CLINICAL AND BIOMECHANICAL COMPARISON OF ALL-ON-4 AND ALL-ON-6 PROTOCOLS FOR COMPLETE EDENTULISM

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Abstract: *Full-arch implant rehabilitation has become a predictable option for the management of complete edentulism. Among fixed protocols, All-on-4 and All-on-6 are the two most frequently compared concepts. The former was developed to maximize the use of available anterior bone, reduce the need for grafting, and enable immediate loading with a limited number of implants. The latter seeks to increase the anteroposterior spread, improve load distribution, and provide greater biomechanical reserve. This extended abstract critically compares both protocols with regard to implant and prosthesis survival, marginal bone behavior, biological and technical complications, biomechanical rationale, and practical treatment planning. The available evidence indicates that both concepts can provide reliable long-term outcomes when primary stability, prosthetic design, occlusal control, and maintenance are adequate. However, the putative advantages of six implants are demonstrated more consistently in biomechanical and engineering studies than in direct clinical comparisons. Therefore, protocol selection should not be ideological; it should be individualized according to anatomy, bone density, occlusal demand, cantilever control, prosthetic material, maintenance burden, and patient expectations.*

Keywords: *complete edentulism; full-arch rehabilitation; All-on-4; All-on-6; tilted implants; immediate loading; prosthetic complications; biomechanics.*

Introduction: Implant-supported full-arch rehabilitation has substantially changed the treatment of edentulous patients by providing fixed restorations with faster functional recovery and better oral-health-related quality of life than conventional removable dentures. In this context, the All-on-4 concept gained wide acceptance because it combines two axial anterior implants with two posterior tilted implants, thereby allowing clinicians to bypass anatomical limitations in the posterior maxilla or mandible and frequently avoid complex grafting procedures. By contrast, the All-on-6 concept introduces two additional implants in order to enlarge the support polygon, reduce the mechanical demand placed on each implant, and decrease reliance on distal cantilevers.

Despite the popularity of both protocols, the comparison between them is often oversimplified. In daily practice, the decision is not a crude choice between four and six fixtures. It is a prosthetically driven choice between a less invasive and more economical solution that may still be highly effective, and a more reinforced configuration that can offer additional biomechanical safety under selected clinical conditions. For that reason, protocol selection should be based on evidence rather than on marketing formulas or routine preference.

Objective: The aim of this thesis is to provide a critical English-language synthesis of the current evidence comparing All-on-4 and All-on-6 in patients with complete edentulism and to define clinically defensible indications for each protocol.

Materials and Methods: A critical narrative review was performed using peer-reviewed publications on fixed full-arch implant rehabilitation. Priority was given to systematic reviews, meta-analyses, randomized and

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comparative clinical studies, long-term cohort studies, and relevant biomechanical investigations. The analysis focused on implant survival, prosthesis survival, marginal bone loss, technical and biological complications, cantilever behavior, effects of tilted implants, and factors influencing treatment selection in the maxilla and mandible. The review was interpretive rather than purely descriptive; the main purpose was to separate clinically proven advantages from assumptions based primarily on theoretical or laboratory models.

Results and Discussion: The available clinical literature shows that both All-on-4 and All-on-6 can achieve high survival rates when patients are carefully selected and the prosthetic workflow is well controlled. Long-term observational studies of the All-on-4 concept demonstrate that four-implant full-arch reconstructions may remain functional for many years, especially when immediate loading is performed only after adequate insertion torque and cross-arch stabilization are achieved. Comparative studies and recent randomized trials indicate that six-implant reconstructions may provide favorable outcomes as well, but they do not consistently prove universal superiority in implant survival or prosthesis survival.

This distinction is important. Similar survival figures do not mean that the two concepts are interchangeable in every clinical setting. The interpretation changes when bone density is poor, the arch is wide, parafunctional loading is suspected, or the restorative design requires more rigid cantilever control. In such situations, the additional support offered by six implants may reduce risk concentration and improve the restorative envelope, especially in the maxilla.

The role of tilted distal implants also deserves balanced interpretation. Current evidence does not support the claim that distal angulation, by itself, compromises outcomes when implant length, anchorage, and prosthetic execution are appropriate. On the contrary, tilted implants may be a rational

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method of using residual bone and avoiding more invasive augmentation. At the same time, tilt is not a universal solution; poor implant distribution, excessive cantilever length, weak prosthetic materials, or inadequate maintenance can still lead to biological and technical complications.

Biomechanical studies more often favor All-on-6 than direct clinical studies do. Finite element analyses and laboratory models generally show lower stress concentration, improved load sharing, and better cantilever control when the number of implants increases from four to six. These findings are mechanically plausible and clinically relevant, but they should not be interpreted as automatic proof that every patient benefits from two additional implants. Mechanical superiority under simulated loading does not always translate into a decisive difference in patient-centered outcomes.

Technical complications remain central to treatment planning. Screw loosening, acrylic or veneering fracture, framework complications, hygiene-related inflammation, and maintenance burden may strongly influence long-term success. Therefore, the clinically relevant comparison is not only surgical survival, but the whole maintenance profile of the prosthetic system over time. In many patients, the real choice is reduced invasiveness and lower initial cost versus greater structural reserve and a potentially lower mechanical risk.

Conclusion: Both All-on-4 and All-on-6 are valid options for fixed full-arch rehabilitation in complete edentulism. Current evidence supports predictable outcomes for both protocols when treatment is prosthetically driven and maintenance care is respected. Six implants provide clearer biomechanical advantages, especially for load distribution and cantilever reduction, but these advantages are not always matched by a decisive superiority in direct clinical studies. All-on-4 remains a rational and cost-effective option when anterior bone is favorable and cantilever control is achievable. All-on-6 is more strongly indicated when occlusal demand is high, bone quality is compromised, the maxilla presents increased risk, or additional support reserve is desirable. The

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most defensible contemporary position is individualized protocol selection rather than routine preference for either concept.

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