

Put Function First – Orofacial Fitness as the Key to Nutrition, Satisfaction and Quality of Life

GERODONTOLOGY





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How well older adults can still chew is one of the aspects of function that most directly shapes their meals, their nutrition, and their quality of life. In geriatric assessment, simple functional markers such as gait speed and grip strength have established themselves because they measure something the patient feels in daily life. Masticatory performance belongs in the same category. It rarely sits there in practice, largely because the tools to measure it were, for many years, confined to the research laboratory. That has changed.

In a Japanese cohort of 21,881 adults aged 75 and over, objective masticatory performance carried the highest population-attributable fraction of any oral-health factor for both functional disability and all-cause mortality (1). Twenty-three per cent of the disability burden and 16% of the mortality burden in this population is statistically associated to impaired chewing. No other oral exposure outranked it, not periodontal disease, not tooth count, not denture status. This is not a peripheral outcome of dentistry. It is, in measurable terms, one of the largest modifiable oral determinants of staying alive and staying independent in late life. And yet, when we examine how dentistry actually treats older patients in Switzerland and across Europe today, function is almost never measured. We count teeth, we probe pockets, we cement crowns, we deliver dentures. We assume that if the dentition has been technically restored, the patient will once again chew, eat, and thrive. The evidence says otherwise.

Restoring the teeth is necessary. It is not sufficient.

The gap between what we build and what patients do

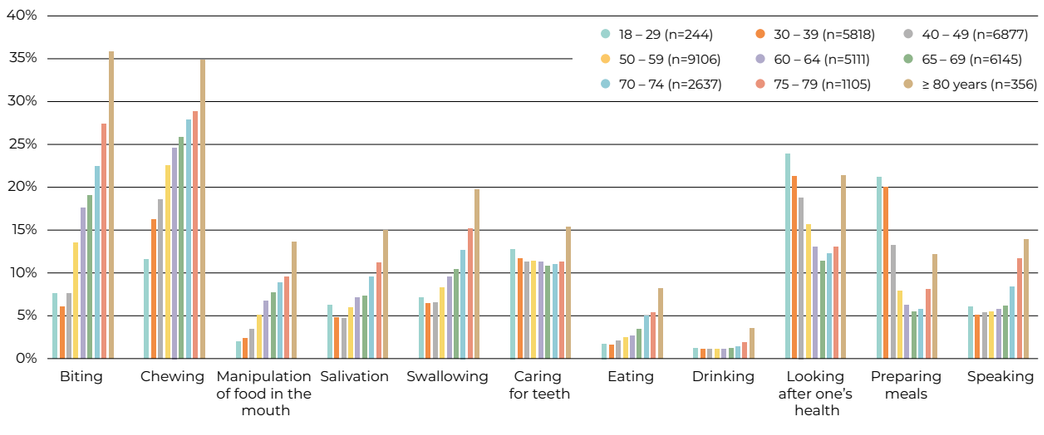
Three randomised controlled trials, one from Belfast, one from Montreal, one from Geneva, converge on a finding that should make any clinician pause. In partially dentate older adults, we showed that both the shortened dental arch concept and conventional removable partial dentures improved objective masticatory performance significantly over twelve months. Neither strategy, however, predicted the nutritional state of the patient at follow-up (2). The mouth chewed better. The diet did not improve. The Montreal group reached the same conclusion at the more dramatic end of the spectrum. Edentulous older adults rehabilitated with two-implant mandibular overdentures, for decades considered the gold standard of geriatric prosthodontics, did not, on their own, eat better than patients with conventional dentures (3). The Geneva trial in very old adults confirmed the pattern (4). Across these three studies, in three countries, in three different prosthetic configurations, the conclusion is the same. Restoring the teeth is necessary. It is not sufficient. The reason is biological rather than technical, and it is the reason the title of this article matters. The aging brain has a finite neuroplastic reserve. Re-learning to chew with a new occlusal scheme, a new bite force pattern, and a foreign body resting on the palate is a complex sensorimotor task. Patients who have spent years quietly adapting their diet to soft, processed, low-fibre foods do not spontaneously return to apples, raw vegetables, and crusty bread once their dentition has been rebuilt. The habits of avoidance, once established, persist past the cause. Kito and colleagues showed in a cluster-randomised trial that combining textured-food gatherings with structured oral and physical exercise was needed to actually shift both function and behaviour in community-dwelling older people (5). The dental chair is the beginning of the rehabilitation, not the end of it.

A framework that takes function seriously

To move beyond a tooth-counting view of oral health, we proposed in 2021 a conceptual model of oro-facial health that adapts the Swiss Meikirch Model of health (6) to oro-facial function (7). The model distinguishes two potentials that together determine whether the mouth can meet the requirements of daily life. The first is the biologically given potential, comprising the dentition you were born with and developed, the salivary glands, the masticatory muscles, and the cortical motor map. This potential inevitably declines with age, with disease, and with tooth loss. The second is the personally acquired potential, comprising the motor skills you have trained, the prosthesis-handling competence you have built, the dietary adaptations you have learned, and the coping strategies you deploy when function falters. This second potential can be trained, reinforced, and rebuilt throughout life.

FIGURE 1

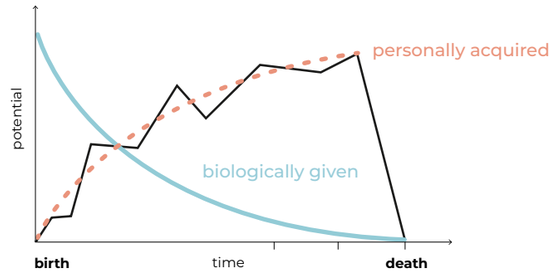
Percentage of individuals with oral impairments according to their age



Redraw from Hennequin et al Appetite 2024: Prevalence of participants with at least one impairment in each ICF item across various age groups (N = 39 597).

FIGURE 2

Biologically given potential



Reference: Schimmel et al. 2021

Orofacial fitness, in this framework, is the state in which the two potentials together suffice to meet the requirements of life: sensing, tasting, biting, chewing, swallowing, speaking, smiling, expressing emotion, sharing meals. Oral hypofunction is the state in which they do not. The framework is patient-centred and deliberately positive. It asks not only what is broken in the mouth, but whether the person sitting in front of you can meet the demands of their daily life. It puts function, and the trainability of function, at the centre of clinical reasoning.

This European framing converges with, but is broader than, the Japanese concepts of oral hypofunction (8) and oral frailty (9). The Japanese diagnosis of oral hypofunction requires three or more of seven impaired items: oral hygiene, oral dryness, occlusal force, tongue-lip motor function, tongue pressure, masticatory function, and swallowing. The signal of these concepts is consistent across continents. What has been missing in routine European practice is a feasible way to measure orofacial fitness at the chairside.

A test that fits in a drawer

For decades, chewing function in research was assessed with laboratory comminution tests. Patients chewed a fixed number of cycles on standardised material, the bolus was sieved, and particle size distributions were calculated. These methods are valid but unfeasible outside a research setting. In clinic, we relied on what patients told us, which correlates only weakly with what they can actually do (10).

The two-colour chewing-gum mixing ability test changed this (11,12). The patient chews a bi-coloured chewing gum, the Hue-Check Gum©, for twenty chewing cycles. The bolus is flattened to a one-millimetre wafer between two transparent sheets. The wafer is then either graded visually on a five-point scale, from SA1 (essentially unmixed, with cusp impressions still visible) to SA5 (a single uniform colour), or scanned and analysed opto-electronically with the ViewGum software, which calculates a standard deviation of hue across the wafer. A low standard deviation of hue means a homogeneous bolus and a well-functioning chewer. A high value means impaired mixing and a patient who has likely been adapting their diet for some time.

The test takes ninety seconds. The materials cost less than one Swiss franc per patient. It requires no electricity. It is feasible in a private practice, in a hospital ward, in a nursing home, and at the bedside of a frail patient who cannot be transported.

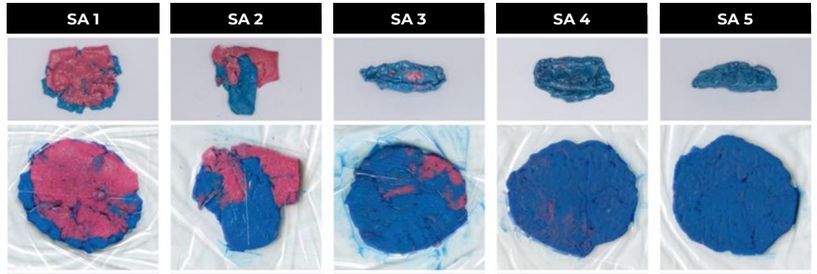
How does this look at population scale? In a study of more than 40,000 adults in the French NutriNet-Santé cohort, in which we applied the Hue-Check Gum together with the International Classification of Functioning, Disability and Health framework, the prevalence of impaired chewing rose steeply with age (13). In adults aged 18 to 29, around 11% showed chewing impairment. In adults aged 80 and over, that figure rose to roughly 35%. Parallel age gradients were seen for biting, manipulation of food in the mouth, and swallowing. This is the population in which the orofacial-fitness framework predicts that the gap between biologically given and personally acquired potential begins to bite, and the instrument detects exactly what the model predicts, at a scale and in a Western European population that no previous study had documented.

Two recent developments have moved this instrument from a research tool to a clinical and regulatory standard. The first is international endorsement. The 2023 ID-COSM consensus, the official core outcome set for implant dentistry clinical trials developed under the COMET methodology, explicitly names masticatory function in the Function core domain, and explicitly names this instrument (14). Any implant trial published after 2023 that ignores masticatory function is now, by international consensus, methodologically incomplete.

The second is the emergence of defensible thresholds. Until recently, clinicians using the test lacked a population-based cut-off for the boundary between normal and impaired. A study published by Hennequin et al. this year established normative reference values in healthy young adults with intact dentition and physiologically normal chewing: at twenty chewing cycles with Hue-Check Gum, the lower bound of normal corresponds to a mixing percentage of approximately 85% and a standard deviation of hue of approximately 0.13 (15). A complementary cut-off for care-dependent older adults, the population where the clinical stakes are highest, was proposed by Imamura and colleagues at approximately 0.43 (16). In daily practice, the visual SA scale is often enough. A bolus graded SA1 or SA2 should trigger a conversation about diet, about nutrition, and about training, not only an adjustment of the denture (17).

FIGURE 3

Subjective Assessment Scale (SA) Evo 5 to assess the Hue-check Gum®



SA1 to SA5 visual scale of the chewed gum wafers.
The brief: a five-image strip showing graded mixing from poor to perfect, captioned with the clinical interpretation at each level.
SA1 and SA2 are the red flags. SA3 is borderline. SA4 and SA5 are unimpaired.

Reference: Eggimann et al.

A question worth asking

Switzerland reached a demographic threshold this spring. For the first time in the country's history, residents aged 65 and over outnumber those under 20. Life expectancy stands at 86.3 years for women and 82.7 years for men (17). The population requiring complex oral rehabilitation, and the population in which oral function determines real-world health, is no longer a minority of dental practice. It is becoming the majority of what we will do for the next thirty years.

Switzerland has chosen, deliberately and consistently, to keep dental care (besides well- defined exceptions such as genetic disorders, or tumour treatment) outside basic health insurance. That is not the discussion this article seeks to open. The discussion this article seeks to open is narrower and, we believe, defensible across the political spectrum. In Swiss long-term care, third-party payers already fund a range of preventive and rehabilitative interventions for care-dependent older adults: physiotherapy after a fall, occupational therapy after a stroke, nutritional counselling in cases of documented malnutrition, swallowing assessment after aspiration. The question worth asking is whether structured assessment of orofacial fitness, and the preventive interventions that follow from a positive screen, such as nutritional counselling, oro-motor training, preventive measures and denture optimisation in the institutional setting, belong in that same category for the frail and care-dependent population.

The instrument to identify the at-risk population now exists, material costs less than two francs per assessment, has been endorsed by international consensus, and produces interpretable distributions in real European populations (17). What the present generation of clinicians and researchers can offer is the measurement. What follows from that measurement, in clinical pathways, in nursing-home quality indicators, in the architecture of long-term care, is a conversation for the broader AVOLA community, for clinical specialists, for payers, and for policymakers to have together.

The WHO Global Oral Health Action Plan 2023–2030 (19) and the Bangkok Declaration adopted in November 2024 (20) commit signatories to integrating oral health into universal health coverage by 2030. The declaration's central commitment, that there is no health without oral health, is operationally empty unless we can measure what we promise. Function is measurable. The instrument exists. How we use it is the question now in front of us.

Where this leaves the clinician on monday morning

For the dentist seeing patients next week, the practical message is short. Consider screening every patient aged 65 and over with a chewing-gum test at first contact and at each recall. An SA1 or SA2 result is a red flag. A standard deviation of hue above 0.13 in a community-dwelling older adult, or above 0.43 in a care-dependent patient, is a red flag. A red flag is not necessarily a reason to make a new denture. It is a reason to talk about what the patient is eating, to consider referral for nutritional counselling, to think about oro-motor training, and, where prosthodontic work is also indicated, to plan that work as part of a functional rehabilitation rather than as the whole of it. We have, for the first time, an inexpensive, validated, internationally endorsed way to measure one of the largest modifiable oral determinants of healthy ageing. Whether and how this measurement enters care pathways, guidelines, and quality assurance in long-term care is a question that the AVOLA community is well placed to take up.

A diagnosis in search of an instrument

The 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, jointly developed by the European Federation of Periodontology and the American Academy of Periodontology, introduced the staging and grading framework that periodontists across Europe now use every day (21,22). Its central innovation — separating the severity of past destruction from the complexity of future management — was overdue and is a real advance.

The complexity criteria for Stage IV, the most severe and most demanding category, begin with a single phrase: need for complex rehabilitation due to masticatory dysfunction, secondary occlusal trauma (tooth mobility degree ≥2), severe ridge defects, bite collapse, drifting, flaring, less than 20 remaining teeth (10 opposing pairs) (21). Masticatory dysfunction is listed first. It is one of the defining features that distinguishes a Stage IV case from a Stage III case — that is, a patient with severe periodontitis from a patient with severe periodontitis whose rehabilitation will be complex.

The classification does not, however, specify how masticatory dysfunction is to be measured. There is no recommended instrument, no threshold, no protocol. Clinicians assign the stage on the basis of overall clinical impression. Two experienced colleagues looking at the same patient may reasonably disagree about whether dysfunction is present, and the system gives them no objective tiebreaker.

This is the same gap, in a different specialty, that this article describes in older adults receiving prosthodontic care. A name has been given to the phenomenon, but the phenomenon has not been operationalised. The validated chairside instruments now exist to close the gap. A ninety-second Hue-Check Gum test and an SA scale reading would give a periodontist staging a complex case the same kind of objective anchor that probing depths give for severity. The 2018 framework would lose nothing of its conceptual clarity and would gain a measurable definition of one of its central terms. We see this not as a critique of the framework, but as a constructive completion of it.

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