



Vitamin D Screening and Supplementation: A Novel Approach to Higher Implant Success

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Introduction/Background

The active form (1,25-hydroxy-vitamin-D3) of vitamin D (25-hydroxy-vitamin D) is a crucial fat-soluble micronutrient that optimizes bone deposition and resorption.^{1,2,3,4} 25-(OH)-D serum levels of < 30 ng/mL is defined as insufficiency while deficiency can be subdivided into mild (< 20 ng/mL), moderate (< 10 ng/mL), and severe (< 5 ng/mL).⁵ Being a risk factor for various acute and chronic local and systemic conditions, low levels of 25-(OH)-D is a pandemic when considering that 30% of the world's population are deficient while 60% are insufficient.⁶ As the engineering behind dental implants continues to improve osseointegration, consideration for other factors that may improve implant success must be had. While smoking and generalized periodontitis are classical high-risk factors for dental implant failures, severe vitamin D deficiencies has been associated with up to a three-fold increase failures.^{7,8} This has led us to postulate: Could pre-operative screening and supplementation decrease early implant failure in daily practice?

Objective

To review and investigate the correlation between vitamin D deficiency/insufficiency and early dental implant failure with the goal of providing a recommendation for pre-operative screening and supplementation.

Materials & Methods

A literature review was performed using the following databases: Cochrane, Google Scholar, PubMed, and SCOPUS. Selected key words were: "Vitamin D" AND "dental implant" AND "implant failure" OR "early implant failure". A total of 30 literature articles were included, limited to randomized clinical studies, case series, systematic reviews, and meta-analysis.

Vitamin D

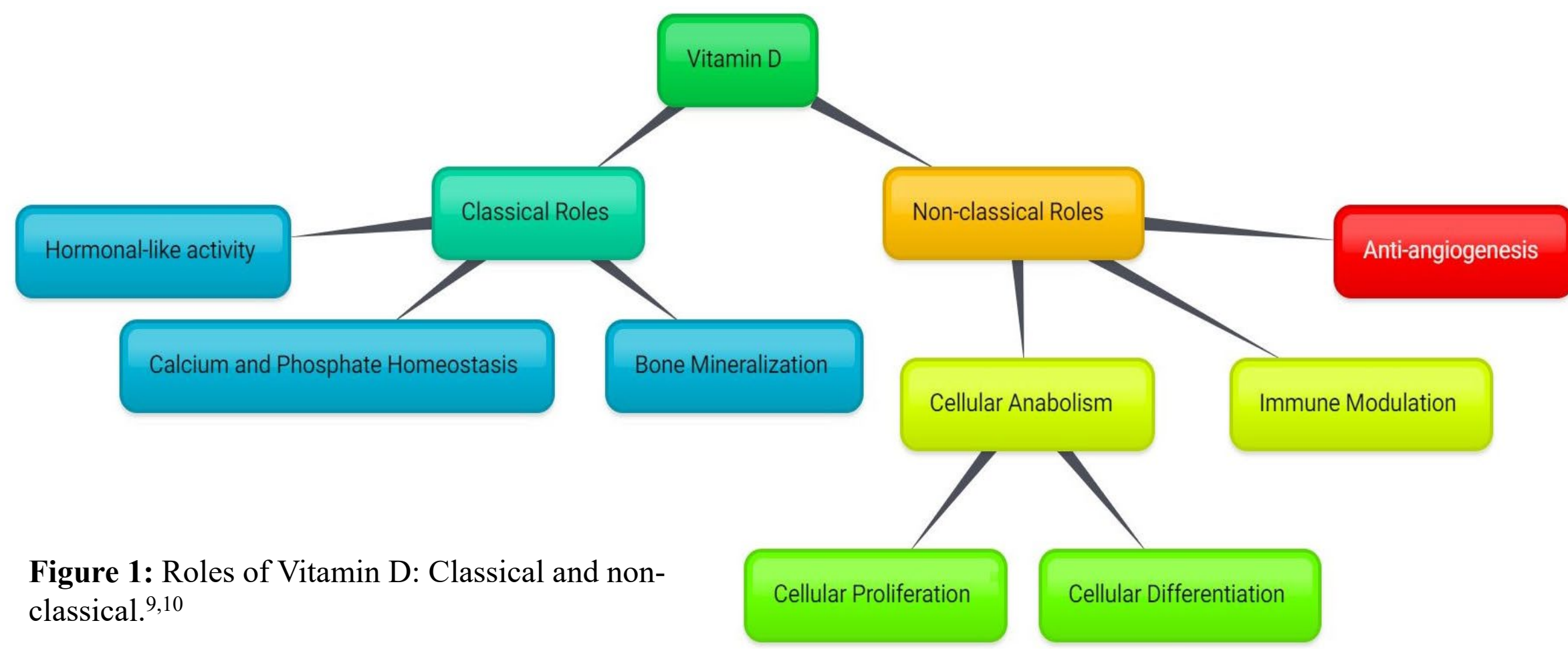


Figure 1: Roles of Vitamin D: Classical and non-classical.^{9,10}

Results

- Vitamin D deficiency may lead to impaired peri-implant bone formation as several studies demonstrate a negative impact for osseointegration and one study reporting a roughly 300% increase in early implant failure rates while another reports a 66% decrease in early implant stability.^{7,10,11,12,13,14,15,16,17,18}
- Several authors postulate that a reduced serum vitamin D correlated to nearly a two-fold increased risk of compromise to the early phases of osseointegration with one retrospective clinical study demonstrating a 3.8-fold increase in early dental implant failure with <10ng/mL of serum vitamin D as compared to patient with normal levels (>30 ng/mL).^{14,15,16,19}
- Altered levels of Vitamin D has been associated with a high susceptibility of immune-mediated disorders and inflammatory diseases by modulating osteal macrophages.^{16,20}
- On the other hand, several studies fail to confirm a causal relationship between low serum vitamin D levels and implant failure due to lack of statistical significance.^{13,21,22}
- Peri-surgical supplementation of 4,000-6,000 IU/day of vitamin D for 6-to-12 weeks demonstrated an increased level of implant osseointegration, increased bone-implant-contact, increased bone regeneration, and decreased early implant failure in at risk demographics.¹⁴

Vitamin D and Implant Failure

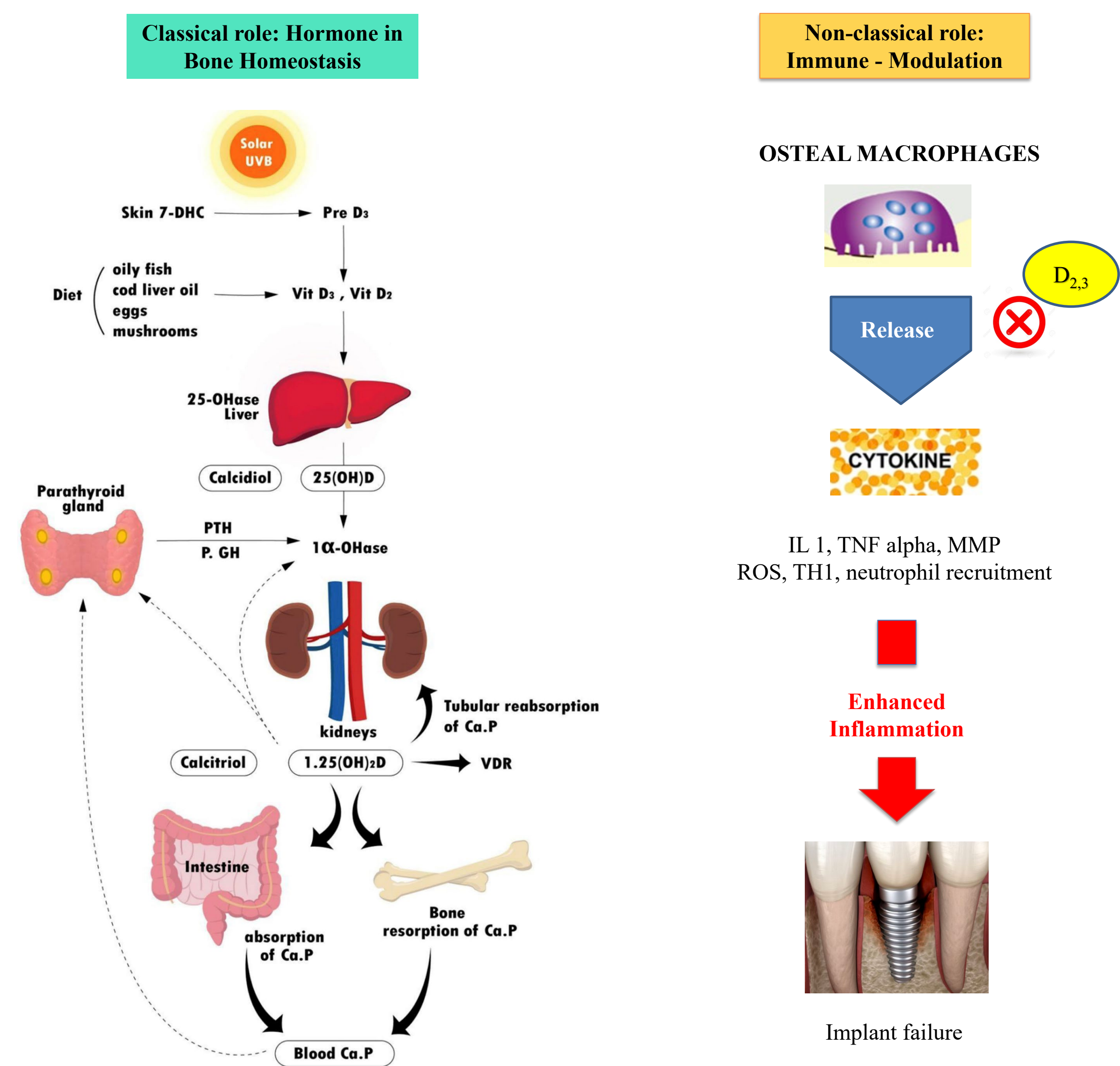


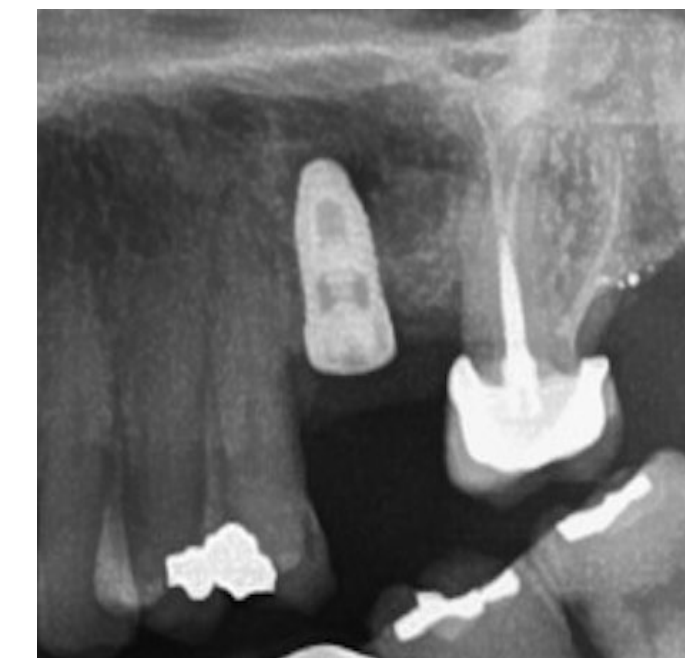
Figure 2. Classical and non-classical roles of vitamin D in bone homeostasis.^{16,19,20}

Vitamin D Deficiency



Figure 3. Vitamin D Deficiency Risk Factors Heat Map.^{2,3,4,9,10}

Case Presentation



Implant placed in posterior maxilla, patient with vitamin D deficiency



Implant failure within 4 months!

Figure 4. Case presentation demonstrating early implant failure in patient with vitamin D deficiency.¹⁵

Our Recommendation

- Test vitamin D levels within 10 minutes using a point of care finger-stick test.
- Supplement as shown below prior to implant or bone grafting procedures.
- A minimum 4-week supplementation is recommended to elevate vitamin levels prior to surgery, followed by an additional 2 weeks post-op.¹⁴

Indications for Supplementation:

Dark Orange or Red Risk Factor

Two or more Light Orange Risk Factors

Three or more Yellow Risk Factors



What is an adequate serum level for surgery?

- Normal (30 ng/mL) may seem to be insufficient.

- American Endocrine Society Preferred Range – 40-60 ng/mL.

Vitamin D Serum Level	Recommended Supplementation
<20ng/mL	Ergocalciferol 50,000 IU/week x 16 weeks + Cholecalciferol 3,000 IU/day (Endocrinology referral)
20-30ng/mL	Ergocalciferol 50,000 IU/week x 16 weeks + Cholecalciferol 3,000 IU/day
30-70ng/mL	Cholecalciferol 2,000 IU/day
>70ng/mL	No recommendation

Figure 5: Recommendation for vitamin D screening and pre-operative supplementation.^{11,12,16,18,19}

Conclusion

Increasing consensus in recent literature shows that low levels of Vitamin D may compromise the early phase of osseointegration, translating to early dental implant failure. Therefore, it is recommended that clinicians pre-operatively evaluate and screen serum Vitamin D levels in patients in certain at-risk (moderate to absolute) groups to increase early implant survival rates.

Resources

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