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A Narrative of Dental Implant Treatments for People with Health Issues: A Review

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Abstract:-

- ***Introduction:***

Dental implant survival is influenced to a certain extent by systemic situation and habits. Surgical success is worsened by conditions that impair the natural healing cascade. However, a disease's revealing existence does not always preclude out implant therapy or have an enormous effect on long-term results. With appropriate management, certain conditions or additional factors can allow implant survival rates to approach those seen in healthy individuals. Patients who do not have systemic or local contraindications to therapy should be chosen in order to ensure implant success.

- ***Objective:***

It has been proposed that certain illnesses and medically compromised stipulations may contraindicate dental implant treatment. This article targets figuring out the precautions to take and analysing whether dental implants' effectiveness and long-term survival rates are poorer in patients with deteriorated health.

- ***Source:***

Using the PubMed/Medline, Scopus, Scirus, and Cochrane databases, an extensive literature review was conducted through digging up keywords and medically confronted diseases that influence implants.

- ***Conclusion:***

Although a variety of disorders may raise the probability of treatment failure or complications, there are very few specific health risks to dental implant therapy. Since the quality of life and functional benefits associated with dental implants may outweigh any risks for many of these patients, the degree of systemic disease control may be significantly greater than the nature of the disorder itself. Individualized medical control should be established before implant therapy.

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I. INTRODUCTION

Dental implant therapy has emerged as a reliable and effective treatment option for both partial and total edentulism, with long-term success rates exceeding 90–95%. But choosing the right cases is essential, particularly for those with health issues. Although they need careful evaluation, conditions that impair immunological response or wound healing may not always preclude treatment.[1] Although there are few recommendations for perioperative treatment in these populations, doctors must manage implant therapy in older patients with complex medical profiles as life expectancy rises. Because diseases and treatments can affect implant outcomes, clinicians must perform a complete assessment of systemic health; knowledge of problems including diabetes and bone disorders improves treatment outcomes. (Fig 1)

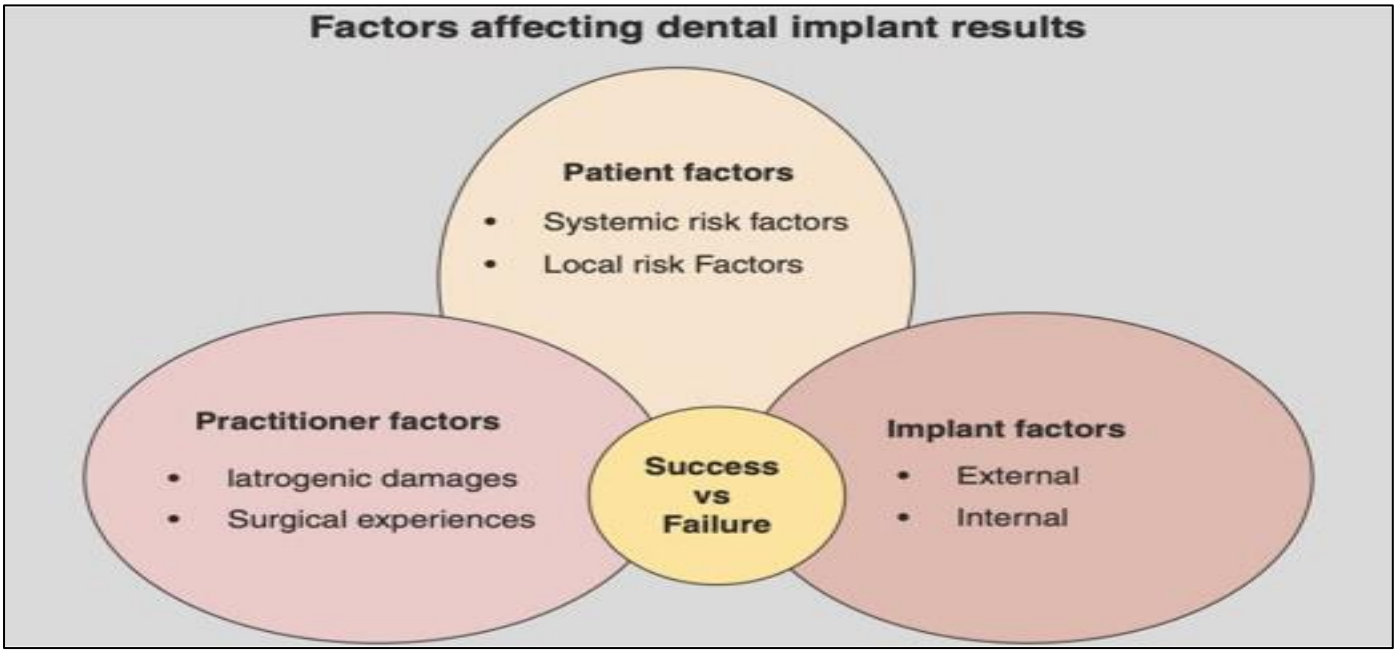

Fig 1 Factors Affecting Dental Implant Results

Using the keywords implants, contraindications, and the following disease categories that have been identified as potential contraindications in multiple publications, I attempted to review the scientific evidence that was available through searches in the PubMed/Medline, Scopus, Scirus, and Cochrane databases for this dissertation.

Among these are: alcoholism; bleeding disorders; bone disease; cancer patients; heart disease; corticosteroids; diabetes; hyposalivation; immunocompromised people; mucosal illness; neuropsychiatric disorders; and titanium allergy.[2] (Fig. 2)

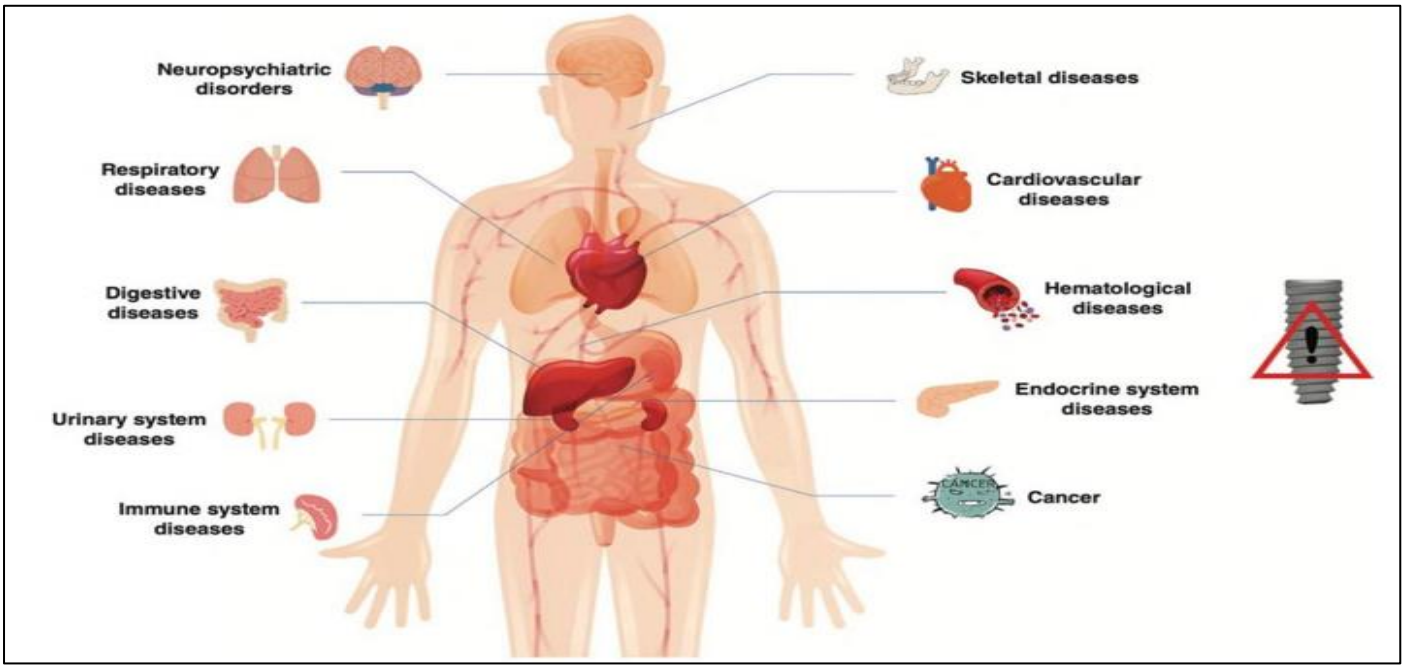

Fig 2 Systemic Disorder Risk Factor

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By separating indications, relative contraindications, and absolute contraindications, my current review study seeks to critically assess the literature and give the practitioner evidence-based information for implant therapy in patients with medical compromised individual.

➢ *Contraindication:-*

Some writers have suggested the following patient categories or conditions as relative contraindications for Dental implants.[6]

- Children and teenagers.
- Patients with epilepsy.
- Risk factors for myocardial infarction.
- Osteoradionecrosis.
- Endocarditis
- Severe bleeding tendency.

Adolescence, ageing, osteoporosis, smoking, diabetes, positive interleukin-1 genotype, human immunodeficiency virus, cardiovascular disease, hypothyroidism, and Crohn's disease are further documented related contraindications.[5,6]

The following are recommended absolute contraindications: recent myocardial infarction and cerebrovascular accident, transplant or valvular prosthesis surgery; severe immunosuppression; severe bleeding problems; active cancer treatment; drug abuse; mental illness; and intravenous bisphosphonate application.[7] However, the majority of these claims are not well supported by research.

II. GENERAL INDICATIONS TO IMPLANT THERAPY IN NORMAL POPULATION

Oral and general health depend on having healthy teeth. Loss of teeth impairs speech, chewing, and appearance, which lowers quality of life. Even with improvements, it is still a public health concern.[8] Dental caries, periodontal disease, impacted teeth, orthodontic needs, and prosthetic procedures are some of the primary causes of tooth loss.[9] While some research found that deep carious lesions are strongly associated with tooth extraction, others suggested that periodontal disorders are the most common cause of tooth loss.[10,11]

Additionally, edentulism causes persistent ridge resorption, poor speech and masticatory function, a depressed sense of self-worth, and a disfigured face, all of which contribute to a poor quality of life connected to oral health.[12] When planning a course of treatment, the needs and preferences of the patient are essential.[13] Thanks to developments in dental implantology, implants are now a well-liked and dependable tooth replacement alternative with a high success rate over the long run.[14,15]

In a recent study, Busenlechner et al. reported that almost half of the implants (46.3%) were placed in partially edentulous patients other than fully edentulous patients.[16] Good oral hygiene, edentulous jaws, and at least 7 mm of occlusal–gingival space are basic inclusion requirements. Although bone quality used to be important, new research shows that healthy and osteoporotic patients have comparable implant results.[17] Sinus floor augmentation is used to treat insufficient bone height in the posterior maxilla. When the amount of residual bone height is greater than 4 to 5 mm, implants are usually put. However, anatomical difficulties may lead to problems such as graft infection and sinus membrane puncture.[18,19]

However, bone augmentation treatments are needed less commonly in the posterior maxilla, and bone height doesn't seem to be a limiting factor in implant placement anymore, since new clinical trials corroborate the favourable therapeutic outcome of short implants.[20]

➢ *Edentulism:-*

The last indicator of oral health disorders, particularly in the elderly, is edentulism, which results from tooth loss.[21] In cases of edentulousness where a risk-benefit ratio can be determined and is acceptable to the patient and the physician, implant therapy is typically recommended.

Table 1 Success Rates

Survival and success rates of different implant supported prosthetic designs		
Different designs of implant supported prosthesess	**Cumulative implant survival rates**	**Cumulative implant success rates**
Single-tooth implant restoration	95.6%	75.6%
Fixed implant restorations—partial arch bridge	96.1%	73.8%
Fixed implant restorations—full arch bridge	100%	63.8%
Implant-supported overdentures	95.7%	78.6%

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From a prosthetic perspective, each type of edentulous condition can be treated with an implant-retained prosthetic device! (Divinyi: Fogászati implantológia 1998).

Table 2 Classification of Implant Restoration Based on Prosthetic Design

Type of implant restoration	Description of the prosthesis/restoration
FP 1	Fixed prosthesis replacing the missing crown with favorable bone and soft tissue levels; the implant is placed in an ideal position
FP 2	Fixed prosthesis replacing the crown and a portion of the root; crown contour appears normal in the occlusal half but is elongated or hyper-contoured in the gingival half
FP 3	Fixed prosthesis replacing missing crowns, gingival contour, and a portion of the edentulous site
RP 4	Removable prosthesis; overdenture supported completely by implants
RP 5	Removable prosthesis; overdenture supported by soft tissue and implants

Primary indicators for the implantation of endosseous implants, as stated by Modern Implant Dentistry, MischCE.

- A dentulous jaw.
- Missing teeth towards the end of the arch, either bilaterally or unilaterally.
- The arch has too many missing teeth.
- One tooth is gone.
- When it comes to so-called "defect prosthetics" after trauma or tumour removal
- In situations involving parafunction and trouble swallowing.
- An allergy to prosthetic acrylics has been confirmed.
- The mucosa is hypersensitive.
- In some illnesses, such as epilepsy, ulcers, gastritis, and asthma.
- Actors, speakers, and singers are in high demand.

III. MEDICAL CONTRAINDICATIONS TO IMPLANT THERAPY

➢ *Absolute Contraindications:-*

Patients who do not have systemic or local contraindications to therapy must be chosen in order to guarantee implant success. The American Society of Anaesthesiologists' definition of medical risk assessment.

Table 3 ASA Status

ASA Status and Dental Care Alterations[2]			
ASA Classification	Patient Attributes	Examples	Dental Care Alterations
I	• Healthy • Little to no dental anxiety		None
II	• Mild to moderate systemic disease • Is not incapacitating • Does not limit activity • Greater dental anxiety	Well-controlled diabetes, epilepsy, asthma, thyroid conditions; pregnancy; active allergies	None
III	• Severe systemic disease • Is not incapacitating • Limits activity	Stable angina; past myocardial infarction (MI) or cerebrovascular accident (CVA) >6 months; congestive heart failure (CHF)	Routine care generally possible. Careful evaluation needed if extensive fixed prosthetic rehab planned. Avoid procedures that provoke immunosuppressed pts. Most surgery not contraindicated.
IV	• Severe systemic disease • Incapacitating • Limits activity	Unstable angina; MI or CVA in last 6 months; severe HTN; severe CHF or COPD; uncontrolled epilepsy, diabetes, thyroid conditions	Manage only acute disease. Fixed and removable prosthetic rehab may be limited. Surgery exposing bone may require extensive prep. Will need much med management prep.
V	Moribund (will not survive with *or without* operation)		
VI	Clinically dead patient maintained for organ harvest		

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- *Recent Myocardial Infarction or Cerebrovascular Accident:-*

Necrosis and functional impairments result from ischaemia to the brain or heart. Six to twelve months are needed for post-event recuperation, during which time surgical stress should be minimised. Complications from myocardial infarction can include cardiac failure, shock, or arrhythmias.[22] Recovery from a stroke usually takes a month, but it can last up to a year. Recurrence, seizures, and other consequences are possible.[23]

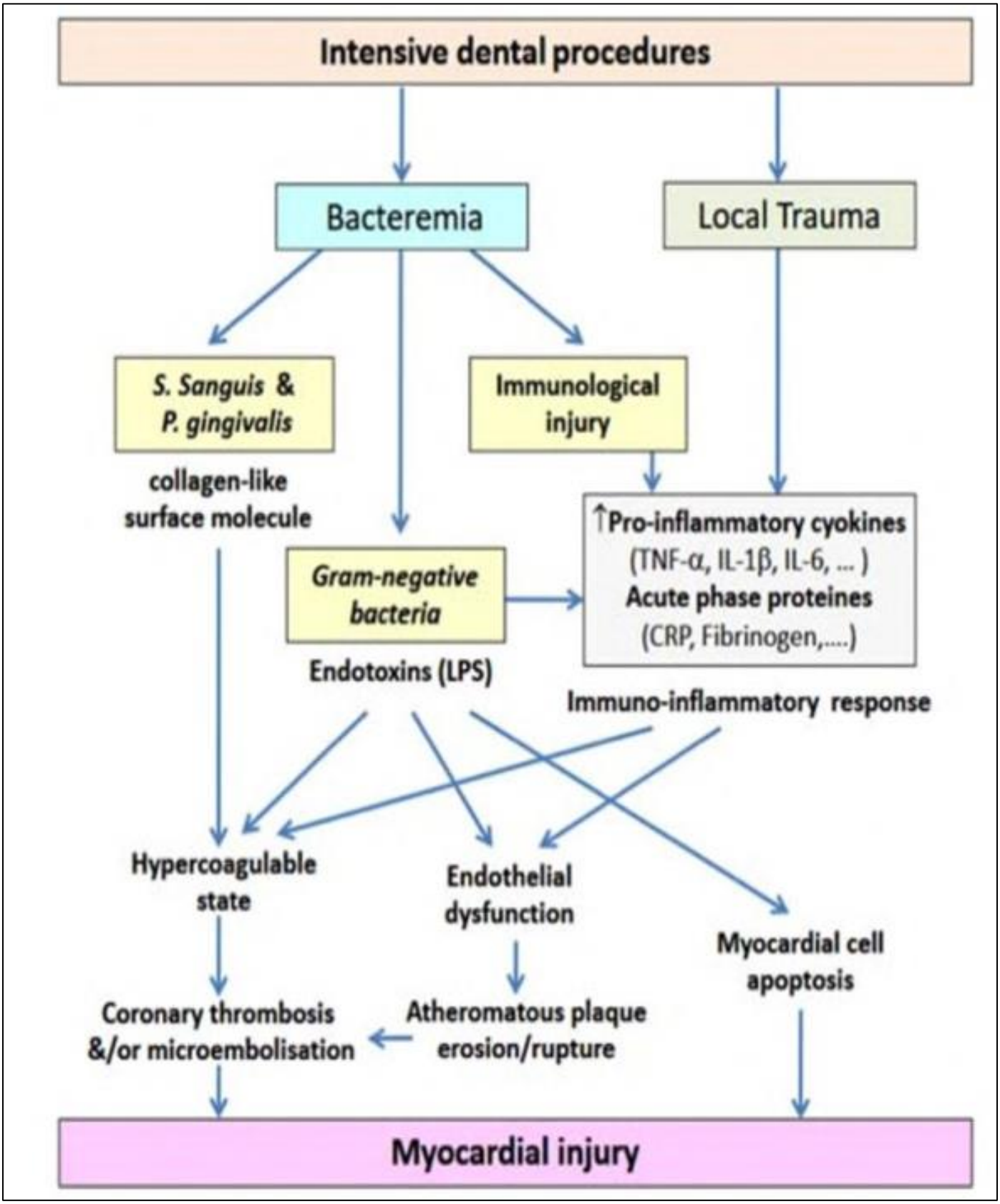

Fig 3 Complication

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There were no appreciable variations in implant failure rates among the groups in a retrospective review of 246 consecutively treated DI patients, which included patients with cardiovascular illness, patients with a history of other systemic diseases, and healthy controls.[24] Furthermore, hypertension and coronary artery disease were not linked to a substantial increase in either early or late implant failures in a number of retrospective DI cohort studies that collected data on local and systemic risk factors for implant failure.[25,26,27]

Although there is no proof that cardiac conditions preclude DI, it is crucial to take into account other factors like bleeding or heart attacks during DI insertion in these patients.[28] As a result, medical counsel should be obtained before to DI operation.

➢ *Inference:-*

- It has been suggested that some cardiovascular events such as recent myocardial infarction, stroke, and cardiovascular surgery, might represent an absolute contraindication to implant.
- Due to the high risk of complications following a myocardial infarction or cerebrovascular accident, the dental provider must wait until preliminary stabilization.
- At least 6 months should elapse after myocardial infarction before implant surgery and for those after stent treatment 12 months is recommended.

➢ *Valvular Prosthesis Placement:-*

Cardiac or vascular repairs frequently endothelialize within a month, lowering the risk of infection. Certain materials, such as Dacron, might, nevertheless, continue to be exposed, making them more vulnerable to endocarditis. Bioprostheses, mechanical valves, and homografts all have a 1-3 percent infection risk[29], with the risk being highest within the first three months. Intraoperative contamination causes early infections, whereas haematogenous spread causes later infections.

➢ *Inference:-*

- The prevalence of prosthetic valve endocarditis hovers around 1% to 3%, and the greatest risk occurs within the first 3 months.
- By 6 months, the prosthetic valve endocarditis rate drops to 0.4%.
- With prosthetic valve replacement, stability occurs at least 6 months to 1 year after cardiac surgery.
- Avoidance of invasive periodontal procedures is mandatory in order to prevent bacteraemia and possible subsequent valve loss.

➢ *Bleeding:-*

Elective surgery should be avoided if haemostasis is impaired.[30] Bleeding risks, often due to anticoagulants, require monitoring of INR. Dental procedures are generally safe with an INR ≤3; Fazio and Fang[31] suggest ≤2.2. If INR exceeds this and cannot be lowered, implant treatment is not recommended. Surgical bleeding may result from low platelet counts brought on by illnesses like radiotherapy, leukaemia, or infection.[32] Abnormal bleeding may result with mild thrombocytopenia (50,000–100,000/mm³); spontaneous bleeding happens below 20,000/mm³, and values below 50,000/mm³ greatly increase risk. In these situations, transfusion is frequently required prior to surgery.

➢ *Inference:-*

- Elective surgery should not be performed if appropriate haemostasis cannot be achieved.
- According to article reviews, the majority of dental implantation treatments involved implant placements costing less than INR 3.5.
- Prior to any invasive procedures, a routine blood check and platelet count should be performed.
- Elective implant treatment is not acceptable if the INR needs to be maintained higher for any reason.

➢ *Immunosuppression:-*

Healing requires a robust immunological response. If the white blood count is less than 1500–3000/mm³, oral surgery is not recommended.[33] Defence is hampered by low neutrophils, even with a normal total count. Antibiotics are required for neutrophil levels between 1000 and 2000/mm³; implant operation is risky and necessitates immediate medical attention below 1000/mm³.[34]

➢ *Inferences:-*

- When the total white blood count drops below 1500–3000 cells/mm3, oral surgery is usually not recommended.
- Patients with a count of less than 1000 cells/mm3 need to see a doctor very away and are not eligible for dental implantation.

➢ *Active Cancer Therapy:-*

Implant placement is dangerous during treatment because radiation and chemotherapy affect healing and immunological function. Bone resorption, fibrosis, and decreased vascularity are among the long-term effects of radiation exposures between 50 and 80 Gy.[35] Three to thirty-five percent of head and neck patients develop osteoradionecrosis as a result of these consequences, which cause a hypovascular, hypoxic, and hypocellular state.[36]

Granulocytopenia, thrombocytopenia, and myelosuppression brought on by cytotoxic treatment result in infection, bleeding, mucositis, and discomfort. Implant therapy is frequently contraindicated due to these side effects. Although there aren't many research, case reports often indicate negative effects from implant placements before to or during chemotherapy.[37,38,39]

➢ *Inference:-*

- Implant rehabilitation may not be appropriate if cytotoxic anti-cancer drugs are being taken actively.
- Sudden and traumatic osteoradionecrosis occur in 3–35% of patients who receive head and neck radiation.

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➢ *Psychiatric Disorders:-*

Patients who are unable to comprehend or comply with dental treatment should not have implants placed. There are serious hazards associated with mental illnesses that are frequently misdiagnosed, including substance misuse, cerebral lesions, dysmorphophobia, psychosis and severe personality disorders, and others.[40,41] Addictions and mental health issues affect healing, cleanliness, and the effectiveness of treatment, even though there is no known direct biological explanation for implant failure.[42]

➢ *Inference:-*

- It is recommended to avoid placing implants in patients who are incapable of understanding and rationally anticipating dental therapy.
- At least none of the biological causes of implant loss in individuals with the majority of the aforementioned diseases have been identified; nonetheless, a number of case reports attribute the removal of osseointegrated fixtures to psychological issues.

➢ *Intravenous Bisphosphonate Treatment:-*

Several physicians have recently reported connections between intravenous (IV) bisphosphonate use and jaw osteonecrosis. By preventing bone resorption, bisphosphonates treat Paget's disease, osteoporosis, and hypercalcemia associated with cancer. They often spend a lot of time inside the bone. There exist both oral and IV routes of administration for bisphosphonates.

Table 4 Type of bisphosphonates

Types of Bisphosphonates			
Drug	Administration	Treats	Notes
Etidronate	Oral	Paget's, hypercalcemia of malignancy,	Not popularly used now, as it causes
	IV	osteoporosis (with alendronate)	osteomalacia with prolonged use
Pamidronate	IV	Refractory Paget's, hypercalcemia of malignancy, osteoporosis	
Zolendronic acid	IV	Hypercalcemia of malignancy	
Alendronate	Oral	Osteoporosis	Good for long-term use
Tiludronate	Oral	Paget's	
Risedronate	Oral	Paget's, osteoporosis	

The company advised dentists to adhere to the following guidelines: (1) assess cancer patients before starting IV bisphosphonates, (2) refrain from performing "invasive" dental procedures while the patient is receiving such treatment, and (3) notify Novartis or the FDA of any significant side effects. These stances were reaffirmed by the American Academy of Periodontology and the American Dental Association.[43,44] However, there are no studies on the risk of osteonecrosis of the jaw following drug withdrawal, and only preliminary data are available. However, a patient contemplating IV bisphosphonate therapy needs to have a comprehensive oral examination and get dental periodontal stability before drug instigation.

Even though there is little evidence to support a "drug holiday," its efficacy in implant therapy is yet unknown. The FDA has not yet released firm guidelines for people at high risk. Low doses for osteoporosis and high doses for cancer-related bone metastases are important factors, not the method of administration.[45] Physicians wonder if low-dose antiresorptive medications (ARDs) raise the likelihood of implant failure. According to certain research, people using low doses of bisphosphonates have increased rates of early implant loss and peri-implantitis. There is little information on bone grafting's safety in these patients. Although there is a risk of MRONJ, it is not well understood, particularly in patients taking low doses of bisphosphonates.[46]

In patients using low-dose intravenous or subcutaneous anti-resorptive medications, there is insufficient data to make any inferences about implant therapy. Patients who use oral bisphosphonate for osteoporosis do not have a higher risk of implant loss or other problems than those who do not take BP. Regardless of implant therapy, patients on low- and high-dose ARD are susceptible to MRONJ. The longer and higher the dose of ARD ingestion, the higher the risk of MRONJ. Although it seems to be modest, the incidence of implant-associated MRONJ in patients receiving low-dose ARD (BP and denosumab) is still unknown. It's uncertain whether implant therapy will benefit from the "drug holiday" idea.[45]

➢ *Inference:*

- Taking oral bisphosphonates does not exclude surgery, but the dentist must take caution. However, elective surgery is prohibited when using IV bisphosphonates.

➢ *Adolescence:-*

Adolescents are defined by the World Health Organisation as those who are between the ages of 10 and 19.[47] An implant may result in ankylosed tooth-like sequelae in a developing person; this has been demonstrated in a pig model.[48] Because they cannot erupt to compensate for the alveolar process's vertical expansion, these teeth submerge during growth. Therefore, the potential for relocation or

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displacement over time with regard to the normal dentition is a key concern when placing implants in teenagers.

In developing people, implant placement may impede bone development, especially in the maxilla, which undergoes alterations in all planes. It is therefore recommended to postpone implants until skeletal growth stops, which is usually between the ages of 14 and 15 for females and 17 and 18 for boys.[49] Serial radiographs are the most effective way to evaluate skeletal maturity. Teenagers are successful, according to studies, but patients who are younger run the danger of infraocclusion. Early implant placement may be required in some developmental diseases, such as hypohidrotic ectodermal dysplasia, with good results reported in the literature. Vertical submergence is still an issue, though. All things considered, waiting for complete bone development guarantees ideal implant placement and lowers problems.[50]

➢ *Inference:-*

If An Implant Is Placed In A Developing Person Before They Reach Adulthood, They May Eventually Submerge It, Thus It Is Wise To Wait Until Skeletal Maturity Is Complete.

➢ *Aging:-*

Numerous studies indicate that age-related failure appears to occur seldom. In a cohort of 59 senior patients, with an average age of 65.6 years, Mericske-Stern and Zarb[51] found that over 90% of implants were successful after 5 years. Two to ten years after loading, Zarb and Schmitt[52] reported a 94% success rate in 20 patients (ages 60-74; 89 implants).

Additionally, Roynesdal et al.[53] had 100% success with 35 maxillary implants in 15 elderly edentulous patients (ages 65–80). After 1-4 years of follow-up, a group of 48 patients (age 80; 254 implants) had a high success rate of 96%; nevertheless, 10% of them had challenges with muscle control and adaption, which did not occur in younger individuals. However, studies show that different age groups have similar success rates, therefore ageing alone has no effect on survival.[54,55]

➢ *Inference:-*

- Age alone does not need to be considered as a risk factor in our clinical dental implant.
- Investigations observe comparable success rates between different age groups, and so aging, by itself, does not affect survival.

➢ *Osteoporosis:-*

Osteoporosis, increasingly prevalent with age—especially in postmenopausal women—results from a systemic reduction in bone mass due to imbalanced resorption and deposition. Though bone loss is generalized, it mainly affects trabecular bone, leading to increased fracture risk. The main concern for implant placement is altered bone quality and healing potential.[56] Osteoporotic bone shows reduced strength, disrupted trabecular architecture, and impaired osteoid formation, likely due to fewer or less responsive osteoprogenitor cells. While some studies suggest healing remains adequate, others report irregular woven bone formation. The exact impact of these changes on implant osseointegration remains uncertain.[57]

According to a retrospective investigation by August et al.[58] (2019), postmenopausal participants experienced a considerably higher rate of maxillary implant failure than their premenopausal counterparts, while mandibular implant failure rates did not differ between premenopausal and postmenopausal women. Fourteen osteoporosis patients had 70 implants put in their jaws by Friberg et al.[59] After three years, this group's success rate in the maxilla and mandible was 97%. Considering the above cited data, osteoporosis by itself has little effect on implant success.

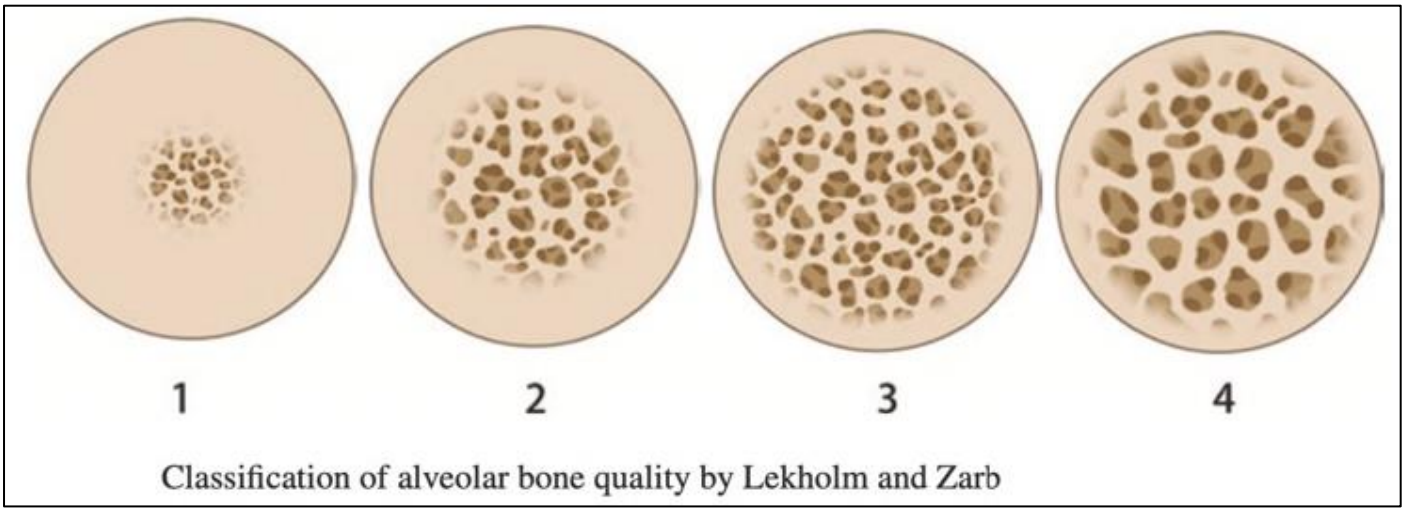

Fig 4 Classification

➢ *Prevention and Management of Osteoporosis:-*

Osteoporosis management involves lifestyle changes, such as exercise and smoking cessation, with cautious use of calcium and vitamin D. Pharmacologic treatments include bisphosphonates, denosumab, hormone therapy, teriparatide, and calcitonin, each with benefits and risks. Glucocorticoid-induced osteoporosis responds best to bisphosphonates to reduce fracture risk effectively.60

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IV. OSTEOPOROSIS IN DENTAL IMPLANT TREATMENT

➢ *Overall Survival :-*

Osteoporosis was once thought to increase implant failure risk, but evidence now suggests otherwise. A 2017 meta-analysis of 15 studies involving 8,859 patients and 29,798 implants found no significant difference in implant survival rates between osteoporotic and non-osteoporotic patients. Thus, osteoporosis alone is not a contraindication for dental implants.[61]

➢ *Implant Primary Stability:-*

Implant primary stability is crucial for successful osseointegration, especially in immediate or early loading. Osteoporosis lowers bone density, leading to reduced implant stability, as shown by lower ISQ scores via resonance frequency analysis.[62] Conservative planning, extended healing time, and personalized implant design adjustments are recommended for osteoporotic patients.

➢ *Peri-Implantitis:-*

An estimated 23.9% of osteoporosis patients experienced periimplantitis. Oral hygiene, particularly the state of periodontal health, is strongly linked to peri-implantitis. In order to screen for and control etiological variables that may lead to bone loss and implant failure, it is highly recommended that patients with osteoporosis have a thorough oral hygiene and dental assessment at least once a year. According to studies, maintaining good dental hygiene on a yearly basis may help prevent implant failures in as many as 90% of instances, regardless of other risk factors including age, gender, ethnicity, and systemic disease.[63]

➢ *Pharmacological Interventions on Implant Success:-*

Predicting implant outcomes in osteoporotic patients on antiresorptive therapy remains challenging due to complex drug-bone interactions. Clinical studies show minimal impact of hormone therapy and oral bisphosphonates on implant success.[64] Hormone replacement may aid osseointegration, but evidence is limited, with some reports of increased implant failure—especially in the maxilla of postmenopausal women.

➢ *MRONJ and Dental Implant Treatment:-*

Related patients benefit from the administration of bisphosphonates. But regrettably, since 2003, the clinic has noted and documented that the usage of bisphosphonates may result in necrosis. The condition known as bisphosphonate-related osteonecrosis of the jaw (BRONJ). Because several antiresorptive treatments would also cause osteonecrosis of the jaw, the American Association of Oral and Maxillofacial Surgeons' special committee suggested in 2014 that the word be changed to medication-related osteonecrosis of the jaw (MRONJ). We will outline the current understanding of MRONJ and dental implant therapy in this section.

V. INFLAMMATION AND INFECTION

Inflammation or infection is another important component of osteonecrosis of the jaw. By histological study, samples from both bisphosphonate-related osteonecrosis of the jaws and osteoradionecrosis are found to be infected by actinomyces.[65] Furthermore, several animal studies demonstrate that bacterial infection is closely related with osteonecrosis of the jaws.

➢ *Patients with Osteoporosis :-*

The chance of developing MRONJ is approximately 1% for cancer patients receiving zoledronate treatment, which is 50–100 times higher than that of the placebo group. The risk of developing MRONJ in individuals treated with the antiresorptive medication denosumab is similar to that of zoledronate, ranging from 0.7% to 1.9%.[66] Patients receiving the antiangiogenic medication bevacizumab have a 0.2% risk. Crucially, patients treated with antiangiogenic medications (such TKIs and monoclonal antibody-targeting VEGF) and bisphosphonates may occasionally have an increased risk of developing MRONJ.[67] According to a retrospective study, patients with renal cell carcinoma who take bisphosphonates and TKI concurrently have a 10% higher chance of developing MRONJ. Additionally, a number of case studies describe how MRONJ develops in individuals receiving antiangiogenic drugs only.

➢ *Inference:*

- To sum up, patients undergoing antiresorptive/ antiangiogenic cancer treatment should not have dental implant treatment, according to the data currently available. With a well-thought-out plan, a minimally invasive technique, and close monitoring, implant placement for patients undergoing antiresorptive medication for osteoporosis can be successful.

➢ *Tobacco Smoking:-*

Smoking negatively affects healing and implant success due to toxic by-products like nicotine, carbon monoxide, and hydrogen cyanide. These substances impair blood flow, oxygenation, immune response, and cellular activity, compromising tissue repair.[68] Clinically, smokers face issues such as dry sockets, poor surgical outcomes, and refractory periodontitis. Studies show smoking increases implant failure risk—especially in the maxilla—by up to 2.5 times.[69] However, surface-modified implants, such as hydroxyapatite-coated ones, have shown improved outcomes in smokers compared to traditional machined implants, offering a potential alternative for better success rates.[70]

➢ *Prevention:-*

Preventing peri-implantitis, especially in smokers, is essential for implant success. Lifestyle factors like tobacco use must be addressed through patient education and cessation support. Dental professionals should provide tiered care—ranging from brief interventions to intensive cessation plans with pharmacotherapy. Programs like "Ask, Advise, Refer" and risk-based prevention models are recommended.[71] Continued education for dental teams and public awareness on the cost-effectiveness of prevention strategies are crucial. Research into risk stratification and personalized care approaches is needed to enhance accuracy and effectiveness.

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➢ *Inference:*

- Overall, smoking seems to decrease the success of maxillary implants; however, quitting smoking before implant rehabilitation seems to enhance outcomes. Although the evidence is preliminary, using surface-modified fixtures may reduce smokers' chance of failure.

➢ *Diabetes:-*

Diabetes's effects on bone and tissue repair can make implants less successful. A lack of insulin decreases the formation of bone matrix and interferes with osteoblast function. Chronically elevated hyperglycemia damages proteins necessary for repair by producing advanced glycation end products. As a result, the environment is less suitable for implant implantation and the quality of the bone is reduced.[72]

Human trials show favorable implant outcomes in well-controlled diabetic patients. Glycemic control is assessed by HbA1C, reflecting average blood glucose over 2–3 months. The American Diabetes Association recommends an HbA1C level below 7.0% for type II diabetes, though targets should be personalized based on individual health status.[73]

Stricter control (<6.0%) lowers the risk of complications, although a larger HbA1C target may be appropriate in patients who experience hypoglycemia frequently. For stability, type I diabetics may run the risk of hypoglycemia. Pre- and postprandial capillary plasma glucose levels are used to evaluate current management, while HbA1C evaluates historical control.

Diabetes has no appreciable impact on implant success provided glycaemic management is sufficient (as determined by HbA1C). There are three forms of diabetes: type 1, type 2, gestational, and particular. In 2012, 3.7 million deaths worldwide were attributed to associated diseases, and poorly managed diabetes increases the risk of both macrovascular and microvascular consequences.[74]

Diabetes mellitus is a relative contraindication for implants because it affects osseointegration, bone remodelling, wound healing, and infection risk. However, implant therapy can be very beneficial for those with well-controlled diabetes. Overdentures supported by implants enhance nutrition, function, and satisfaction—all of which are important for glycaemic management. For long-term success, careful planning and monitoring are necessary.[75,76]

➢ *Osseointegration in Diabetic Patient:-*

According to experimental research, diabetes hinders osseointegration by decreasing bone growth, postponing healing, and lowering the quality of the bone surrounding implants. Animals with diabetes have immature and asymmetrical bone structures, as well as decreased bone-to-implant contact, bone mineral density, and bone area.[77] By promoting osseointegration, bone remodelling, and implant durability, insulin therapy enhances these results. The findings emphasises the dangers of inadequate glycaemic control and the advantages of insulin in enhancing implant success, even though animal models may not accurately represent human diabetes, particularly type 2 diabetes.[78]

➢ *Implant Stability:-*

About three weeks after implantation, there is a "stability dip" as implant stability shifts from primary mechanical to biological stability. Detailed analyses reveal that poorly controlled diabetes (HbA1c >8%) prolongs healing, decreases outcome predictability, and slows recovery from this dip, even though some studies demonstrate no differences in stability between diabetic and non-diabetic patients.[79] Conversely, people with well-controlled diabetes (HbA1c <8%) exhibit implant stability patterns that are comparable to those of people without diabetes. While patients with controlled glycemia may continue with conventional procedures, clinicians should postpone implant loading in patients with poorly managed diabetes.[80]

➢ *Inference:-*

In light of the available data, dentists are advised to take into account the following factors while treating patients with diabetes mellitus with dental implants:

- The most crucial thing is to keep an eye on blood glucose levels. Implant therapy is appropriate for patients whose HbA1c is less than 8%. Patients should be made aware of their increased risk of implant failure if they have poor glycaemic control.
- Examine the patients' oral hygiene, history of periodontitis, and current state of their gums. Make sure you have control over your periodontitis.
- To maintain peri-implant health and guarantee long-term implant performance, biannual periodontal maintenance therapy is necessary.
- To prevent postoperative infection, use antiseptic mouthwash and prophylactic antibiotics as adjuvant treatments.
- The preservation of the peri-implant marginal bone is favoured by delayed implant implantation.
- The life rate of implants can be increased by applying surface treatments like hydroxyapatite and SLA (sand blasted, big grit, acid etched).
- Bone transplant procedures are possible, but in order to promote wound healing and lower the risk of postoperative infection, surgeons must refrain from causing severe surgical trauma.
- Patients with well-controlled diabetes can use the immediate loading approach, but patients with poorly managed diabetes respond better to conventional loading.

➢ *Human Immunodeficiency Virus:-*

Highly active antiretroviral therapy (HAART) has significantly reduced HIV-related mortality and oral lesions. Despite HIV's global prevalence, particularly in sub-Saharan Africa, studies show that HIV infection alone does not increase postoperative complications in dental procedures.[81] Implant success is achievable even in patients with low CD4 counts, provided immunosuppression and bleeding risks are controlled. Antibiotics may be used when needed.

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➢ *Inference:-*

- Without the presence of severe immunosuppression or bleeding disorders, HIV status as such does not lower implant success.

➢ *Cardiovascular Disease:-*

The healing process, which depends on the oxygen supply provided by a normal blood flow, may be hampered by five types of cardiovascular illness: hypertension, atherosclerosis, vascular stenosis, coronary artery disease, and congestive heart failure. In a series of studies on the inferior alveolar artery, Bradley[82,83] used radiography and angiography to show that 79% of patients had obstruction and 33% had no flow. Patients with edentulous mandibles displayed significant vascular deterioration. Consequently, the periosteum is stripped, and bone necrosis follows. Additionally, infection may occur if hypoxia causes a decrease in fibroblast activity,collagen production, capillary expansion, and macrophage activity. It also seems to have an impact on the normal mending of shattered bones.

➢ *Antibiotic Prophylaxis:-*

Patients with cardiovascular illness, particularly those with valve disease, are particularly vulnerable to infective endocarditis. Prior to invasive dental operations, prophylactic antibiotics are recommended. However, there is a chance of negative side effects when using ordinary antibiotics with a lot of cardiovascular medications. Digoxin or statins may be hazardous when used with macrolides and tetracyclines, and warfarin interactions should be avoided.[84] For patients with allergies, the American Heart Association suggests amoxicillin or ampicillin, with substitutes such as cefazolin or clindamycin. Before prescribing antibiotics, a cardiologist must be consulted, particularly for patients with renal impairment or those using anticoagulants.

➢ *Inference:-*

- Gathering medical history on a systemic level, including coagulation function, anaemia, immunological state or infection, and metabolic disorders.
- Cardiovascular risk assessment: (a) Preoperative measurements of cTnT, cTnI, BNP, and NT-proBNP are advised for high-risk patients.
- Evaluation of heart function: (a) echocardiography is advised; and (b) carotid artery and cerebral imaging are required for patients who have experienced a transient ischaemic attack or stroke within the last six months.
- Measurement of the blood's total haemoglobin or red blood cells (RBCs).
- Blood clotting tendency assessment: INR ≤1.5 is advised, while INR 2-4 is appropriate for straightforward dental implant surgery.
- Blood pressure assessment: Postponed surgery is advised for patients whose systolic and diastolic blood pressures are 180 mmHg and 110 mg, respectively.
- Other: (a) Before implant surgery, at least six months should pass after myocardial infarction, and twelve months is advised for those who have received stent treatment; (b) ARBs should be used in place of ACE inhibitors; and (c) patients taking antiplatelet and anticoagulants shouldn't stop taking warfarin or aspirin before surgery.
- It is strongly advised to speak with the cardiologist prior to surgery.

➢ *Hypothyroidism:-*

Thyroid disorders, particularly hypothyroidism, impact bone metabolism and wound healing, potentially affecting implant osseointegration. While hypothyroidism reduces bone cell activity and may impair healing, studies show no significant difference in implant success rates in controlled hypothyroid patients.[85] Untreated hypothyroidism may increase implant failure, though evidence is limited. Experimental studies suggest thyroid hormones influence cortical bone healing around implants, with less effect on cancellous bone.

➢ *Inference:-*

- Patients undergoing implant procedures should have their thyroid hormone levels checked in advance. Patients who prioritised treating their thyroid conditions recovered well from implant procedures. The management of thyroid function should be reaffirmed when we administer implant treatments to patients during the course of treating thyroid disease.

➢ *Titanium Allergy:-*

Once thought to be inert, titanium can cause hypersensitive reactions in vulnerable people, which could result in implant failure. Titanium allergies are uncommon (≈0.6%) but can result in symptoms including gingival hyperplasia and eczema. Patients who are allergic to other metals are at higher risk.[86] Zirconia implants are an alternative, and long-term monitoring and allergy testing are recommended.

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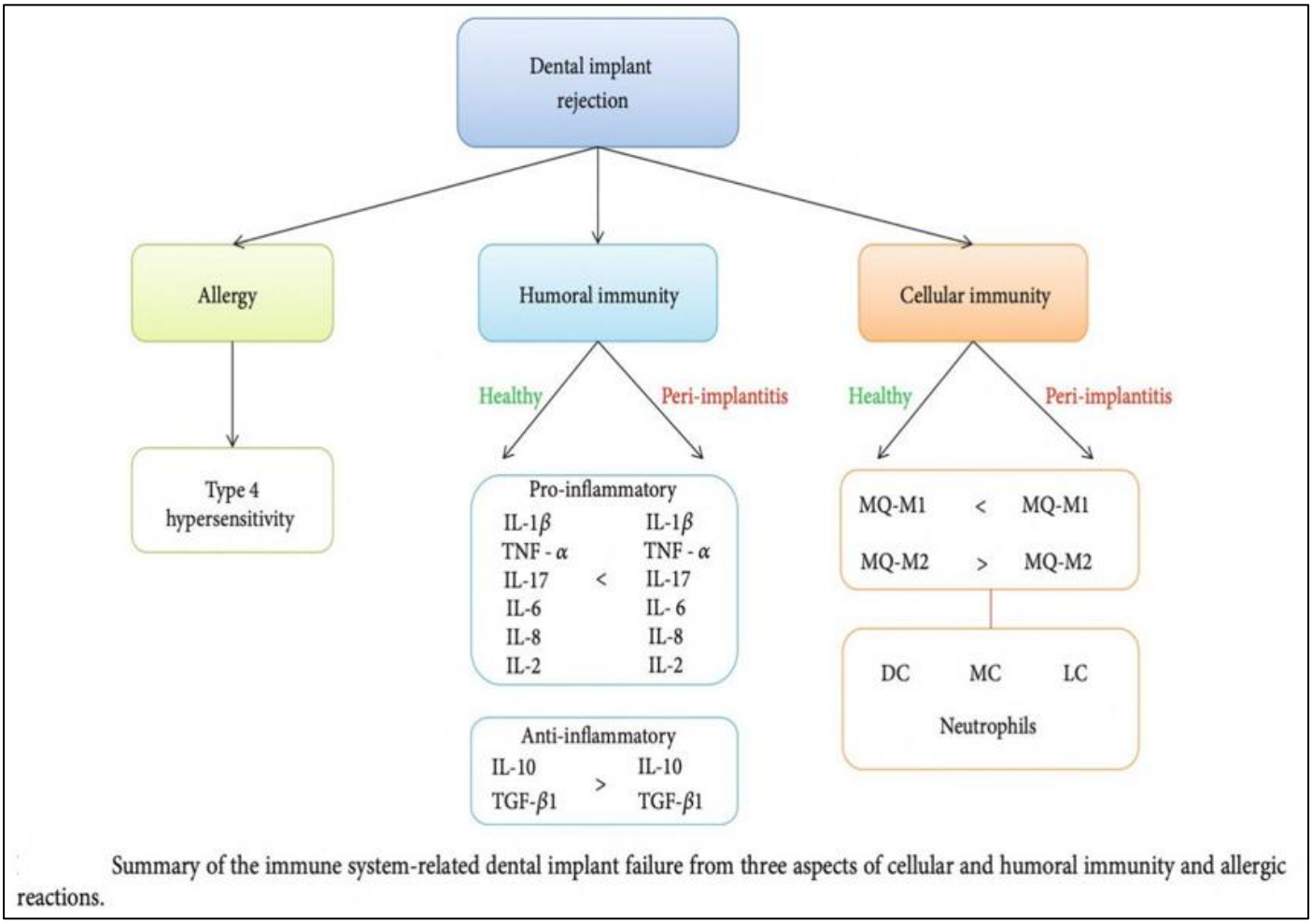

Fig 5 Summary of Immune Response.

➢ *Inference:*

- Allergic reactions to titanium are very rare, but they are possibilities is good to consider MELISA test to check for a titanium allergy so you can avoid the resulting side effects.
- Use alternative implant material. Eg Zirconia.

➢ *Down's Syndrome:-*

Down syndrome (DS), the most common survivable chromosomal disorder, presents with congenital anomalies, intellectual disability, speech and muscle impairments, and increased risk of systemic diseases. Dental features include multiple missing teeth and malformations, making oral and implant care more complex.[87]

Down syndrome patients (DSPs) have higher rates of gingivitis, periodontitis, and early edentulism due to impaired immunity and poor plaque control. Removable dentures often provide limited comfort, making implant-supported rehabilitation potentially more beneficial. However, factors like poor hygiene, cognitive impairment, bruxism, and delayed healing raise implant failure risks—especially during early healing. Despite concerns, implant treatment may still enhance quality of life if caregivers are well-informed and professional maintenance is individualized.[88,89]

➢ *Inference:-*

- Several complicating factors result in decreased implant survival, however Down syndrome is not a contraindication for dental implant placement, according to the literature search.
- If dental cleanliness and compliance are high, a fully implanted implant, enough bone volume, and delayed loading may reduce the first failure rate and guarantee long-term bonestability.

➢ *The Risk of Osseointegration in thE Coronavirus Disease 19 Pandemic :-*

COVID-19 may impair osseointegration due to its impact on bone metabolism via the ACE2/Ang-(1-7)/MasR pathway, cytokine storm, and microvascular dysfunction. SARS-CoV-2 binds to ACE2, downregulating a pathway critical for maintaining the osteoblast/osteoclast balance. This disruption may promote bone resorption and hinder bone healing, warranting further investigation.

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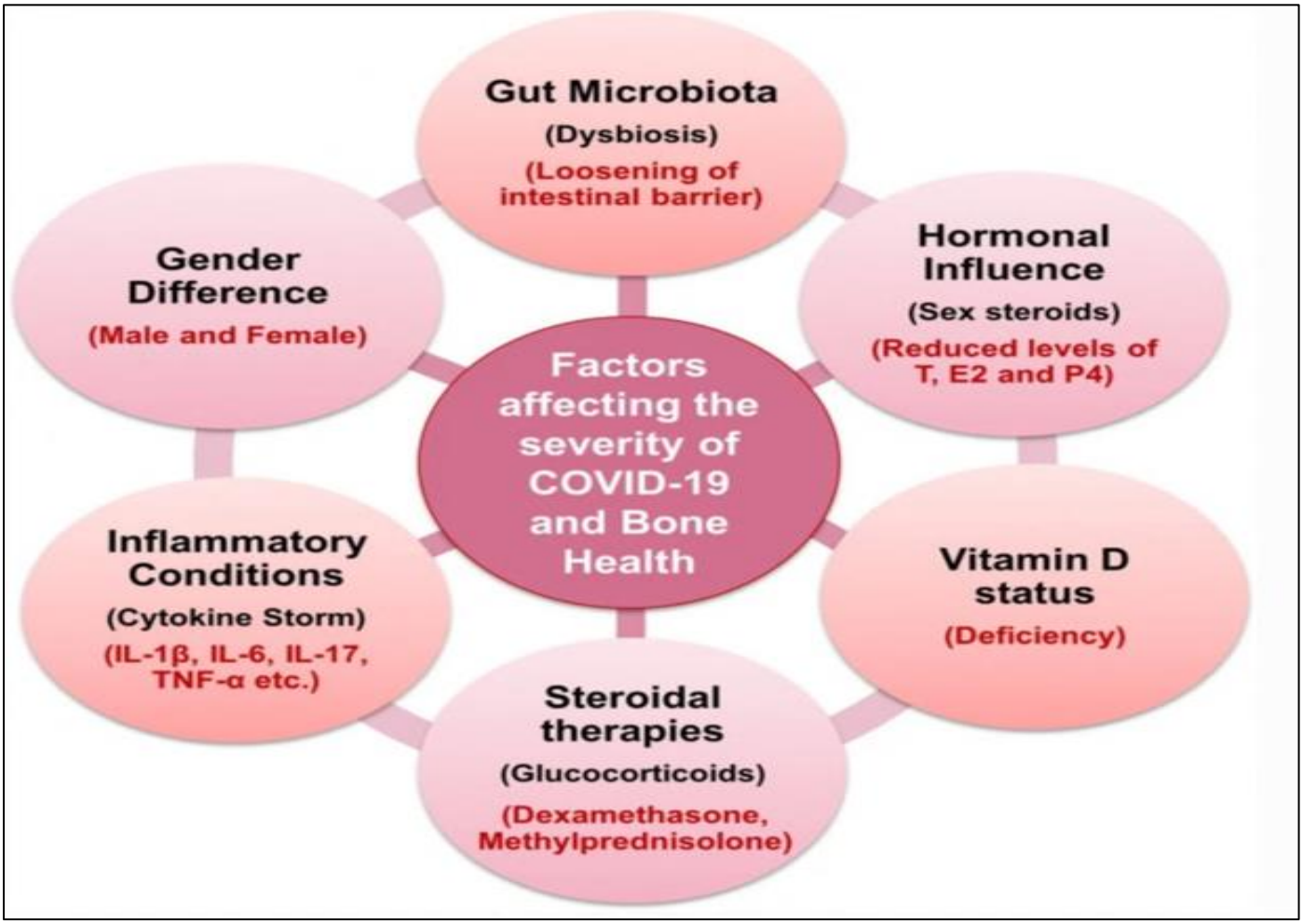

Fig 6 Different Factors.

VI. ARE BIOLOGIC MEDICATIONS BECOMING THE NEW CATCH-22 IN

➢ *Implant Dentistry?*

Biologic drugs, a rapidly growing class of targeted therapies, are revolutionizing treatment for autoimmune, inflammatory, and neoplastic diseases. Unlike conventional drugs, they act on specific immune components, reducing side effects.[91] With over 200 approved biologics and 1,500 in trials, their expanding use presents new challenges for implant dentistry, potentially surpassing bisphosphonates in significance.[92]

Table 5 Biological Medication.

Most Common Biologic Medications		
BRAND NAME	**GENERIC NAME**	**CONDITIONS**
Humira	adalimumab	rheumatoid arthritis, Crohn's disease, ulcerative colitis
Rituxan	rituximab	lymphoma, leukemia, rheumatoid arthritis
Enbrel	etanercept	rheumatoid arthritis, plaque psoriasis, psoriatic arthritis
Herceptin	trastuzumab	breast cancer, metastatic gastric adenocarcinoma
Avastin	bevacizumab	cervical, hepatocellular, and colorectal cancer
Remicade	infliximab	rheumatoid arthritis, Crohn's disease, ankylosing spondylitis
Avonex	interferon beta-1α	multiple sclerosis
Cosentyx	secukinumab	psoriatic arthritis, ankylosing spondylitis
Taltz	ixekizumab	psoriatic arthritis
Xeljanz	tofacitinib	rheumatoid arthritis

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➢ *Preoperative Preventive Measures for Biologic Medication Patients-*

With rising dental implant procedures, clinicians must be cautious with patients on biologic medications due to increased infection risks.[93] Medical consultation is essential—even for past users—to assess immune status and guide treatment planning. For current users, drug holidays are often advised, tailored to the medication's half-life and under physician guidance.

VII. CONCLUSION

Table 6 Different Condition

Condition	(Relative) contraindication	Implant survival rate	Precautions/recommendations
Alcoholism	No	Similar	Assure that patients will keep adequate oral health maintenance.
Bleeding disorder	No	Similar	Check coagulation status before placement of implants.
Bone disease			
Osteoporosis	No	Similar	Be aware of a slightly higher risk on MRONJ in patients on oral antiresorptive drugs. Bone augmentation surgery is allowed.
Bisphosphonate use	Yes	Similar/ reduced	Antibiotic prophylaxis. Risk of MRONJ is high in patients treated for bone metastasis. When implants in latter patients are indicated, do it early after start of antiresorptive therapy. Also, no augmentation surgery in patients on i.v. administration unless early after start of usage.
Other antiresorptive drugs, for, example, denosumab	Yes	Similar/ reduced	Antibiotic prophylaxis. Risk on MRONJ is high in patients treated bone metastasis. When implants in latter patients are indicated, do it early after start of antiresorptive therapy. Also, no augmentation surgery in patients on i.v. administration unless early after start of usage.
Cardiac disease	No	Similar	Assure that patient will keep adequate oral health maintenance, also with regard to control of cardiac disease.
Diabetes mellitus			
Uncontrolled	No	Similar/ reduced	Antibiotic prophylaxis. Assure that patient will keep adequate oral health maintenance, also with regard to control of diabetes.
Controlled	No	Similar	Assure that patient will keep adequate oral health maintenance, also with regard to control of diabetes.
Drugs			
Anticoagulants	No	Similar	See bleeding disorder.
Antiresorptive drugs	No	Similar/ reduced	See bone disease.
Biologicals	No	Similar	See Immunocompromised patients.
Chemotherapy	No	Similar	See head neck cancer.
Immunotherapy	Yes	Unknown	Implant treatment often can be postponed until end of therapy.
Xerostomic drugs	No	Similar	See hyposalivation.
Head and neck cancer			
Chemotherapy	No	Similar	Assure that patient will keep adequate oral health maintenance during the course of chemotherapy. After completion, the risk of developing peri-implant health problems is comparable to healthy subjects.
Radiotherapy	Yes	Reduced	Preferably place dental implants during ablative surgery. When placed after completion of radiotherapy, implant should be placed under antibiotic coverage (e.g., amoxicillin 500 mg t.i.d. for 2 weeks, starting 1 day before placement of the implants). If cumulative radiation dose in the implant area is >40 Gy, it is recommended to apply hyperbaric oxygen therapy pre- and postimplant placement.
Hypersalivation	No	Similar	-
Hyposalivation	No	Similar	Higher risk of peri-implant health problems, assure that patient will keep adequate oral health maintenance.
Immunocompromised patients			
Biologicals	No	Similar	Discuss with physician whether administration of biologicals has to be adjusted or specific precautions are needed.
Crohn's disease	No	Similar/ reduced	Antibiotic prophylaxis. Older studies mention that implant survival is decreased compared to controls. Recent studies indicate that survival is similar.
Mixed connective tissue disease	No	Similar	Antibiotic prophylaxis. Higher risk of peri-implant health problems, Antibiotic prophylaxis.

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Condition	(Relative) contraindication	Implant survival rate	Precautions/recommendations
Rheumatoid arthritis	No	Similar	Higher risk of peri-implant health problems, assure that patient will keep adequate oral health maintenance.
Scleroderma	No	Similar	Antibiotic prophylaxis. Higher risk of peri-implant health problems, assure that patient will keep adequate oral health maintenance.
Sjögren's syndrome	No	Similar	Antibiotic prophylaxis. Higher risk of peri-implant health problems, assure that patient will keep adequate oral health maintenance.
Systemic lupus erythematosus	No	Similar	Antibiotic prophylaxis. Higher risk of peri-implant health problems, assure that patient will keep adequate oral health maintenance.
Mucosal disease			
Epidermolysis bullosa	No	Similar	Antibiotic prophylaxis. Careful treatment of oral mucosa. Slightly higher risk of peri-implant health problems. Assure that patient will keep adequate oral health maintenance.
Lichen planus	No	Similar	Antibiotic prophylaxis. Slightly higher risk of peri-implant health problems. Assure that patient will keep adequate oral health maintenance. Place implants when mucosal disease is in control.
Others (Crohn, SLE)	No	Similar	Antibiotic prophylaxis. Slightly higher risk of peri-implant health problems. Assure that patient will keep adequate oral health maintenance. Place implants when mucosal disease is in control.
Pemphigoid	No	Similar	Antibiotic prophylaxis. Slightly higher risk of peri-implant health problems. Assure that patient will keep adequate oral health maintenance. Place implants when mucosal disease is in control.
Pemphigus	No	Similar	Antibiotic prophylaxis. Slightly higher risk of peri-implant health problems. Assure that patient will keep adequate oral health maintenance. Place implants when mucosal disease is in control.
Smoking	Yes	Similar/ reduced	Implant survival is reduced, in particular for the maxilla, in heavy smokers. Increased risk of peri-implantitis.
Titanium allergy	Yes	Reduced	Use alternative implant material, for example, zirconium.

VIII. SUMMARY

As of right now, dental implant therapy has relatively few absolute contraindications. However, given the likelihood that we may soon encounter more patients with compromised health, it is imperative that we consider the impact that systemic diseases or disorders have on implants. Failure risk, complication incidence, and preventative measures before, during, and after treatment—such as prophylactic antibiotic use or implant insertion timing—should all be known to us. We should also be clear about our ability to manage any potential difficulties should they arise. We can only reduce the chance of dental implant failure in individuals who are already damaged in this manner.

Dental implants may be the best option for patients with poor health when it comes to replacing lost teeth or retaining dentures. These patients' implant survival and peri-implant health are largely on par with those of healthy participants. Sometimes special measures are required, including prophylactic antibiotic use or implant placement early in the course of the illness or shortly after the initiation of a drug. Medically challenged individuals typically require a high level of follow-up care because they are more likely to experience peri-implant health issues, especially if they have mucosal disorders or restricted salivary flow. When follow-up care is organised properly, these issues can be identified early and addressed effectively.

➢ *Thus, Dental Implants can Safely be Applied in Most Medically Compromised Patients when :-*

- The required precautions are taken for the disease the patient is suffering from or treated for
- Immediate implant complications are quickly recognized and treated when needed, and
- Follow-up care is strict and peri-implant health problems are recognized and treated promptly.

Since there is little evidence of implant loss, the survival rate of dental implants placed in medically compromised patients who smoke or have controlled systemic diseases does not suggest that implant placement is completely or partially contraindicated. It appears to be a safe procedure that does not need to be regarded as risky, though there is no data available for patients with severe illness.

Patients with osteoporosis who use oral bisphosphonates appear to be somewhat contraindicated for dental implant therapy, and they should be aware that a longer

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follow-up period is required to identify any indications of skeletal chemical necrosis. It is contraindicated to place them in patients who have received intravenous bisphosphonates or who are taking immunosuppressors, corticosteroids, or hormonal therapy because, on the contrary, patients who have undergone head or neck radiation protocols with doses greater than 50 Gy appear to exhibit lower levels of osseointegration over time.

Naturally, physiologic changes brought on by systemic illnesses may impair the body's ability to respond to surgical stress and affect homeostasis in the aftermath. However, they do not pose a threat to the patient's life after surgery. The most important element in implant survival is patient selection. Generally speaking, a suitable healing response permits, if not guarantees, success. However, not everyone who wants implant rehabilitation is a good candidate for surgery.

There are absolute medical contraindications, which must be followed to avoid infection, implant failure, or even patient death. Certain disorders do not appear to significantly impede repair once they are stabilised. A careful practitioner is aware of the nature of many diseases, assesses the evidence for implant therapy in these patients, and chooses cases accordingly. We make an informed decision, and if we make the right one, predictability will follow. These related contraindications to elective implant therapy are numerous. The great majority of diseases or life stages (such as advanced age or adolescent) do not significantly impact implant survival if they are managed or isolated.

A competent physician should be able to distinguish between candidates, make the right choices, and initiate medical treatment as needed. Not all patients who need implant therapy initially qualify for it.

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