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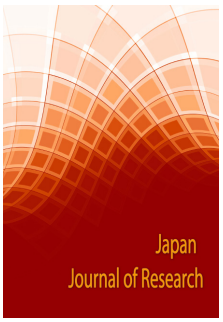

Bone and Fat Pad Restoration Using CMC Combined with HA: Innovative Approaches in Facial Rejuvenation

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Introduction

Facial aging is a complex, multifactorial process involving degenerative changes across several anatomical layers: skin, subcutaneous fat, deep fat compartments, musculature, retaining ligaments, and the underlying facial skeleton. Age-related bone resorption primarily affects critical structural pillars such as the maxilla, zygomatic arch, and mandibular angle, reducing projection and support for overlying soft tissues. Traditional rejuvenation approaches emphasize soft tissue restoration but often neglect the foundational skeletal changes driving facial aging.

This study introduces the concept of 'bone projection enhancement' by employing carboxymethyl cellulose (CMC) and hyaluronic acid (HA) to address deep structural deficits. CMC offers a biocompatible, stable, cross-linked matrix ideal for long-lasting periosteal support. HA, with varying rheological profiles, is used for volumizing superficial and deep fat compartments. Our methodology combines these agents in anatomically strategic layers to restore facial convexity, reduce ptosis, and recreate youthful contours.

Methods

Between May 2022 and February 2024, a prospective study was conducted involving 21 patients aged 45–72 years with visible signs of skeletal aging. Advanced 3D MRI imaging and cephalometric analysis were used pre-treatment to quantify bone atrophy and determine targeted injection sites, primarily the pyriform aperture, lateral midface, infraorbital rim, mandibular angle, and zygomatic eminence.

Using blunt-tipped cannulas for precision and safety, CMC was placed directly onto the periosteum to simulate lost bony projection. A guiding principle was respecting the retaining ligament architecture and avoiding distortion of dynamic mimetic musculature. Subsequently, HA of varying G' (elastic modulus) was layered within deep and superficial fat compartments—such as the medial cheek fat, lateral cheek fat, deep temporal fat pad, and the nasolabial fold complex—to restore volume and contour.

A maximum of 6–8 ml total product volume was used per session, with HA solutions containing lidocaine to enhance patient comfort. Safety protocols included vascular mapping with Doppler ultrasound in high-risk zones such as the glabella and nasal dorsum.

Results

Outcomes demonstrated statistically significant improvements in midface projection, mandibular definition, and temporal hollowing, with high patient satisfaction scores. CMC provided a stable scaffold with minimal post-injection edema or inflammation, owing to its low hygroscopicity and excellent tissue integration. HA fillers effectively corrected superficial deflation without migration or lumpiness, due to their tailored viscoelastic properties.

Evaluation at 2, 7, and 10 days, followed by 3-month and 6-month assessments, revealed no incidence of vascular occlusion, nodules, or granuloma formation. Pain scores were consistently low (average 2 on a 10-point scale), and no adjunctive therapy with analgesics or antibiotics was required.

Conclusions

CMC cross-linked filler is considered safe due to its excellent biocompatibility, low immunogenicity, and minimal risk of vascular complications. Unlike some permanent fillers, it integrates well with surrounding tissues and induces minimal inflammatory response. A significant safety advantage is its reversibility—CMC can be effectively dissolved using cellulase enzymes, allowing for corrective intervention if overcorrection, asymmetry, or adverse events occur. This ability to reverse the product adds an essential layer of control and confidence in clinical aesthetic practice.

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This approach validates the anatomical principle that effective facial rejuvenation must begin at the skeletal level. CMC's mechanical properties—including moldability, low immunogenicity, and resistance to enzymatic degradation—make it uniquely suited for deep foundational support. When complemented by HA in tissue-specific rheological formats, the result is a comprehensive, multilayered restoration strategy that respects both form and function.

Clinicians should be well-versed in facial anatomy, particularly the aging trajectories of fat pads and bony landmarks, to ensure optimal aesthetic and functional outcomes. Future studies could explore combining CMC-HA protocols with regenerative therapies such as PRP or stem cell-enriched matrices for biological rejuvenation. Awareness of dissolution agents, anatomical variants, and vascular landmarks remains critical for minimizing risk, especially in complex facial zones.

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