially difficult to achieve when more than two adjacent teeth are missing.

The 21

bone loss and lack of interdental soft tissue com- plicate the final esthetic result, especially in the cervical region of the crowns. The restorative material of choice for an FP-1 prosthesis is porcelain to noble-metal alloy. A noble-metal substructure can easily be separated and soldered in case of a nonpassive fit at the metal try-in, and noble metals in contact with implants corrode less than nonprecious alloys. Any history of exudate around a subgingival base metal margin will dramatically increase the corrosion effect between the implant and the base metal. A single tooth FP-1 crown may use aluminum oxide cores and porcelain crowns or ceramic abutments and porcelain crowns. However, the risk of fracture may increase with the latter scenario because impact forces are greater on implants than natural teeth. (Tjan et al, 1984).

FP-2

An FP-2 fixed prosthesis appears to restore the anatomical crown and a portion of the root of the natural tooth. The volume and topography of the available bone are more apical compared with the ideal bone position of a natural root (1-2 mm below the cement-enamel junction) and dictate a more apical implant placement compared with the FP-1 pros- thesis. As a result, the incisal edge of the restoration is in the correct position, but the gingival third of the crown is overextended, usually apical and lingual to the position of the original tooth. These restorations are similar to teeth exhibiting periodontal bone loss and gingival recession. (Tjan et al, 1984).

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(Figure 8.1)A , An FP-2 prosthesis has longer clinical crowns than healthy natural teeth.

The soft tissue drape is also reduced around the prosthesis. B, The FP-2 prosthesis appears of normal contour in the esthetic zone during a high smile and/or speech. (Tjan et al, 1984).

The patient and the clinician should be aware from the onset of

treatment that the final FP-2 prosthetic teeth will appear longer than healthy natural teeth (without bone loss). The esthetic zone of a patient is established during smiling in the maxillary arch. (Tjan et al, 1984)

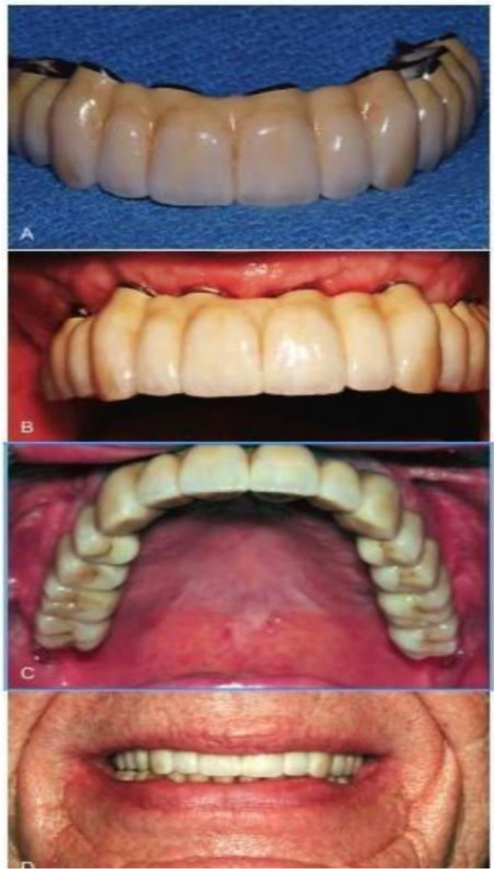
The number of teeth displayed in a smile is variable. Fewer than 10% of the population limits their smile to the anterior six teeth. Almost 50% of people show up to the first premolar. Only 4% of our patients display almost all the maxillary teeth during a smile. If the teeth do not show during smiling or speech, an FP-2 restoration is not a compromise. The low lip position is evaluated during sibilant sounds of speech (e.g., Mississippi). It is not unusual for patients to show less lower anterior teeth during smiling, especially in younger patients. Older patients are most likely to show the anterior teeth and gingiva during speech, with

men showing more than women. Likewise, if the high lip line during smiling or the low lip line during speech does not display the cervical regions, the longer teeth are usually of no esthetic consequence, provided23 that the patient has been informed before treatment. (Tjan et al, 1984)(Cade et al, 1979).

(Figure 9.1) The number of teeth displayed in a smile may include the first molars (top) or be limited to the first premolar (bottom).

The soft tissue is also observed around the teeth. (Tjan et al, 1984)(Cade et al, 1979)

As the patient becomes older, the maxillary esthetic zone is altered. Whereas only 10% of younger patients do not show any soft tissue during smiling, 30% of 60-year-old adults and 50% of 80-year-old adults do not display gingival regions during smiling (Tjan et al, 1984)(Cade et al, 1979).



(Figure 10.1) A full-arch maxillary implant prosthesis. Note that the maxillary right anterior implant is in an embrasure.

B, The maxillary full arch FP-2 restoration in place. €, The FP-2 prosthesis appears as natural teeth in the esthetic zone. D, The high smile line of the same patient. The low position of the maxillary lip duringsmiling permitted the fabrication of an FP-2 prosthesis. (Tjan et al, 1984)(Cade et al, 1979).

The low lip position of the mandibular lip during speech is not affected as much as the maxillary lip during the high smile line. Rarely do younger or middle-age patients show the lower gingival during speech. Only 10% of older patients show the mandibular soft tissue during speech. Hence, FP-2 restorations in the mandible are common and usually of no compromise (Tjan et al, 1984)(Cade et al, 1979).

(Figure 11.1) An FP-2 complete mandibular fixed prosthesis from an occlusal view.

The anterior teeth appear ideal in width and contour. (Tjan et al, 1984)(Cade et al, 1979)

A multiple-unit FP-2 restoration does not require as specific an implant position in the mesial or distal position because the cervical contour is not displayed during function. The implant position may be chosen in relation to bone width, angulation, or hygienic considerations rather than purely esthetic demands (compared with the FP-1 prosthesis).

On occasion, the implant may even be placed in an embrasure between

wo teeth. This often occurs when replacing mandibular anterior teeth with a full-arch fixed restoration the incisal two thirds of 26 the two crowns should be ideal in width, as though the implants were not present. Only the cervical region is compromised. Although the implant is not positioned in an ideal mesiodistal position, it should be placed in the correct facial- lingual position to ensure that contour, hygiene, and direction of forces are not compromised. (Brinemark et al, 1985).

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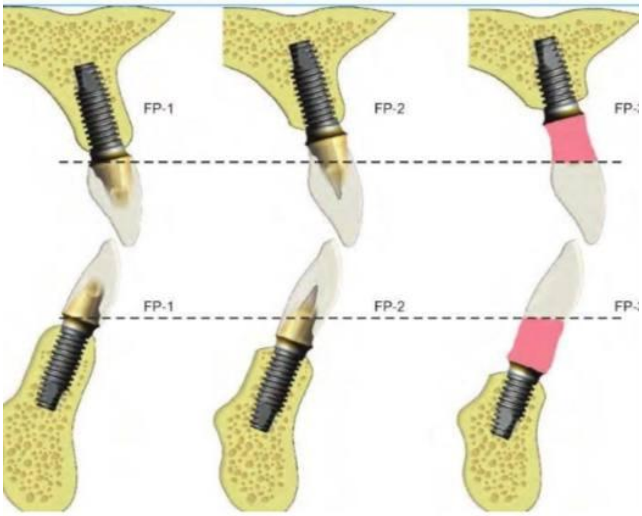
(Figure 12.1)Almost every implant is in the interproximal embrasure of this mandibular FP- 2 restoration.

The technician fabricated the incisal aspect of the restoration without regard to the mesiodistal position of the implants. (Brinemark et al, 1985)

The material of choice for an FP-2 prosthesis is precious metal to porcelain. The amount and contour of the metal work is different than for an FP-1 restoration and is more relevant in an FP-2 prosthesis because the amount of additional volume of tooth replacement increases the risk of unsupported porcelain in the final prosthesis, when the metal work is under- contoured. (Brinemark et al, 1985).

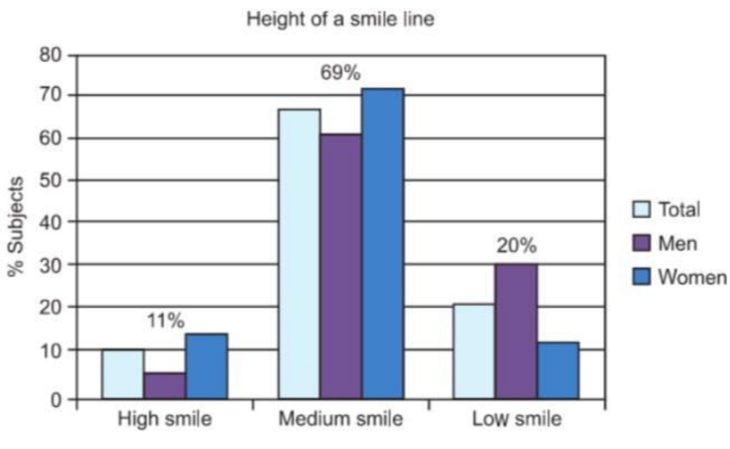
FP-3

The FP-3 fixed restoration appears to replace the natural teeth crowns and has pink-colored restorative materials to replace a portion of the soft tissue, especially the interdental papillae. As with the FP-2 prosthesis, the original available bone height has decreased by natural resorption or osteoplasty at the time of implant placement. To place the incisal edge of the teeth in proper position for esthetics, function, lip support, and speech, the excessive vertical dimension to be restored requires teeth that are unnatural in length. However, unlike the patient requirements for an FP-2 prosthesis, the patient may have a normal to high maxillary lip line during smiling or a low mandibular lip line during speech. As a consequence, the soft tissue drape should also be replaced. Prosthetic replacement of the soft tissue drape (FP-3 prosthesis) is most often desirable when multiple adjacent teeth are missing. (Tjan et al,1984).



(Figure 13.1) Fixed restorations have three categories:

FP-1, FP-2, and FP-3. The restoration type is related to the contour of the restoration. (FP-1 is ideal, FP-2 is hyper-contoured, and FP-3 replaces the gingiva drape with pink porcelain or acrylic) The difference between FP-2 and FP-3 most often is related to the high maxillary lip position during smiling or the mandibular lip position during sibilant sounds of speech. FP-2 and FP-3 restorations often require more implant surface area support by increasing implant number or size. (Tjan et al, 1984). The ideal high smile line occurs in almost 70% of the population and the maxillary lip displays the interdental papilla of the maxillary anterior teeth but not the soft tissue above the mid-cervical regions (Tjan et al, 1984).



(Figure 14.1) A smile that shows interdental papillae but no cervical tissue is ideal and found in 70% of patients.

60 A low smile line shows no soft tissue during smiling and is seen in 20% of patients (more men than women).

A high smile line displays interdental papillae and the cervical regions above the teeth and are observed in 11% of patients (women more often than men). (Adapted from Tjan AH, Miller GD, The JG: Some esthetic factors in a smile, J Prosthet 20 Dent 51:24-28, 1984.) Approximately 7% of men and 14% of women have a high smile or “gummy” smile and display the interdental papillae and at least some of the gingival tissues above the free gingival margin of the teeth. (Tjan et al, 1984). Patients in both of these categories of high lip line should have the soft tissue replaced by either the prostheses or the patient's soft tissue. (Brinemark et al, 1985

(Figure 15.1) A, An intraoral view of a maxillary full arch FP-3 restoration shows how it replaces the interdental papillae with pink porcelain. B, The high maxillary lip line during smiling shows the interdental papillary regions in the anterior maxilla. Therefore, the fixed prosthesis replaces the gingival regions in the esthetic zone by soft tissue surgery or, as in this case, with the final restoration (FP-3). (Brinemark et al, 1985)

(Figure 16.1) Maxillary and mandibular FP-3 prosthesis with pink porcelain on a porcelain-to-metal restoration.

B, An intraoral view of the maxillary FP-3 prosthesis. The pink porcelain permits the teeth to appear as normal size. (Brinemark et al, 1985) There are basically two approaches for an FP-3 prosthesis: (1) a hybrid restoration of denture teeth and acrylic with a metal substructure' (Brinemark et al, 1985) (2) a porcelain-metal restoration (Figure 23). An FP-3 porcelain-to-metal restoration is more difficult to fabricate for the laboratory technician than an FP-2 prosthesis. The pink porcelain is harder to make appear as soft tissue and usually requires more baking cycles. This increases the risk of porosity or porcelain fracture. (Misch, 2005)

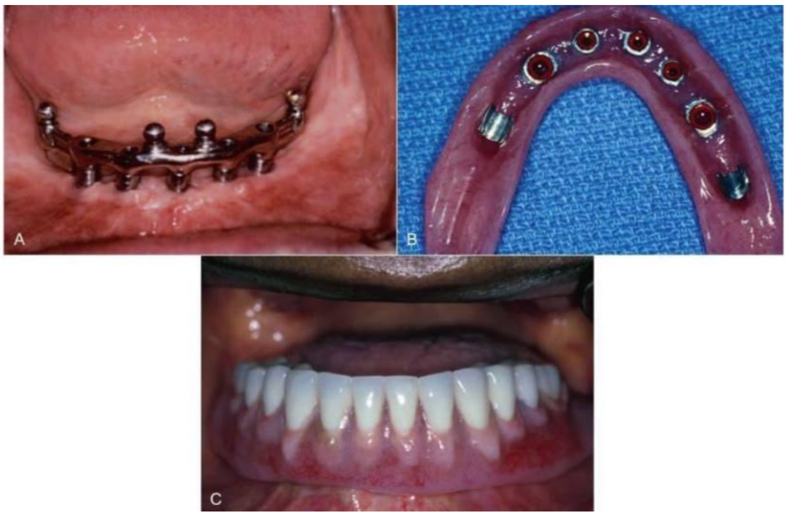
(Figure 17.1) A, An FP-3 porcelain-to-metal restoration in the maxilla and an FP-3 hybrid with acrylic—metal and denture teeth in the mandible.

B, The maxillary FP-3 porcelain to metal and mandibular FP-3 hybrid prosthesis during a smile. (Misch, 2005) Removable Prostheses There are two types of RPs based on support, retention, and stability of the restoration. (Misch, 1990). Patients are able to remove the restoration but not the implant- supported superstructure attached to the abutments. The difference in the two categories of removable restorations is not in appearance (as it is in the fixed categories). Instead, the two removable categories are primarily determined by the amount of implant support. The most common removable implant prostheses are over-dentures for completely edentulous patients.

Traditional removable partial dentures with clasps on implant abutment crowns have not been reported in the literature with any frequency. No long- term studies are currently available. On the other hand, complete removable overdentures have often been reported with predictability for many decades. (Naert et al, 1991)(Spiekermann et al, 1995)(Chan et al, 1995)(Johns et al, 1992)(Zarb et al, 1996). As a result, the removable prosthetic options are primarily overdentures for the completely edentulous patient.

RP-4 :

RP-4 is an RP completely supported by the implants, teeth, or both.” The restoration is rigid when inserted: overdenture attachments usually connect the RP to a low-profile tissue bar or superstructure that splints the implant abutments. Usually, five to seven implants in the mandible and six to eight implants in the maxilla are required to fabricate completely implant- supported RP-4 prostheses in patients with favorable dental criteria (Figure 26). (Misch, 1991)



(Figure 18.1) A, An RP-4 restoration is a removable prosthesis (usually an overdenture) that is completely implant supported.

In this patient, the mandibular restoration has five implants between the mental foramina and a cantilevered bar to the posterior regions.

The prosthesis is rigid during function and therefore requires attention to implant position and an implant number similar to an FP-3 restoration. B, The mandibular overdenture for an RP-4 prosthesis has attachments that permit a rigid restoration during function. C, An intraoral view of an RP-4 prosthesis appears as a mandibular denture but is rigid during function. (Misch, 1991) The implant placement criteria for an RP-4 prosthesis is different than that for an FP. Denture teeth and acrylic require more prosthetic space for the removable restoration. In addition, a superstructure and overdenture attachments must often be added to the implant abutments. This requires a more lingual and apical implant placement compared with the implant position for an FP. The implants in an RP-4 prosthesis (and an FP-2 or FP-3 restoration) should be placed in the mesiodistal position for the best biomechanical and hygienic situation. On occasion, the position of an attachment on the superstructure or prosthesis may also affect the amount of spacing between the implants. For example, a Hader clip requires the mesiodistal implant spacing to be greater than 6 mm from edge to edge and as a consequence reduces the number of implants that may be placed between the mental foramina. The RP-4 prosthesis may have the same appearance as an FP-1, FP-2, or FP-3 restoration. A porcelain-to-metal prosthesis with attachments in selected abutment crowns can be fabricated for patients with the cosmetic desire of an FP. The overdenture attachments permit improved oral hygiene or allow the patient to sleep without the excess forces of nocturnal bruxism on the prosthesis. (Misch, 1991) retention and lateral stability; or (4) four or five implants splinted with a cantilevered bar to improve retention, stability, and support which reduces soft tissue abrasions and limits the amount of soft tissue coverage needed for prosthesis support. The primary advantage of an RP-5 restoration is the reduced cost because fewer implants may be inserted compared with a fixed restoration and there is less demand for bone augmentation, often required for additional implants. The prosthesis is very similar to traditional overdentures supported by natural teeth. (Misch, 2005).

(Figure 19.1) Intraoral view of three mandibular implants inserted between the foramina.

A bar connects the implants and can support an RP-5 mandibular overdenture, Soft tissue support of the restoration is required in the posterior regions because the implant position and number are not conducive to a completely implant-supported prosthesis. (Misch, 2005) A preimplant treatment denture may be fabricated to evaluate to occlusal vertical dimension or ensure the patient's esthetic satisfaction. (Misch, 2005).

This technique is especially indicated for patients with demanding needs and desires regarding the final esthetic result or with severely reduced vertical dimensions with their present prosthesis. The implant dentist can also use the treatment denture as a guide for implant placement. The patient can also wear the treatment prosthesis during the healing stage. After the implants are uncovered, the superstructure is fabricated within the guidelines of the existing treatment restoration. After this is achieved, the preimplant treatment prosthesis may be converted to the RP-4 or RP-5 restoration. The clinician and the patient should realize that the bone will continue to resorb in the soft tissue-borne regions of the prosthesis. Relines and occlusal adjustments every few years are common maintenance requirements of an RP-5 restoration. Bone resorption in the posterior regions with RP-5 restorations may occur two to three times faster than the resorption found with full dentures. (Jacobs et al, 1992).

1.7 Criteria for Dental Implant Type Selection

1. Patient-Related FactorsPatient-related factors play a crucial role in dental implant selection. Systemic health conditions such as diabetes mellitus, osteoporosis, smoking habits, and immune disorders can significantly affect osseointegration and implant survival. Age, oral hygiene status, and parafunctional habits like bruxism must also be considered. These factors influence the choice of implant length, diameter, surface characteristics, and loading protocol.

2. Bone-Related FactorsBone quantity and quality are fundamental determinants in implant selection. Bone height and width dictate the possible implant dimensions, while bone density (D1–D4) affects primary stability. In cases of insufficient bone volume, bone augmentation procedures such as grafting or sinus lift may be required. Tapered

implants are often preferred in poor bone quality to enhance primary stability.

3. Implant Design Criteria

Implant design significantly influences stress distribution and long-term success. Threaded implants demonstrate better load distribution compared to smooth implants. Increasing implant length and diameter reduces stress on the surrounding bone. Surface-treated implants, such as SLA surfaces, promote faster and stronger osseointegration.

4. Prosthetic-Related Factors

Prosthetic planning should precede implant selection. The type of restoration (single tooth, multiple units, or full arch) affects implant number, position, and connection type. Internal implant-abutment connections and platform switching have shown better biomechanical stability and reduced crestal bone loss.

5. Surgical Considerations

Surgical factors include timing of implant placement (immediate or delayed), loading protocol, and surgical technique. Immediate placement and loading may reduce treatment time but require excellent primary stability. Operator experience is a critical factor affecting implant success.

6. Esthetic Considerations

In the esthetic zone, implant selection must consider gingival biotype, implant positioning, and neck design. Zirconia implants may be preferred in highly esthetic areas due to their favorable color and soft tissue response.

7. Implant Material

Titanium implants remain the gold standard due to their high strength and biocompatibility. Zirconia implants offer superior esthetics but have limited long-term clinical evidence compared to titanium.

8. Evidence-Based Selection

Evidence-based implant selection relies on clinical studies, survival rates, and long-term outcomes. Research by El-Anwar et al. emphasized implant design as a critical selection criterion, while studies from the American College of Prosthodontists highlighted implant-abutment connection and scientific evidence as primary decision factors.

Successful dental implant therapy depends on a comprehensive evaluation of patient, bone, prosthetic, surgical, and esthetic factors. Proper implant selection based on scientific evidence significantly enhances long-term success and patient satisfaction.

According to Albrektsson et al., systemic health and patient-related factors are among the primary determinants of implant success. Conditions such as uncontrolled diabetes and smoking have been shown to negatively affect osseointegration and increase implant failure rates. Good oral hygiene and patient compliance are essential for long-term implant survival.

Albrektsson, Zarb, Worthington, & Eriksson (1986) established the classical success criteria for dental implants, emphasizing the importance of biological and patient-related considerations

Lekholm and Zarb classified bone quality into four types (D1–D4), which remains a widely used system in implant dentistry. They concluded that poor bone quality (D3–D4) is associated with reduced primary stability and higher failure rates, necessitating careful implant design selection and surgical technique.

Buser et al. demonstrated that rough-surfaced implants, particularly SLA (Sandblasted, Large-grit, Acid-etched) surfaces, significantly enhance bone-to-implant contact and accelerate osseointegration compared to smooth-surfaced implants.

Additionally, El-Anwar et al. (2017) proposed that threaded implant designs provide superior stress distribution and reduce crestal bone stress, making implant design a critical selection criterion.

Misch emphasized that implant selection must be prosthetically driven. According to Misch's classification, implant diameter and number should be selected based on occlusal load and prosthetic design. He also highlighted the importance of internal implant–abutment connections in reducing mechanical complications.

According to Brånemark, achieving stable osseointegration requires minimal surgical trauma and adequate healing time. While immediate loading protocols have shown success, Brånemark emphasized that primary stability is a prerequisite for such approaches.

Glauser et al. reported that zirconia implants show favorable soft tissue response and esthetic outcomes, particularly in the anterior region. However, titanium remains the gold standard due to its superior mechanical properties and long-term clinical evidence.

Based on the scientific contributions of Brånemark, Albrektsson, Lekholm, Zarb, Misch, Buser, and El-Anwar, dental implant selection should be guided by patient health, bone characteristics, implant design, prosthetic requirements, and evidence-based clinical outcomes.

1.8 Types of Conventional Implant Systems

A conventional dental implant system typically consists of three main components:

1. Implant fixture (inserted into bone)
2. Abutment (connects implant to prosthesis)
3. Prosthetic restoration (crown, bridge, or denture)

Understanding the types of conventional implant systems is essential for proper case selection, treatment planning, and long-term success of implant therapy.

Classification of Conventional Implant Systems

Conventional implant systems can be classified based on several criteria including implant design, shape, surface characteristics, connection type, and loading protocol. The most common classification is based on implant design and shape.

Main types include:

- Endosteal implants
- Subperiosteal implants
- Transosteal implants

Among these, endosteal implants are the most commonly used in modern dentistry due to their high success rate and versatility.

Endosteal Implant Systems

Endosteal implants are placed directly into the alveolar bone and are the most widely used type of conventional implants. They are typically made of titanium or titanium alloys due to their excellent biocompatibility and ability to achieve osseointegration.

Endosteal implants can be further classified into:

- Screw-form implants
- Cylindrical (press-fit) implants
- Blade-form implants

Screw-form implants are the most popular because they provide good primary stability and are suitable for most clinical situations.

Screw-Form Implant Systems

Screw-form implants are designed with external or internal threads that allow them to be screwed into prepared osteotomy sites. This design enhances primary stability, especially in softer bone types.

Advantages:

- High initial stability
- Better load distribution

• Suitable for immediate or early loading

Disadvantages:

• Risk of excessive compression of bone if improperly placed

References:

Cylindrical (Press-Fit) Implant Systems

Cylindrical implants rely on frictional fit between the implant and bone. They are inserted by tapping or gentle pressure rather than screwing.

Advantages:

• Reduced stress on bone during placement

• Suitable for dense bone

Disadvantages:

• Lower primary stability compared to screw-form implants

Page 6: Blade-Form Implant Systems

Blade-form implants are thin and flat in design and were historically used in cases with narrow alveolar ridges.

Advantages:

• Can be used in narrow ridges without bone augmentation

Disadvantages:

• Lower success rates

• Less favorable stress distribution

Due to these limitations, blade implants are rarely used today.

Subperiosteal Implant Systems

Subperiosteal implants are placed on top of the bone but beneath the periosteum. They are custom-made frameworks that rest on the alveolar bone.

Indications:

- Severe alveolar bone resorption
- Patients unsuitable for bone grafting

Disadvantages:

- Complex fabrication
- Higher complication rates

Transosteal Implant Systems

Transosteal implants pass completely through the mandible and are secured with plates and screws.

Indications:

- Severely resorbed mandible

Disadvantages:

- Requires extensive surgery
- High morbidity
- Rarely used today

Discussion

Conventional implant systems have demonstrated predictable and successful outcomes when proper case selection and surgical protocols are followed. Endosteal screw-form implants remain the gold standard due to their high success rate, versatility, and compatibility with modern loading protocols.

Although subperiosteal and transosteal implants played an important historical role, advances in bone augmentation techniques and implant surface technology have significantly reduced their indications. The choice of implant system should be based on bone quality, quantity, patient health, and prosthetic requirements.

Conventional implant systems form the foundation of modern implant dentistry. Among the various types, endosteal implants—particularly screw-form designs—are the most widely accepted and clinically successful. Proper understanding of implant types, indications, advantages, and limitations is essential for achieving long-term success and patient satisfaction.

Continuous advancements in implant design and materials are expected to further improve outcomes and expand the indications for implant therapy.

Chapter Two : Discussion

Discussion

The results of this study demonstrate that Iraqi dentists tend to rely on a limited number of dental implant systems, primarily influenced by availability, cost, and personal clinical experience. These findings are consistent with previous studies indicating that economic factors and market accessibility play a major role in implant system selection, especially in developing countries.

Most participants preferred rough-surface implants, which is supported by the literature showing improved osseointegration and higher success rates compared to smooth-surface implants. The preference for conventional implant placement over immediate placement may reflect a cautious clinical approach aimed at minimizing complications and ensuring primary stability.

Implant failure, when reported, was most commonly associated with poor bone quality, infection, and inadequate primary stability. This aligns with well-established evidence identifying these factors as key contributors to implant failure. The results emphasize the importance of proper case selection, careful surgical planning, and adherence to standardized protocols.

Overall, the findings highlight the need for continuous professional education and improved access to high-quality implant systems to enhance implant success rates among Iraqi dentists

Chapter Three

Conclusion

Within the limitations of this study, Iraqi dentists show clear preferences in implant system selection, mainly influenced by availability, cost, and clinical experience. Proper case selection, implant design, and adherence to surgical protocols remain the most important factors for achieving successful implant outcomes.

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