Comprehensive Diagnostic and Therapeutic Approaches to Oral Dysbiosis

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Article

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Abstract

Relevance. The study examines the quantitative and qualitative colonization of microorganisms in the oral cavity (OC) and its dependence on exogenous and endogenous factors, as well as the variability related to the design and number of removable dentures (RD). A microbial “landscape” — including the types, colonization levels, and quantity of microorganisms — was determined for clinically healthy adults to establish normative parameters for oral microflora.

Objective. To diagnose dysbiotic conditions of the oral cavity, establish the normative microbial “landscape,” and substantiate the role of removable dentures in microbial colonization and composition.

Materials and Methods. The study included 260 individuals (males and females aged 18–60 years). Group I (n=105) consisted of individuals diagnosed with various degrees of oral dysbiosis (61 males [58.09%], 44 females [41.9%]; mean age 44.6 years). Group II (n=96) included patients with oral dysbiosis of varying severity and the presence of removable dentures (41 males [43.15%], 54 females [56.84%]; mean age 49 years). Group III (n=60) served as the control group for determining the microbiological norm (27 males, 33 females; mean age 37 years).

Results. In the clinically healthy adult population of Andijan City, the quantitative range of oral microflora was established as follows: Lactobacillus spp. 10^3–10^4, Streptococcus spp. 10^5–10^8, Str. pyogenes – absent, Leptotrichiaspp. 10^2–10^4, Staphylococcusspp. 10^2–10^4, Candida spp. 10^2–10^3, conditionally pathogenic Enterobacteriaceae10–10^2, Corynebacterium spp. <10^2, Bacteroides spp. <10^3, Veillonella spp. 10^3–10^8, Fusobacterium spp. 10^3–10^4, Staphylococcus aureus– absent, Neisseria spp. 10^5–10^7. Dysbiotic states of the oral cavity were classified as follows: Grade I — reduction of resident microflora; Grade II — alteration of resident and conditionally pathogenic species composition; Grade III — predominance and proliferation of Candida spp. fungi.

Conclusions. A classification of oral dysbiosis severity (Grade I–III) was developed and normative microbiological indices were established for the adult population of Andijan City. The microbial “landscape” of oral cavities with removable dentures was characterized. The obtained results substantiate the clinical and preventive significance of using Anethum graveolens leaf extract and decoction in orthopedic dental practice to enhance treatment outcomes and predict the effectiveness of therapeutic-preventive measures.

Relevance

It is well established that the oral cavity harbors between 300 and 400 species of microorganisms, with their quantitative concentration under normal conditions not exceeding 10^2–10^3 CFU/mL. Among these microorganisms, streptococci are predominant, accounting for 30–60% of the total oropharyngeal microflora, forming a specific “geographic specialization” within the oral ecosystem [1–3]. According to the World Health Organization (WHO), more than 20% of the global population develop various forms of candidiasis during their lifetime. Candida species rank fourth among pathogens isolated from the

bloodstream—after Staphylococcus aureus, Streptococcus epidermidis, and Enterococcus spp.—and play a significant role in mortality associated with nosocomial septic conditions [4–6]. It has been reported that in the treatment of oral mucosal candidiasis, the development of specific and targeted antifungal drugs has shown high therapeutic efficacy. In addition, numerous studies have been devoted to counteracting microbial colonization in the oral cavity and restoring the balance of the normal microflora [7–9]. For example, considerable research has been conducted to evaluate the state and degree of dysbiosis both in the body and within the oral cavity. In recent years, there has been growing scientific interest in studying the impact of artificial dental prostheses (ADP)—their types, designs, base materials, and their influence on the oral microbiocenosis—given their widespread use in the correction of dental defects [10–12]. This necessity arises from the current lack of a standardized definition of oral dysbiosis, the heterogeneous composition of the oral microbiota across different sites, and the absence of differentiated approaches to its diagnosis and treatment [13–15].

The purpose of the study. To develop a scientifically based framework for a rational approach to the diagnosis of oral cavity dysbiosis and the optimization of oral microflora composition aimed at improving the management and prevention of dental pathologies.

Materials and methods

The research was conducted in accordance with established ethical principles, taking into account the following factors: the study objectives, methodology, potential risks, availability of alternative treatment options, participants' right to withdraw from the study at any stage, measures to mitigate possible harm, voluntary participation, and confidentiality of obtained data, as well as ensuring the safety of all participants [16-18]. Participants were selected based on the following inclusion criteria: men and women aged 18 to 60 years, free from systemic somatic pathologies, with no contraindications to the proposed treatment methods or medications, and no history of drug or alcohol dependency. A total of 155 individuals participated in the study, including 68 men and 87 women. The main group (MG) consisted of 95 individuals diagnosed with oral cavity dysbiosis, of whom 41 (43.15%) were men and 54 (56.84%) were women, with an average age of 49 years. According to the severity of dysbiosis, 22 participants (23.15%) had grade I, 36 (37.89%) had grade II, and 37 (38.94%) had grade III dysbiosis. The control group (CG) included 60 individuals (27 men and 33 women) with an average age of 37 years, who were somatically healthy, not registered for any chronic diseases, had no clinical complaints, and were free from periodontal and oral mucosal disorders. This group was used to determine the microbiological norms of the oral cavity.

Ethics approval and consent to participate: The study protocol was reviewed and approved by the Local Ethics Committee of the Center for the Development of Professional Qualifications of Medical Workers under the Ministry of Health of the Republic of Uzbekistan with the participation of the Department of "Dentistry, Pediatric Dentistry and Orthodontics." The decision approving the study was issued as Protocol No. 6 dated September 03, 2025. Prior to enrollment, all patients were provided with comprehensive information regarding the objectives, tasks, methods of the study, possible risks, and

anticipated benefits. Written informed consent for participation in the study and the use of clinical data for scientific purposes was obtained from all participants, with strict adherence to confidentiality principles. The study did not cause any harmful physical or psychological effects on the participants. Personal data were coded and processed in anonymized form in accordance with medical confidentiality requirements.

Clinical and functional data were recorded in a specially designed **"Information Sheet" (questionnaire)**, which included participants' **personal and demographic information**, **age**, and **dental status**. The condition of the **hard dental tissues** was assessed using the **CPI index** — where *(C)* represents carious, *(F)* represents filled, and *(E)* represents extracted teeth. Oral hygiene was evaluated using the **PHP (Podshadley and Haley)** and **Silness–Löe indices**. The condition of the **oral mucosa** was examined by assessing the **Dorsal Tongue Surface Index (DTSI)**, which reflects **swelling of the dorsal tongue surface**, **the expression of lingual papillae**, and **the presence of coating**. The DTSI was graded as follows: **0 points** – no visible changes; **1 point** – coated dorsal surface of the tongue; **2 points** – presence of coating and mild hyperkeratosis of filiform papillae; **3 points** – dense coating and pronounced hyperkeratosis of filiform papillae [19, 20].

The microbiological composition of the oral cavity was assessed by **cultural methods** (smear inoculation and microbial cultivation) in the **Bacteriological Laboratory**. Biological material was collected **on an empty stomach or 3–4 hours after a meal**, without prior tooth brushing, medication intake, or mouth rinsing, using a sterile swab (*SORAP*, Germany). To determine the **total microbial contamination level (TMCL)**, the sample was prepared in a **1:10 sodium chloride solution**. The following culture media were used: **Blood agar** – for determining the total microbial contamination; **Yellow-salt agar** – for *Lactobacillus* species; **Sabouraud medium** – for *Candida* species; **Endo medium** – for *Enterobacteriaceae*; **Columbia agar** – for anaerobic bacteria; **Lacto-agar** – for *Lactobacillus* isolation. **Inoculation scheme:** From **1:10 dilution** – inoculation onto staphylococcal agar, Sabouraud medium, and Endo medium; From **1:100 dilution** – inoculation onto Columbia agar, lacto-agar, and blood agar; From **1:1000 dilution** – inoculation onto blood agar. Microscopic examination (*Biolam* microscope) was carried out **48 hours after incubation**. Microbial identification was performed as follows: **Lactobacillus species** (*L. casei, L. acidophilus, L. fermenti, L. salivarius*) – using the **API 20 STREP** test system (*bioMérieux Vitek, Inc.*); **Streptococci** (*Streptococcaceae, genus Streptococcus*) – using the **API 20 STREP** test system (*bioMérieux Vitek, Inc.*); **Staphylococci** (*Micrococcaceae, genus Staphylococcus*) – using the **API Staph** test system (*bioMérieux Vitek, Inc.*); **Candida species** – identified on **Candiselect-4** chromogenic medium; **Enterobacteria** – using **Diagnostic System** plate tests; **Anaerobic bacteria** – identified using **Anaerotest 23** (*Pliva Lachema*). Statistical analysis of the obtained results was performed using an **IBM personal computer** with a **Pentium Dual-Core Inside processor**, applying **variation statistical methods** described in several referenced publications.

To correct dysbiotic conditions in the oral cavity, initial dental sanitation was performed, which included restoration of carious teeth, removal of dental calculus and plaque, and correction of dental arch defects. For orthopedic rehabilitation, patients in the main group (MG) were provided with artificial dental

prostheses (ADPs) fabricated from metal–ceramic and zirconium-based materials using modern digital (3D) technology systems. As an adjunctive phytotherapeutic measure, the medicinal plant Anethum graveolens (dill) was used. Freshly harvested leaves were chewed for 3–4 minutes, 2–4 times daily, both before and after meals. An infusion was also prepared by steeping 50 g of dill in 1 liter of boiling water for 2 hours. The infusion was consumed 4–6 times per day, 50–70 mL per intake. The plant contains essential oils and phthalides, while its fruits are rich in essential oils, fatty acids, phthalides, furocoumarins, and hydroxycoumarins. The condition of participants' hard dental tissues, periodontal tissues (PT), and oral mucosa (OM) was evaluated before treatment, and reassessed at 14, 60, and 90 days after the initiation of therapeutic and preventive interventions.

Results and Their Analysis

The initial microbiological assessment of the **oral cavity** in the **control group (CG)** revealed the following **microbial titers**: 10^3–10^4 (literature data: 10^2–10^3); <10^3 (literature data: <10^2); 10^3–10^4 (literature data: 10^2–10^3). A decrease in **streptococcal contamination** was observed—from 10^8–10^{14} to 10^2–10^5. Based on these findings, the following **normative indicators** were established as characteristic for the **adult population of Andijan city**: *Lactobacillus* spp. — 10^{13}–10^{14} CFU; *Streptococcus* spp. — 10^5–10^8 CFU; *Streptococcus pyogenes* — 0; *Staphylococcus aureus* — 0; *Staphylococcus* spp. — 10^4–10^6 CFU; *Candida* spp. — 10^{12}–10^{13} CFU; Conditionally pathogenic *Enterobacteriaceae* — 10^2–10^4 CFU; *Corynebacterium* spp. — <10^2 CFU; *Bacteroides* spp. — <10^4 CFU; *Veillonella* spp. — 10^{12}–10^{16} CFU; *Fusobacterium* spp. — 10^4–10^6 CFU; *Leptotrichia* spp. — 10^4–10^6 CFU; *Neisseria* spp. — 10^6–10^8 CFU. Based on the obtained data, **the severity of oral dysbiosis** was categorized as follows: **Grade I dysbiosis:** Slight decrease in *Lactobacillus* titers with the presence of **2–3 types of pathogenic microorganisms**. This stage is characterized by noticeable changes in the counts of *Lactobacillus* and *Corynebacterium*, while other rod-shaped microorganisms (*Bacteroides, Fusobacterium, Leptotrichia*), coccal flora (*Streptococcus,* nonpathogenic *Staphylococcus, Veillonella, Neisseria*), and *Candida* spp. may fluctuate. However, titers of **conditionally pathogenic microorganisms** (*Enterobacteriaceae, Streptococcus pyogenes, Staphylococcus aureus*) remain within normal limits. **Grade II dysbiosis:** Noticeable quantitative shifts are observed in nonpathogenic *Staphylococcus, Corynebacterium, Bacteroides, Fusobacterium*, and *Leptotrichia* species—both increases and decreases may occur.
Titers of *Lactobacillus, Veillonella, Neisseria*, and *Streptococcus* significantly decline, while **counts of** *Staphylococcus aureus* **and** *Enterobacteriaceae* increase, and *Candida* spp. remain within normal values. **Grade III dysbiosis:** Marked reduction in the titers of *Lactobacillus, Streptococcus, Veillonella*, and *Neisseria* species, accompanied by **pronounced changes in** *Bacteroides* **and** *Corynebacterium* populations. The counts of *Staphylococcus aureus*, nonpathogenic *Staphylococcus*, *Enterobacteriaceae, Fusobacterium, Leptotrichia*, and *Candida* spp. increase substantially, with **Candida spp. often forming fungal associations** at this stage.

The clinical condition of the oral cavity in the study participants was evaluated using the oral mucosa and dorsal tongue surface index (DTSI), CFE (carious, filled, and extracted teeth), periodontal tissue (PT)

status, and oral hygiene indices (PHP and Silness–Löe). A negative change in DTSI was observed, characterized by the presence of coating and hypertrophy of filiform papillae, particularly pronounced in participants with Grade III (severe) dysbiosis ($p < 0.05$). Similarly, CFE, PT status, and oral hygiene indices (PHP and Silness–Löe) exhibited comparable clinical manifestations, indicating a consistent association between the severity of dysbiosis and deterioration in both dental and periodontal health (Table 1).

Table 1. Description of the relationship between clinical–dental assessment indices and the degree of dysbiosis, M ± t, p (Control group, M ± t)

Observed group: M/G (n = 95)		CFE	Hygienic indices		CPI scores	DTSI, scores
			PHP, scores	Silness–Löe, scores		
1	I-grade n=22	13,44±0,46	0,98±0,04	1,21±0,04	1,88±0,05	1,32±0,11
2	II-grade n=36	13,54±0,42	1,04±0,04	1,34±0,06	1,84±0,16	1,56±0,12
3	III-grade n=37	19,8±0,26	2,04±0,08	2,04± 0,05	2,98±0,24	1,91±0,23
C/G	n=60	8,50±0,48	0,54±0,02	0,12±0,01	0,11±0,02	0,24±0,06

Note: CFE - carious, filled, and extracted teeth, DTSI - dorsal tongue surface index.

The results presented in the table demonstrate the following trends: **Caries intensity** was classified as **"moderate"** in **Grade I dysbiosis**, **"high"** in **Grade II**, **"very high"** in **Grade III**, and **"low"** in the **control group (CG)**. The **Silness–Löe index** indicated **mild gingivitis** in **Grade I dysbiosis** ($p < 0.001$), and **moderate gingivitis** in **Grades II and III**. **Periodontal tissue inflammation (periodontitis)** was observed as **mild** in **Grade I dysbiosis**, and **moderate** in **Grades II and III**. **Oral hygiene** was generally assessed as **satisfactory** in all participants of the main group (MG), whereas it was considered **good** in the control group (CG). These results indicate a clear correlation between **dysbiosis severity** and the **intensity of dental and periodontal pathology**, as well as oral hygiene status.

The significance of various adverse factors in the development of **oral dysbiosis** was observed in the **main group (MG)** among patients with **artificial dental prostheses (ADPs)**. This condition is illustrated in **Figure 1**.

It has been reported in several studies that **dental diseases** develop against the background of **intermediate dysbiosis**, and that **microecological disturbances** occur not only in the **oral cavity** but also in the **upper gastrointestinal tract (UGT)**. In this context, **dysbiotic changes in these systems are synchronous**, and according to specialists, the **number and diversity of bacteria in the OC correlate with those in the intestines** within the same sample. This suggests that **intermediate oral dysbiosis may be a consequence of intestinal dysbiosis**, serving as a confirming factor of systemic microbial imbalance (Table 2, 3).

Table 2. Frequency and composition (%) of artificial dental prostheses (ADPs) in relation to dysbiosis severity and somatic pathology.

Observation group (n = 95)	Frequency and composition of diseases, %			
		URT	GIT	CVS
1-gr. (n=22)	**Up to 3 dental crowns**	2/9,1	2/9,1	1 /4,5
	More than 3 dental crowns	2/13,6	4/18,2	1 /4,5
	More than 2 types of materials	2/9,1	5/22,7	1 /4,5
	Total for Group I	6/27,3	11/50,0	3/13,6
2-gr. (n=36)	**Up to 3 dental crowns**	2/5,5	2 /5,5	1 / 2,7
	More than 3 dental crowns	4/11,1	5/13,9	2/5,5
	More than 2 types of materials	5/13,9	10/27,8	2/ 5,5
	Total for Group II	11/30,5	17/47,2	5/13,9
3-gr. (n=37)	**Up to 3 dental crowns**	4/10,8	5/13,5	2/5,5,3
	More than 3 dental crowns	5/13,5	7/18,9	2/8,1
	More than 2 types of materials	4/10,8	11/29,7	2/8,1
	Total for Group III	13/35,1	23/62,1	6/16,2
Total number of prostheses		30/31,6	51/53,7	14/14,7

Note: URT – Upper Respiratory Tract; GIT – Gastrointestinal Tract; CVS – Cardiovascular System.

Table 3. Comparative characteristics of oral clinical-functional parameters in groups with various prosthetic constructions, M ± t, p

M/G and subgroups / Type of prosthetic construction and material		CFE	Hygienic indices		CPI scores
			PHP, scores	Silness–Löe, scores	
I-grade n=22	Up to 3 dental crowns	13,04±0,34	0,56±0,06	1,14±0,04	1,11±0,04
	More than 3 dental crowns	13,88±0,82	0,86±0,04	1,54±0,08	1,68±0,11
	More than 2 types of materials	19,94±0,24	1,86±0,04	2,32±0,12	2,06±0,09
II- grade n=36	Up to 3 dental crowns	13,44±0,22	0,68±0,06	1,64±0,44	1,48±0,08
	More than 3 dental crowns	14,48±0,42	1,24±0,22	1,99±0,68	1,98±0,41
	More than 2 types of materials	19,99±0,74	1,66±0,24	2,34±0,11	2,56±0,24
III- grade n=37	Up to 3 dental crowns	14,54±0,42	1,48±0,26	1,98±0,24	1,88±0,04
	More than 3 dental crowns	16,88±0,62	1,84±0,12	2,69±0,38	2,44±0,88
	More than 2 types of materials	22,24±0,98	2,56±0,44	2,68±0,22	3,00±0,12
C/G n=60		8,50±0,48	0,54± 0,02	0,12±0,01	0,11±0,02

Disbiotic conditions associated with gastrointestinal pathologies can impair not only the oral cavity but also the overall functioning of the digestive system. In subgroups with gastrointestinal disorders, cardiovascular diseases, and upper respiratory tract conditions, the average caries intensity, oral hygiene status, and severity of periodontitis progression were found to be nearly identical. As previously mentioned, the therapeutic-preventive interventions conducted in the main group involving 95 patients were evaluated at −14, 60, and 90 days. Analysis of Table 4 demonstrates a positive shift in the oral microbiota following the applied treatment measures.

Table 4. Microbiological characteristics of the oral cavity under therapeutic-preventive intervention

Microflora	Observation period	Isolation rate, %			
		Significance	Non-physiological range	Significance	Physiological range
Lactobacillus spp.	Before treatment	100		0	
	*	P_{1-2} <0,001	55,8	P_{1-2} <0,001	58,7
	**	P_{2-3} <0,001	24,6	P_{2-3} <0,001	68,4
	***	P_{3-4} <0,001	3,13	P_{3-4} <0,001	74,8
		P_{1-4} <0,0001		P_{1-4} <0,0001	
Streptococcus spp.	Before treatment	58,0		20.6	
	*	P_{1-2} <0,05	30,4	P_{1-2} <0,05	64,6
	**	P_{2-3} <0,05	14,4	P_{2-3} <0,05	76,8
	***	P_{3-4} <0,05	2,8	P_{3-4} <0,05	82,4
		P_{1-4} <0,01		P_{1-4} <0,01	
Staphylococcus spp.	Before treatment	60,8		24,6	
	*	P_{1-2} >0,05	34,6	P_{1-2} >0,05	48,4
	**	P_{2-3} >0,05	12,2	P_{2-3} >0,05	56,2
	***	P_{3-4} >0,05	0	P_{3-4} >0,05	64,8
		P_{1-4} >0,005		P_{1-4} >0,005	
Enterobacteriaceae	Before treatment	46,8		33,6	
	*	P_{1-2} <0,05	20,4	P_{1-2} <0,05	42,8
	**	P_{2-3} <0,05	12,4	P_{2-3} <0,05	68,2
	***	P_{3-4} <0,05	4,2	P_{3-4} <0,05	78,7
		P_{1-4} <0,005		P_{1-4} <0,005	
Corynebacterium spp.	Before treatment	58,9		18,6	

	*	P_{1-2} <0,001	40,2	P_{1-2} <0,001	44,6
	**	P_{2-3} <0,001	13,4	P_{2-3} <0,001	56,4
	***	P_{3-4} < 0,001	2,2	P_{3-4} <0,001	92,5
		P_{1-4} <0,001		P_{1-4} <0,001	
Bacteroides spp.	Before treatment	84		22	
	*	P_{1-2} < 0,01	60,8	P_{1-2} < 0,01	40,6
	**	P_{2-3} < 0,01	24,4	P_{2-3} < 0,01	85,4
	***	P_{3-4} < 0,01	4,2	P_{3-4} < 0,01	79,9
		P_{1-4} < 0,001		P_{1-4} < 0,001	
Fusobacterium spp.	Before treatment	48,4		56,4	
	*	P_{1-2} >0,05	12,4	P_{1-2} >0,05	76,4
	**	P_{2-3} >0,05	4,2	P_{2-3} >0,05	84,4
	***	P_{3-4} >0,05	0	P_{3-4} >0,05	89,6
		P_{1-4} >0,005		P_{1-4} >0,005	
Leptotrichia spp.	Before treatment	37,5		55,8	
	*	P_{1-2} < 0,01	28,4	P_{1-2} < 0,01	84,4
	**	P_{2-3} < 0,01	11,2	P_{2-3} < 0,01	98,4
	***	P_{3-4} < 0,01	0,6	P_{3-4} < 0,01	99,0
		P_{1-4} < 0,01		P_{1-4} < 0,01	

Note: *- after 14 days; **- after 60 days; ***- after 90 days; P_2 – reliability of data from the first subgroup compared to the second subgroup; P_3 – reliability of data from the first subgroup compared to the third subgroup; P_{2-3} – reliability of data from the second subgroup compared to the third subgroup; P_{1-4} – reliability of data from the first subgroup compared to the fourth subgroup;
P_{3-4} – reliability of data from the second subgroup compared to the fourth subgroup.

In the first subgroup, normalization of Lactobacillus ($p < 0.05$), Streptococcus ($p < 0.05$), conditionally pathogenic Enterobacteriaceae ($p < 0.05$), Corynebacterium ($p < 0.05$), Bacteroides ($p < 0.05$), and

Leptotrichia ($p < 0.01$) was observed. Among participants, 66.6% achieved complete recovery, while 23.7% showed no change in microbiological composition. Thus, in Grade I dysbiosis, treatment with Anethum graveolens (dill) improved oral hygiene, reduced periodontal inflammation, and allowed normalization of the oral microbiocenosis in 67% of cases. In the second subgroup, normalization of the oral microbiocenosis occurred in 13.3% of cases, and in the third subgroup in 53.3% of cases. Improvement was observed in 46.7% of participants in the second subgroup and 20.9% in the third subgroup. However, Grade II dysbiosis persisted in 40.9% of cases in the second subgroup and 26.7% in the third subgroup ($p < 0.05$).

After the therapeutic-preventive intervention, normalization was observed in Staphylococcus aureus, Staphylococcus spp., Candida spp., conditionally pathogenic Enterobacteriaceae, Bacteroides ($p < 0.05$), and Corynebacterium. Other microbiological indicators showed no significant changes. Thus, for all degrees of dysbiosis, the use of Anethum graveolens (dill) and its decoction, in combination with the placement of ceramo-metal and ceramo-ceramic prostheses in the dental arches, was observed to improve the oral microbiocenosis by up to 70%.

Analysis. It is well established that the human microbiota plays both **protective and pathogenic roles**. Therefore, maintaining a **balanced microbial landscape in the oral cavity** is crucial for preventing complications of dental diseases and, in certain cases, has significant therapeutic value. In line with the perspectives of numerous **international and local authors**, we support the use of the term **"dysbiosis"** to describe quantitative changes in **protozoa, fungi, and viruses**. Based on the objectives of our study, we also constructed a **reference profile of the oral microbial landscape** in healthy individuals.

In all participants of the study, the oral cavity microflora was analyzed using laboratory microbiological methods, and the obtained data were compared with published literature. Subsequently, we aimed to define microbiological and clinical criteria for dysbiosis according to its severity. For this purpose, 60 individuals who visited the Andijan City Dental Polyclinic for oral sanitation were included. Their dental status was assessed, and during the clinical examination, caries intensity, periodontal tissue status, oral hygiene, and Silness–Löe indices were recorded. Analysis of the OC in healthy respondents demonstrated that the tongue dorsal surface index (TDSI) increased significantly with worsening dysbiosis from Grade I to Grade III ($p < 0.05$; $p < 0.025$). Similarly, dental indices including CPI, PHR, Silness–Löe, and PT status showed the same trend. Additionally, the presence and construction type of dental prostheses (ADPs) were examined in relation to the state of oral microbiocenosis, while the impact of URT, and CVS pathologies on OC dysbiosis was also assessed. When treating Grade III dysbiosis, a positive correlation was observed between the improvement of all clinical-dental indices and the normalization of oral microbiocenosis, which was confirmed by statistical analysis.

Conclusion

In healthy adults, the normal quantitative ranges of the oral cavity (OC) microflora are as follows: Lactobacillus – 10^3–10^4 CFU; Streptococcus spp. – 10^5–10^8 CFU; Str. pyogenes – 0; Leptotrichia – 10^2–

10^4 CFU; Staphylococcus spp. – 10^2–10^4 CFU; Candida spp. – 10^2–10^3 CFU; conditionally pathogenic Enterobacteriaceae – 10–10^2 CFU; Corynebacterium – <10^2 CFU; Bacteroides – <10^3 CFU; Veillonella – 10^3–10^8 CFU; Fusobacterium – 10^3–10^4 CFU; Staph. aureus – 0; Neisseria – 10^5–10^7 CFU.

Oral dysbiosis is classified by severity as follows: Grade I – reduction of resident microflora; Grade II – alterations in both resident and conditionally pathogenic microflora; Grade III – pronounced overgrowth of Candida spp. The severity of dysbiosis and deterioration of oral hygiene are influenced by carious lesions, periodontal pathologies, and the presence of dental prostheses (ADPs). In particular, ADPs made of various constructions and metal alloys, especially mixed-metal prostheses, negatively affect the oral microbiota through local immunological disruption. Moreover, pathologies of the upper respiratory tract (URT), gastrointestinal tract (GIT), and cardiovascular system (CVS) contribute to instability of oral hygiene.

Restoration and continuous correction of the OC microbiocenosis can be effectively achieved by replacing conventional prosthetic constructions with zirconia and ceramo-metal prostheses, combined with oral rinsing using local Anethum graveolens (dill) decoction and chewing fresh dill leaves 2–3 times daily, which demonstrates positive microbiological and clinical outcomes.

Declarations

Ethics approval and consent to participate: The study protocol was reviewed and approved by the Local Ethics Committee of the Center for the Development of Professional Qualifications of Medical Workers under the Ministry of Health of the Republic of Uzbekistan with the participation of the Department of “Dentistry, Pediatric Dentistry and Orthodontics.” The decision approving the study was issued as Protocol No. 6 dated September 03, 2025. Prior to enrollment, all patients were provided with comprehensive information regarding the objectives, tasks, methods of the study, possible risks, and anticipated benefits. Written informed consent for participation in the study and the use of clinical data for scientific purposes was obtained from all participants, with strict adherence to confidentiality principles. The study did not cause any harmful physical or psychological effects on the participants. Personal data were coded and processed in anonymized form in accordance with medical confidentiality requirements.

Availability of data and materials. All data used in this review are contained in publicly available publications listed in the references. The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

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Djambilov R.S. – conduct of the research;

Gafforov S.A. – supervision of manuscript preparation;

Sobirov A.A. – manuscript formatting;

Usmonov B.A. – writing and formatting of the text;

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Gafforova S.S. – text editing.

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Submission and Peer Review. The manuscript was submitted to the journal on the authors' own initiative.

Clinical trial number: not applicable.

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Figures

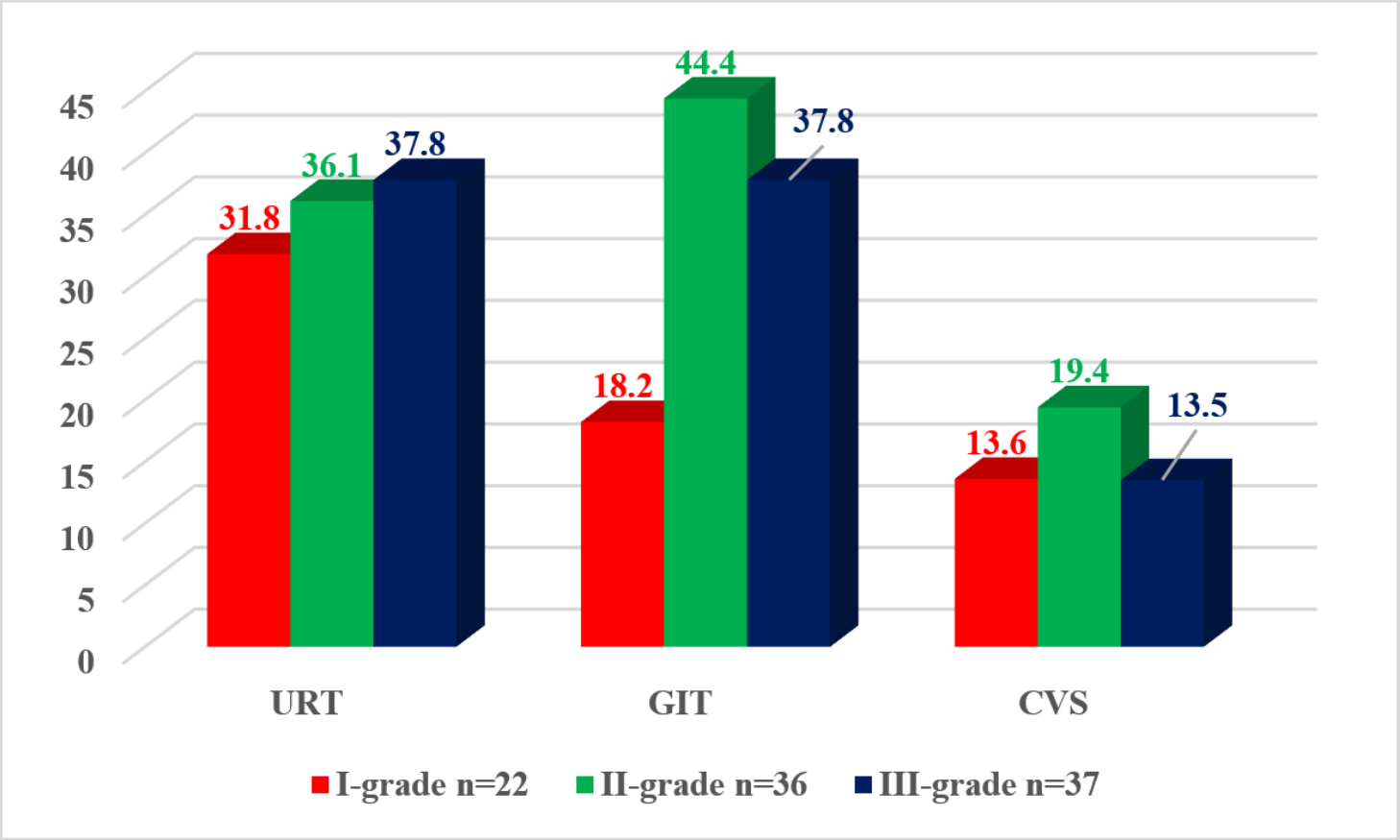

Figure 1

Description of identified somatic pathologies (%) in participants of the main group (MG).