ISSN: 2181-3337 | SCIENTISTS.UZ VOLUME 5 ISSUE 9 | SEPTEMBER 2026

INTEGRATED ASSESSMENT OF DENTAL RISK AND QUALITY OF LIFE IN PATIENTS UNDERGOING DIFFERENTIATED PROSTHODONTIC TREATMENT FOR ACID-RELATED GASTRIC DISEASES

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DOI: 10.67620/sai.59d0006

ABSTRACT

This study developed an integrated dental risk index for patients with acid-related gastric diseases and evaluated its clinical relevance in relation to oral-health-related quality of life after personalized versus standard prosthodontic care. The study included 150 patients with hyperacid gastric disease, hypoacid gastric disease, or a history of bariatric surgery (50 per group) and 30 healthy controls. Each clinical group was randomized to personalized or standard dental management (n = 25 each). The Integrated Acid-Related Dental Risk Index (IADRI) combined 17 clinical, laboratory, functional, and radiological criteria spanning dental, periodontal, salivary, immunologic, mucosal, microcirculatory, and bone parameters, with a total score of 0–34. OHI-S, BOP, PD, CAL, ICDAS II, BEWE, salivary flow, pH, buffering capacity, and OHIP-14 scores were monitored for 12 months. Personalized management produced greater and more sustained improvements in dental indices and salivary function than standard care. OHIP-14 scores decreased by 50%–55% across the three clinical groups, compared with 27%–34% under standard management, while correlations between quality of life and residual local symptoms were attenuated. IADRI therefore provides a clinically useful framework for stratifying dental risk in patients with acid-related gastric diseases, and risk-guided personalized prosthodontic care may improve oral health outcomes and quality of life.

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Keywords: *acid-related gastric diseases, dental risk assessment, oral health-related quality of life, personalized dental care, prosthodontic treatment, salivary function.*

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Introduction

The problem of acid-related gastric diseases is becoming increasingly important because of the high prevalence of this pathology, low detection rates, and the frequent inadequacy of treatment (Pavlenko et al., 2021; Richter & Rubenstein, 2018).

It is well established that diseases of the gastrointestinal tract are accompanied by diverse changes in the oral cavity involving combined damage to the hard dental tissues, periodontium, and salivary glands; the mechanisms of these changes differ substantially depending on the direction of the disturbance in gastric secretion (Eremin, 2013; Hatipoğlu et al., 2025; Madariaga et al., 2023).

Depending on gastric juice secretion, gastritis is classified as hyperacid gastritis, hypoacid gastritis, or gastritis with normal gastric acidity. Hyperacid gastritis is the most common form of acid-related gastric

disease and includes gastric and duodenal peptic ulcer disease, gastroesophageal reflux disease (GERD), Zollinger-Ellison syndrome, and other conditions. Hypoacid gastritis is less common and may develop under the influence of external and internal factors, including stress, dietary disturbances, long-term medication use, endocrine disorders, and Helicobacter pylori infection (Cavalcoli et al., 2017; Livzan et al., 2024; Pavlenko et al., 2021).

In accordance with the objective of our research, we included a group of patients after bariatric surgery. Because these patients lose a substantial amount of body weight over 12–18 months, they experience changes in hormonal status, impaired absorption of macro- and microelements (Ca, Fe, Zn), vitamin D and vitamin B12 deficiency, and pronounced restructuring of protein-energy metabolism, all of which contribute to a high level of dental risk. These patients develop systemic changes affecting the musculoskeletal system, vascular regulation, and the structural parameters of the alveolar bone. In combination with more frequent episodes of gastroesophageal reflux, vomiting, and developing xerostomia, these changes lead to a sharp increase in the incidence of dental caries, erosive lesions, and inflammatory periodontal diseases, which in turn complicates prosthodontic treatment in this patient population (Castilho et al., 2019; Marschner et al., 2024; Patel et al., 2017; Rizaev & Elnazarov, 2023).

Analysis of the available data showed that there is still no consensus among specialists regarding the need to take acid-related gastrointestinal diseases into account when preparing the oral cavity for prosthodontic dental treatment. Accordingly, methods for predicting dental risks and complications of dental treatment in patients with acid-related gastric diseases are lacking.

The aim of this study was to develop an integrated dental risk index for patients with acid-related gastric diseases and to evaluate its clinical significance by comparing it with changes in oral-health-related quality of life during personalized and standard prosthodontic treatment.

Materials and Methods

A total of 180 participants aged 25–65 years with partial acquired edentulism were examined and distributed into three clinical-pathogenetic groups of 50 patients each: Group I - hyperacid gastric diseases (chronic hyperacid gastritis, gastric and duodenal peptic ulcer disease); Group II - hypoacid gastric diseases (chronic atrophic gastritis with hypochlorhydria); and Group III - patients after bariatric surgery. Each group was divided by simple randomization into two subgroups of 25 patients: subgroup 1 (personalized treatment algorithm) and subgroup 2 (standard management protocol). The control group consisted of 30 apparently healthy individuals comparable in age and sex.

Based on the results of a comprehensive clinical, laboratory, functional, and radiological examination, the Integrated Acid-Related Dental Risk Index (IADRI) was developed. Clinical data were collected using a standardized case-record form that ensured a unified approach to documenting gastroenterological history, dental status, and longitudinal follow-up findings. On the basis of the obtained data, patients with a high dental risk index received a personalized therapeutic and preventive program addressing dental indices and the functional status of oral fluid. Examinations were performed at admission and repeated after 1 month (30 days), 3 months, 6 months, and 12 months. The OHI-S oral hygiene index, gingival bleeding index (BOP), periodontal pocket depth (PD), clinical attachment loss (CAL), ICDAS II and BEWE indices, unstimulated and stimulated salivary flow rates, oral-fluid pH and buffering capacity, secretory immunoglobulin A (sIgA) concentration, and lysozyme activity were evaluated. Statistical analysis was performed using parametric and nonparametric tests; differences were considered statistically significant at $p < .05$.

Patients in the personalized-treatment subgroup were additionally prescribed a set of local therapeutic and preventive measures differentiated according to the clinical-pathogenetic group. In patients with hyperacid gastric diseases, SensiKIN toothpaste was used twice daily for 8–12 weeks to reduce dentinal hypersensitivity and promote remineralization; KIN Hydrat was used continuously to moisturize the oral mucosa; KIN Care was administered for 10–14 days to improve mucosal repair; professional oral

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hygiene (Air Flow plus ultrasonic scaling) was performed every 3 months; and topical fluoride varnish was applied every 6 months.

Quality of life was assessed using the OHIP-14 (Oral Health Impact Profile) questionnaire at admission and after 3, 6, and 12 months, followed by correlation analysis between the total score and clinical parameters characterizing the condition of the denture-bearing tissues (Slade, 1997).

Results

The developed IADRI includes 17 diagnostic criteria combined into seven domains: hard dental tissues (ICDAS II, BEWE), periodontium (OHI-S, BOP, PD, CAL), oral fluid (unstimulated salivary flow rate, pH, buffering capacity, xerostomia index XI), local immunity (sIgA, lysozyme), mucosa (thickness of the mucosa of the denture-bearing area), microcirculation (perfusion index according to laser Doppler flowmetry), and bone tissue (height, thickness, and density of the alveolar ridge according to cone-beam computed tomography). Each criterion is scored on a three-level scale (0, 1, or 2 points) depending on the degree of deviation from the physiological norm, and the final IADRI value is the sum of scores for all 17 criteria, ranging from 0 (absence of clinically significant abnormalities) to a maximum of 34 points (a combination of pronounced abnormalities in all parameters).

All criteria included in the index have equal weight. The analysis demonstrated the absence of a single universal diagnostic indicator capable of determining the outcome of prosthodontic treatment; the effectiveness of rehabilitation depends on the combined influence of changes in hard dental tissues, the periodontium, functional status of oral fluid, local immunity, mucosa, microcirculation, and bone tissue. According to the total score, patients are stratified into three risk categories, making it possible to determine the required extent of pre-prosthodontic preparation and to substantiate the choice of prosthetic material in conjunction with the clinical-pathogenetic model of the disease.

A personalized therapeutic and preventive program was applied to patients with a high dental risk index.

At the initial examination of patients with gastric disease associated with excessive gastric juice production, the mean duration of gastroenterological disease exceeded 6 years, and the mean GERD-Q score was more than twice the control value (10.3±2.2 and 10.5±2.3 versus 5.2±1.5; $p < .001$), confirming chronic acid exposure of the oral mucosa. The most characteristic findings were generalized dentinal hypersensitivity, erosive enamel changes on the palatal surfaces of maxillary teeth and occlusal surfaces of molars, and reduced oral-fluid pH and buffering capacity.

In the personalized-treatment subgroup, the OHI-S index decreased from 2.01±0.43 at admission to 1.74±0.40 after 30 days, 1.51±0.37 after 90 days, 1.32±0.34 after 180 days, and 1.18±0.29 points after 12 months; in the standard-treatment subgroup, the decrease was noticeably slower, reaching 1.46±0.35 points at 12 months. A similar pattern was observed for BOP, which decreased from 27.4±8.6% to 10.9±5.4% in the personalized-treatment subgroup, compared with a decrease to only 17.4±6.1% in the standard-treatment subgroup.

After 12 months, PD in subgroup 1 decreased to 2.31±0.38 mm versus 2.55±0.42 mm in subgroup 2 (control, 1.50±0.04 mm; $p < .001$ between subgroups), while CAL decreased to 2.63±0.49 mm versus 2.87±0.58 mm. The BEWE index decreased from a baseline value of 13.6±0.3 to 6.9±0.6 points in subgroup 1 versus 8.5±0.3 points in subgroup 2, whereas ICDAS II in subgroup 1 stabilized at 2.01–2.04 points and in subgroup 2 continued to increase, reaching 2.82±0.5 points by 12 months.

Comprehensive assessment of the functional status of oral fluid in the personalized-treatment subgroup demonstrated consistent restoration of all investigated parameters (Table 1). The most pronounced increases were observed in unstimulated salivary flow (+72.4%) and salivary buffering capacity (+65.3%), whereas local immune parameters - sIgA and lysozyme - increased by 46.1% and 55.4%, respectively. In parallel, against the background of comprehensive treatment, the total GERD-Q

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score decreased by 36.3% and the xerostomia index by 33.7%, reflecting concomitant improvement in gastroenterological status and subjective oral condition.

Table 1

Changes in Oral-Fluid Parameters and Standardized Questionnaire Scores in Patients With Hyperacid Gastric Diseases, Personalized-Treatment Subgroup (M ± SD)

Oral-fluid parameter (hyperacid group, personalized-treatment subgroup)	At admission	After 12 months	Increase/decrease
Unstimulated salivary flow, mL/min	0.29 ± 0.08	0.50 ± 0.07	+72.4%
Stimulated salivary flow, mL/min	1.23 ± 0.17	1.46 ± 0.15	+18.7%
Oral-fluid pH	5.80 ± 0.21	6.82 ± 0.15	+17.6%
Buffering capacity, points	4.9 ± 1.1	8.1 ± 0.8	+65.3%
sIgA, mg/L	112.4 ± 18.6	164.2 ± 18.5	+46.1%
Lysozyme, µg/mL	8.3 ± 1.5	12.9 ± 1.2	+55.4%
GERD-Q, points	9.1 ± 2.6	5.8 ± 2.0	−36.3%
Xerostomia Index (XI), points	24.6 ± 7.3	16.3 ± 5.7	−33.7%

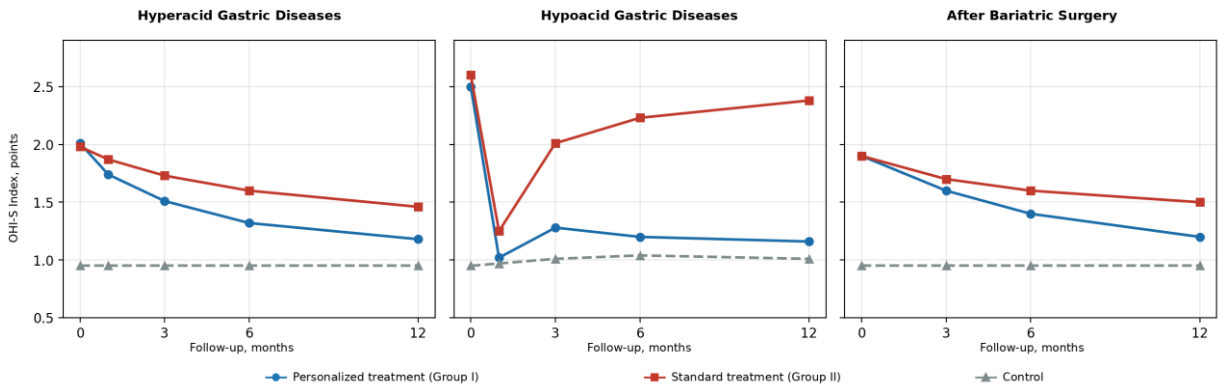
Note. All changes were statistically significant compared with baseline ($p < .05$ to $p < .001$).

In patients with hypoacid gastric pathology, the dynamics of the indices were fundamentally different. In subgroup 2 (standard treatment), a return of the parameters toward baseline was observed after a short-term improvement by day 30: OHI-S decreased to 1.25 points by day 30 but increased to 2.38 points by day 360 (baseline, 2.60 points), and BOP similarly returned from 15.2% to 28.7% (baseline, 32.0%). In subgroup 1, analogous parameters, once improved, remained stable throughout the entire follow-up period. The unstimulated salivary flow rate, which was initially the lowest among the three groups (0.15–0.16 mL/min versus 0.50 mL/min in the control group), recovered to 0.47 mL/min in subgroup 1 compared with only 0.27 mL/min in subgroup 2.

In patients after bariatric surgery, baseline index values were formed under the combined influence of residual gastroesophageal reflux and nutritional deficiency. By 12 months, subgroup 1 achieved stabilization of the ICDAS index (total number of lesions) and BEWE; salivary buffering capacity increased to 7.7 points versus 7.0 points in subgroup 2, and secretory immunoglobulin A concentration increased to 159.2 mg/L versus 134.7 mg/L.

Figure 1

Dynamics of the OHI-S Oral Hygiene Index in the Three Clinical-Pathogenetic Groups



Note. Solid lines show changes in the personalized- and standard-treatment subgroups; the dashed line represents the control group. Of particular note is the divergent pattern in the standard-treatment subgroup of the hypoacid group: after improvement by day 30, the parameter returns toward its baseline level.

In all three groups, differences between the personalized- and standard-treatment subgroups reached statistical significance ($p < .05$ to $p < .001$) for most of the investigated parameters as early as 6 months of follow-up. The most pronounced contrast between the subgroups was recorded in the hypoacid group, in which the standard strategy was accompanied not merely by slower improvement but by reversal of the positive dynamics, with loss of the achieved improvement by the end of follow-up. This reflects the instability of the effect of standard treatment in the presence of secretory insufficiency underlying this clinical-pathogenetic model.

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Analysis of patient quality of life showed that in patients with hyperacid gastric diseases, the total OHIP-14 score decreased from 29.6–30.1 at admission to 13.5 points after 12 months in the personalized-treatment subgroup (a level close to the control value of 10.8 points), compared with 19.8 points in the standard-treatment subgroup - a reduction of 54% versus 34%. In patients with hypoacid diseases, the score decreased from 30.4–31.0 to 15.1 points versus 22.6 points (a reduction of 50% versus 27%), representing the least complete recovery among the three groups and reflecting the more inert nature of compensation for secretory insufficiency. In post-bariatric patients, in whom the OHIP-14 score increased by almost 1.7-fold immediately after surgery (from baseline values of 18.4–18.8 to 31.8–32.4 points), the personalized strategy reduced the score to 14.2 points compared with 21.9 points under standard management (a reduction of 55% versus 32%).

Table 2

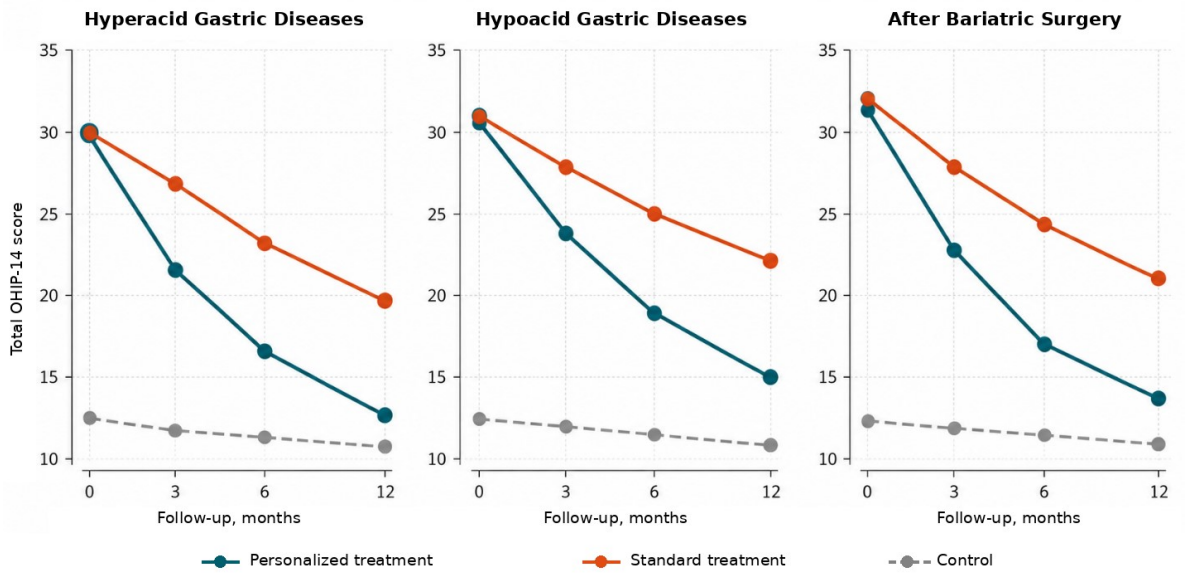
Final Reduction in OHIP-14 Score and Attenuation of the Correlation With Local Symptoms After 12 Months

Group	OHIP-14 reduction, personalized (%)	OHIP-14 reduction, standard (%)	r with local symptoms, personalized	r with local symptoms, standard
Hyperacid diseases	54%	34%	.25–.34	.55–.62
Hypoacid diseases	50%	27%	.28–.36	.57–.65
After bariatric surgery	55%	32%	.29–.34	.61–.67

Note. *r* is the correlation coefficient between the total OHIP-14 score and the leading local symptoms in each group (hypersensitivity/BEWE for hyperacid diseases; xerostomia/mucosal inflammation for hypoacid diseases; hyperemia/pain/pressure areas for post-bariatric patients).

Figure 2

Dynamics of the Total OHIP-14 Score in the Three Clinical-Pathogenetic Groups



In all three groups, personalized treatment statistically significantly attenuated the correlation between OHIP-14 and residual local manifestations of disease. In hyperacid patients, the association with hypersensitivity and the BEWE erosive index decreased from $r = .55–.62$ (standard treatment) to $r = .25–.34$ (personalized treatment). In hypoacid patients, the association with xerostomia and mucosal inflammation decreased from $r = .57–.65$ to $r = .28–.36$. In post-bariatric patients, the association with mucosal hyperemia, the number of areas of increased pressure, and pain intensity according to the VAS decreased from $r = .61–.67$ ($p < .001$) to $r = .29–.34$ ($p > .05$), whereas the negative correlation between OHIP-14 and the degree of functional adaptation to the prosthesis, conversely, persisted and remained statistically significant in both subgroups ($r = −.52$ in the personalized-treatment subgroup versus $r = −.69$ in the standard-treatment subgroup).

The observed pattern—attenuation of the dependence of quality of life on residual local pathology specifically in the personalized-treatment subgroups, with persistence and even strengthening of this

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dependence in the standard-treatment subgroups—indicates that the personalized approach does not merely accelerate the resolution of individual symptoms but alters the pathogenetic mechanism underlying dental discomfort itself, shifting it away from dependence on residual local pathology toward overall functional adaptation to the prosthodontic construction.

Conclusion

The developed Integrated Acid-Related Dental Risk Index (IADRI), which combines 17 clinical, laboratory, functional, and radiological criteria into a unified three-level scoring system, provides objective stratification of patients with acid-related gastric diseases regardless of the predominant pathogenetic mechanism.

Personalized dental care provides a more pronounced and, importantly, more sustained normalization of clinical indices and functional parameters of oral fluid than the standard strategy in all three studied clinical-pathogenetic groups of patients with acid-related gastric diseases. The most important clinical advantage of the personalized approach—prevention of recurrence of pathological changes observed under standard management in hypoacid patients—emphasizes the need to consider the specific pathogenetic variant of the disease when planning the scope and content of dental care.

Comparison of the dynamics of IADRI with oral-health-related quality of life confirms the clinical significance of the developed system. In all three studied groups, personalized treatment aimed at reducing dental risk not only provides more complete restoration of quality of life but also qualitatively changes the mechanism determining it—from dependence on residual local symptoms to the predominant role of functional adaptation to the prosthodontic construction.

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