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DENTAL IMPLANTATION IN PATIENTS WITH POSTMENOPAUSAL OSTEOPOROSIS: CURRENT EVIDENCE AND CLINICAL PERSPECTIVES (LITERATURE REVIEW)

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Abstract:

Postmenopausal osteoporosis is one of the most common metabolic bone disorders affecting women worldwide. Estrogen deficiency during menopause leads to accelerated bone resorption, reduced bone mineral density, and impaired bone remodeling, which may negatively influence the outcomes of dental implant therapy. With the growing demand for implant-supported rehabilitation among aging populations, understanding the relationship between osteoporosis and implant success has become increasingly important. To analyze current scientific evidence regarding the impact of postmenopausal osteoporosis on dental implant treatment and to evaluate contemporary diagnostic, preventive, and therapeutic approaches aimed at improving implant osseointegration and long-term clinical outcomes. The reviewed literature indicates that postmenopausal osteoporosis is not an absolute contraindication for dental implant placement. Implant survival rates in osteoporotic patients are generally comparable to those observed in healthy individuals when appropriate treatment protocols are applied. However, reduced bone mineral density may compromise primary implant stability and prolong osseointegration. Advanced diagnostic methods, including cone-beam computed tomography and bone densitometry, improve treatment planning and

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risk assessment. Furthermore, the use of implants with bioactive surface modifications, vitamin D supplementation, calcium therapy, and individualized anti-osteoporotic management may enhance implant success and peri-implant bone preservation. Successful implant rehabilitation in postmenopausal women with osteoporosis requires a multidisciplinary approach integrating comprehensive bone quality assessment, metabolic correction, and evidence-based surgical protocols. Contemporary diagnostic technologies and surface-modified implant systems significantly improve clinical outcomes. Further prospective multicenter studies are required to establish standardized treatment guidelines for this growing patient population.

Keywords: Dental implants; Postmenopausal osteoporosis; Osseointegration; Bone mineral density; Menopause; Implant survival; Bone remodeling; Oral rehabilitation.

Materials and Methods

This study was designed as a narrative literature review focusing on the impact of postmenopausal osteoporosis on dental implant therapy. The review aimed to evaluate current evidence regarding bone metabolism alterations, implant osseointegration, implant survival, and contemporary strategies for improving clinical outcomes in osteoporotic patients. The search strategy included combinations of the following keywords and Medical Subject Headings (MeSH): “postmenopausal osteoporosis”, “dental implants”, “osseointegration”, “bone mineral density”, “implant survival”, “peri-implantitis”, “vitamin D”, “bone remodeling”, and “implant rehabilitation”. Data regarding study design, sample size, patient characteristics, implant survival rates, bone density assessment methods, peri-implant bone loss, and therapeutic interventions were extracted and qualitatively analyzed. Due to methodological heterogeneity among the included studies, a descriptive synthesis approach was adopted.

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Results

A total of 487 records were identified through database searching. After duplicate removal and eligibility assessment, 56 studies met the inclusion criteria and were included in the review. The analysis demonstrated that osteoporosis does not represent an absolute contraindication for dental implant placement. Implant survival rates reported in the reviewed studies ranged from 92% to 98%, which were generally comparable to those observed in healthy populations. Several studies reported reduced primary implant stability and delayed osseointegration in patients presenting with significantly decreased bone mineral density. Furthermore, increased peri-implant marginal bone loss was observed in some cohorts of postmenopausal women with untreated osteoporosis. The reviewed literature consistently demonstrated that comprehensive preoperative assessment, including cone-beam computed tomography (CBCT), bone densitometry, and evaluation of serum vitamin D levels, significantly improved treatment planning and risk assessment. Implants with moderately rough, hydrophilic, and bioactive surfaces showed enhanced bone-to-implant contact and improved osseointegration in low-density bone. In addition, calcium and vitamin D supplementation were associated with improved bone metabolism and favorable implant outcomes.

Discussion

The findings of this review indicate that successful dental implant rehabilitation can be achieved in patients with postmenopausal osteoporosis when appropriate diagnostic and therapeutic protocols are applied. The pathophysiological mechanisms underlying osteoporosis involve estrogen deficiency, increased osteoclast activity, and accelerated bone resorption. These processes may compromise bone quality and affect implant stability during the early healing phase. Nevertheless, contemporary evidence suggests that implant survival is influenced more by local bone conditions, surgical technique, and systemic

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disease control than by osteoporosis alone. The widespread adoption of CBCT-based planning and digital implant navigation has significantly improved treatment predictability. Accurate assessment of bone quantity and quality enables clinicians to optimize implant positioning and reduce biomechanical complications. Another important aspect is the use of advanced implant surface technologies. Hydrophilic and bioactive implant surfaces enhance osteoblast adhesion and accelerate bone formation, particularly in patients with compromised bone metabolism. These findings support the growing interest in biologically active implant designs for medically compromised populations. Moreover, multidisciplinary management involving dentists, endocrinologists, and gynecologists appears essential for optimizing systemic bone health before implant placement. Correction of vitamin D deficiency and individualized osteoporosis treatment may contribute to improved osseointegration and long-term implant stability. Despite encouraging results, significant heterogeneity remains among published studies. Differences in osteoporosis severity, pharmacological treatment regimens, implant systems, and follow-up periods limit direct comparison of outcomes. Therefore, further well-designed multicenter clinical trials are required.

Conclusion

Postmenopausal osteoporosis should not be considered an absolute contraindication to dental implant therapy. Current evidence demonstrates high implant survival rates when treatment is preceded by comprehensive assessment of bone quality and systemic health status. The implementation of advanced diagnostic technologies, digital treatment planning, bioactive implant surfaces, and individualized metabolic correction contributes substantially to improved osseointegration and long-term implant success. Future research should focus on establishing evidence-based clinical guidelines for implant rehabilitation in

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osteoporotic patients and identifying predictors of long-term treatment success through large-scale prospective studies.

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