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Orthodontic Treatment in Geriatric Patient: A Review

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Abstract
The growing global geriatric population has led to a rising demand for orthodontic care among older adults seeking functional, aesthetic, and psychosocial improvements. Orthodontic treatment in geriatric patients is feasible when guided by careful biological, systemic, and biomechanical considerations. Age-related changes in bone density, periodontal health, and systemic conditions such as osteoporosis and diabetes necessitate modified force application, thorough medical evaluation, and interdisciplinary coordination. Advances in digital technology, clear aligner systems, and temporary anchorage devices have expanded treatment possibilities, enabling precise, minimally invasive, and comfortable care. Psychosocial factors, including the desire for enhanced appearance and confidence, further drive treatment acceptance. Adjunctive procedures like corticotomies and low-level laser therapy can aid in accelerating movement and improving outcomes. Overall, geriatric orthodontics embodies a holistic, patient-centered approach that integrates biological insight, technology, and collaboration to achieve lasting oral health and aesthetic benefits.

Keywords: Geriatric Orthodontics, Bone Remodelling, Clear Aligners, Interdisciplinary Care, Orthodontic Biomechanics

Introduction

The global demographic transition toward an aging population has significantly influenced the demand for orthodontic care, with the number of individuals aged 65 years and above projected to nearly double from about 830 million in 2025 to approximately 1.7 billion by 2054. This rise has led to an increasing number of older adults seeking orthodontic treatment to manage age-related dental issues such as tooth loss, periodontal recession, tooth migration, and occlusal imbalance.[1] In countries like India, where the geriatric population is expanding rapidly, the need for specialized orthodontic and geriatric dental care remains largely unmet. For elderly patients, maintaining oral function, aesthetics, and quality of life is a primary motivation for seeking orthodontic treatment, which aims to restore masticatory efficiency, enhance speech, improve facial harmony, and support overall oral health factors closely linked to better nutrition, social confidence, and psychological well-being.[2]

Common objectives include preparing the dentition for prosthodontic rehabilitation by optimizing abutment teeth and occlusal relationships, correcting malocclusion to improve function and alleviate temporomandibular joint discomfort, enhancing smile esthetics to boost self-esteem, and promoting periodontal stability through improved alignment that facilitates effective oral hygiene.[3] With proper assessment and tailored planning, orthodontic therapy in geriatric patients is both feasible and beneficial, offering improvements in oral health, function, and appearance. Clear aligners are often favored for their comfort, aesthetics, and ease of maintenance, though conventional fixed appliances can also be adapted for use in elderly cases.[4] Successful treatment, however, requires careful consideration of systemic conditions such as osteoporosis, diabetes, and cardiovascular disorders, as these can influence bone metabolism and tissue healing. Interdisciplinary collaboration between orthodontists, periodontists, and prosthodontists is crucial to ensure safe and predictable outcomes.[5] As longevity increases and dental awareness improves, orthodontic management in the elderly represents an essential component of comprehensive oral healthcare, emphasizing individualized, biologically informed, and minimally invasive approaches that align with the unique physiological and psychological needs of aging patients.[6]

Biological Considerations in Geriatric Orthodontics

Biological factors play a pivotal role in orthodontic treatment for geriatric patients, as the physiological changes associated with aging significantly influence treatment planning, biomechanics, and overall outcomes. With advancing age, bone remodeling capacity declines due to reduced osteoblastic activity, diminished vascularity, and slower bone turnover, resulting in denser cortical bone with limited cellularity and delayed tooth movement.[7] The predominance of osteoclastic activity over osteoblastic function further contributes to potential risks such as root resorption and anchorage loss, necessitating the application of lighter and well-controlled orthodontic forces to prevent overloading and ensure gradual movement. Periodontal health also poses a major concern in elderly patients, as chronic periodontitis, gingival recession, and attachment loss are prevalent, often creating a compromised support structure.[8]

A stable and inflammation-free periodontal condition must be established prior to orthodontic intervention, with ongoing plaque control and maintenance during treatment to prevent further deterioration. Age-related pulpal and alveolar changes, including reduced pulp vitality, secondary dentin deposition, and decreased elasticity of the periodontal ligament, lead to slower and less predictable tissue responses, warranting modifications in force magnitude and duration.[9] Additionally, degenerative alterations in the temporomandibular joint (TMJ) and masticatory musculature such as cartilage wear, reduced joint adaptability, and diminished muscle tone require careful occlusal evaluation to maintain comfort and functional balance. Collectively, these biological considerations highlight the importance of an individualized, biologically sensitive approach to orthodontic therapy in older adults, integrating lighter forces, periodontal stabilization, and TMJ-friendly mechanics to achieve safe, stable, and satisfactory results in the aging population.[10]

Clinical Aspects

Clinical aspects of orthodontics in geriatric patients emphasize limited, targeted corrections to optimize oral function, prosthodontic preparation, and stability, given age-related tissue changes. Procedures like molar uprighting, derotation, and intrusion are performed with light forces (50-100g), extended timelines, and periodontal monitoring to accommodate slower bone remodeling and reduced vascularity. These

interventions facilitate removable partial denture (RPD) placement by creating parallel abutments, improving occlusion, and enhancing retention.[2]

Tilted molars, often resulting from extractions or periodontal loss, are uprighted to provide a stable vertical abutment for adjacent dentures. Use segmented mechanics with a transpalatal arch (TPA) or Nance button on the opposing arch for anchorage, combined with a tip-back bend or helical spring from an auxiliary wire (0.016x0.022 NiTi) delivering 60-80g force. In clear aligner therapy, sequential attachments on the mesial and distal surfaces guide extrusion/rotation over 6-12 months; mini-implants in palatal bone enhance control if density permits. Radiographic monitoring every 4-6 weeks confirms apex alignment and root parallelism.[18]

Anterior or premolar derotation corrects rotation from drifting, ensuring proper path of insertion for RPD clasps. Employ couple forces via 0.016 NiTi sectional wires with rotational wedges or power chains from lingual cleats to labial brackets, applying 50g per tooth. Clear aligners with rectangular attachments (2x4mm) on rotated teeth achieve 10-15° derotation per aligner set, changed biweekly; fixed retainers post-treatment prevent relapse. Periodontal probing depths must remain <4mm pre-treatment, with oral hygiene reinforced to avoid clasp undercuts exceeding 0.01 inches.[11]

Overerupted or protrusive incisors are intruded to level occlusal planes and deepen the sulcus for RPD stability. Continuous intrusion arches (0.016x0.022 TMA) with anterior helical loops or J-hooks deliver 50-75g, supported by infrazygomatic mini-implants or headgear if anchorage is compromised. Aligners use optimized attachments (ellipsoid shape, 4x4mm) and overcorrections of 1-2mm, sequenced over 8-16 months with bite turbos to disocclude. Pulpal vitality tests and CBCT monitor for resorption, pausing if >1mm root shortening occurs. Intrude protrusive incisors (2-4mm supraocclusion) with utility arch (0.016 TMA) from molar stops, J-hook pull (50-70g), and bite planes on posteriors. Segmental: isolate 2-4 teeth with cantilever from infrazygomatic mini-implant (1.6x8mm, palatal if low density). Progress 0.5mm/month; CBCT at 3 months checks crestal bone. Aligners: pressure ridges + ellipsoid attachments, bite ramps.[11]

Initiate with periodontal stabilization (scaling, grafting if needed) and medical clearance for bisphosphonates or anticoagulants. Use low-friction self-ligating brackets or Invisalign for hygiene; adjuncts like micro-osteoperforations accelerate movement by 30-50% in dense bone. Post-procedure, bond fixed lingual retainers and schedule 3-month recalls for RPD integration.[11]

Table: Techniques Used in Geriatric Orthodontics

Category	Technique / Modality	Key Features & Parameters	Clinical Indications / Advantages
Fixed Appliances	Ceramic / self-ligating brackets (e.g., Damon Q2)	Low-friction brackets; NiTi wires 0.014–0.016 inch; forces ~40–80 g	Derotation, leveling, selective alignment with improved comfort
	Lingual fixed appliances	Esthetic, concealed placement	High aesthetic demand in elderly patients
	Segmental mechanics	Sectional wires (0.016 × 0.022 TMA), loops/springs	Molar uprighting, intrusion, localized corrections

Category	Technique / Modality	Key Features & Parameters	Clinical Indications / Advantages
Clear / Removable Appliances	Clear aligners (Invisalign, Spark)	0.25–0.5 mm movement per tray; 7–14 day wear; attachments 3–4 mm	Hygiene-friendly, esthetic, ideal for prosthodontic preparation
	Hybrid systems	Aligners with bonded auxiliaries	Enhanced control for rotations, extrusions
Anchorage Techniques	Temporary Anchorage Devices (TADs)	Mini-implants 1.4–1.6 mm × 6–8 mm; loaded at 100–150 g	Intrusion, molar control, anchorage reinforcement
	Transpalatal arch / Nance button	Auxiliary anchorage units	Support for molar uprighting and segmental mechanics
	Extraoral appliances	Occipital headgear (rare use)	When TADs are contraindicated
Accelerating Adjuncts	Micro-osteoperforations (Propel)	3–5 perforations, 1.5 mm depth, quarterly	Induces RAP, reduces treatment time by ~30%
	Corticotomy-assisted orthodontics	Surgical RAP induction	Dense bone, prolonged treatment cases
	Low-level laser therapy (LLLT)	810 nm, biweekly sessions	Faster remodeling, reduced discomfort
	Vibrational devices	30–50 Hz, 20 min/day	Adjunctive acceleration and comfort
Common Clinical Procedures	Molar uprighting	Tip-back bends, helical springs; 60–80 g	Creation of vertical abutments for RPDs
	Derotation (anterior/premolar)	Sectional NiTi wires; ~50 g	Improve path of insertion for clasps
	Incisor intrusion	TMA intrusion arches; 50–75 g	Occlusal leveling, RPD stability
Retention Protocols	Fixed lingual retainers	0.0175 × 0.025 CoCr wires	Long-term stability, minimal compliance
	Removable retainers	Hawley / wraparound plates	Adjunct to fixed retention
	Follow-up	3-month recalls	Periodontal, occlusal, prosthetic integration

Systemic and Medical Considerations in Geriatric Orthodontics

Systemic and medical factors are of paramount importance in geriatric orthodontics, as elderly patients commonly present with multiple comorbidities and are often on long-term medications that influence oral

health, bone metabolism, and tissue healing. Conditions such as diabetes mellitus, osteoporosis, cardiovascular diseases, and hypertension significantly impact treatment outcomes by altering bone remodeling dynamics, healing capacity, and tolerance to orthodontic forces.[11] For instance, diabetes may impair wound healing and increase susceptibility to periodontal infections, while osteoporosis reduces bone density and compromises the biological response required for tooth movement. Cardiovascular disorders necessitate stress management during dental procedures to avoid complications, and hypertension may require careful scheduling and monitoring during treatment. The medications prescribed for these systemic conditions can also pose challenges: bisphosphonates used in osteoporosis management inhibit bone turnover and heighten the risk of osteonecrosis of the jaw; calcium channel blockers can induce gingival hyperplasia that complicates plaque control; and anticoagulants elevate bleeding risks during clinical interventions. [12]

Given the prevalence of polypharmacy among older adults, comprehensive medical history assessment and interdisciplinary communication with the patient's physician are essential before initiating orthodontic therapy. Orthodontic force application should be conservative, employing lighter and well-controlled mechanics to accommodate slower bone remodeling and delayed tissue response.[13] Clinicians must also implement strict oral hygiene protocols, schedule shorter and stress-free appointments, and vigilantly monitor for signs of discomfort, inflammation, or delayed healing. Ultimately, successful orthodontic management in geriatric patients depends on integrating systemic health evaluation, individualized force application, and collaborative care planning to ensure both safety and efficacy while addressing the unique physiological constraints of aging patients.[14]

Psychosocial and Motivational Considerations in Geriatric Orthodontics

Psychosocial and motivational factors significantly influence the acceptance, compliance, and overall success of orthodontic treatment in geriatric patients, whose motivations and expectations often differ from those of younger individuals. Older adults typically pursue orthodontic care not only for functional rehabilitation but also to enhance facial appearance and smile aesthetics, which contribute to improved self-esteem, social confidence, and quality of life. The desire to maintain an attractive, youthful appearance and active social engagement often serves as a strong motivator, especially as aesthetics play a key role in psychological well-being during aging. Unlike younger patients, elderly individuals generally possess more pragmatic expectations, focusing on comfort, improved oral function, and subtle aesthetic enhancement rather than perfection.[15]

Nonetheless, effective communication and thorough counseling are essential to align their expectations with realistic clinical outcomes. Discussing treatment goals, anticipated duration, possible discomfort, and limitations fosters trust and satisfaction, while addressing anxieties or apprehensions related to aging and dental interventions can improve cooperation and morale. Orthodontists should therefore adopt a patient-centered approach that emphasizes both functional and psychosocial benefits, providing reassurance and motivation throughout treatment. By understanding the emotional and social dimensions that drive treatment acceptance, clinicians can better tailor their approach enhancing adherence, comfort, and overall treatment satisfaction among geriatric orthodontic patients.[16]

Biomechanical and Appliance Considerations in Geriatric Orthodontics

In geriatric orthodontics, biomechanical strategies and appliance selection must be carefully adapted to accommodate the physiological changes in aged tissues, ensuring treatment safety, efficiency, and patient

comfort. Due to reduced bone density, diminished vascularity, and slower remodeling capacity in elderly patients, the application of light, continuous forces typically around 5–15 grams per tooth is essential to promote controlled tooth movement while minimizing the risk of root resorption, hyalinization, and periodontal trauma. Gentle and biologically compatible forces help preserve alveolar integrity and optimize the limited regenerative potential of aging tissues. Anchorage control is another critical consideration, as variable bone quality can compromise conventional anchorage methods.[2,3,16]

The use of temporary anchorage devices (TADs), such as mini-implants placed in areas of sufficient bone density, provides reliable skeletal support, minimizes unwanted reciprocal movements, and enhances overall biomechanical precision without overloading weakened structures. Appliance selection should also reflect the patient's biological and practical needs clear aligners are often preferred for their superior aesthetics, comfort, and ease of oral hygiene maintenance, reducing plaque accumulation and facilitating periodontal health. In cases requiring fixed appliances, digitally customized, low-friction systems such as 3D-printed or self-ligating brackets can deliver gentle, individualized force systems and improve patient comfort. Segmental mechanics may be employed for targeted corrections, limiting the scope of active tooth movement and avoiding excessive stress on the dentition.[9,17]

Adjunctive and Supportive Procedures in Geriatric Orthodontics

Adjunctive and supportive procedures play an important role in enhancing treatment efficiency, optimizing outcomes, and integrating orthodontic care with restorative and implant therapies in geriatric patients. Techniques such as corticotomies and micro-osteoperforations (MOPs) are frequently employed to stimulate the regional acceleratory phenomenon (RAP), thereby increasing localized bone remodeling activity through enhanced osteoclastic and osteoblastic function. These minimally invasive interventions help expedite tooth movement, shorten treatment duration, and can be complemented by adjunctive modalities like low-level laser therapy and vibration-based systems such as AcceleDent, which, though showing variable evidence, may contribute to faster movement and reduced discomfort. Following orthodontic alignment, coordination with restorative and implant procedures becomes crucial to achieve functional occlusion, prosthodontic harmony, and long-term stability. Proper timing ensures that periodontal health is preserved and that occlusal relationships are optimized before final restorative interventions.[18]

Post-treatment retention represents a critical phase in elderly orthodontics, as age-related factors such as diminished bone remodeling, periodontal alterations, and occlusal adaptations predispose to relapse. Fixed retainers are generally favored in this demographic due to their superior stability, minimal dependence on patient compliance, and ease of maintenance compared to removable appliances. Long-term success relies on consistent follow-up appointments to monitor retainer integrity, periodontal health, and occlusal balance. Overall, the judicious use of adjunctive acceleration techniques, coupled with strategic integration of restorative care and vigilant post-treatment maintenance, ensures that geriatric orthodontic treatment achieves durable functional and aesthetic outcomes tailored to the unique biological characteristics of aging patients.[19,20]

Conclusion

In conclusion, orthodontic treatment in geriatric patients is both feasible and highly beneficial when approached with a comprehensive understanding of biological and systemic factors. Successful outcomes rely on meticulous case selection, the use of light and biologically compatible forces, and close

interdisciplinary collaboration to manage complex oral and medical conditions. Technological innovations such as digital treatment planning, clear aligners, and customized appliances have further enhanced precision and comfort in elderly care. With increasing life expectancy and greater emphasis on oral health-related quality of life, orthodontic intervention in older adults is no longer a rarity but a vital component of comprehensive dental rehabilitation. Thus, geriatric orthodontics represents a growing frontier where science, technology, and patient-centered care converge to promote lifelong oral function and aesthetics.

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