

## EDENTULISM COMPLICATIONS IN PATIENTS ELIGIBLE FOR HYBRID PROSTHETIC TREATMENT. A CROSS-SECTIONAL STUDY

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STUDY ON EDENTULISM COMPLICATIONS IN PATIENTS ELIGIBLE FOR HYBRID PROSTHETIC TREATMENT. A CROSS-SECTIONAL STUDY (Abstract). Aims of study. Patients with extended partial edentulism or complete edentulism, eligible for hybrid prosthetic solutions, are frequently affected by edentulism complications. The **aim** of our study was to find out the distribution of the edentulism complications that can impair biomechanical stability of the prosthetic treatment in patients eligible for hybrid prostheses. **Materials and methods:** A descriptive cross sectional, retrospective study, was conducted in Clinical Learning Base of Faculty of Dental Medicine, “Grigore T. Popa” University of Medicine and Pharmacy Iasi. 150 subjects with partial extended or complete edentulism (mean age 61,54 +/- 8,99 yrs.), eligible for hybrid prosthetic therapy were evaluated. Patients were divided in two groups: Group A (n=96): patients with partial reduced or extended edentulism that were eligible to hybrid prosthetic therapy, retained by fixed teeth-supported prosthetic restoration; Group B (H-PFR/IP) (n=54): patients with total or subtotal edentulism that were eligible to implant-supported hybrid prosthetic therapy, retained by fixed implant-supported prosthetic restorations. Data were collected regarding the patients' variables and edentulism complications. The need for therapeutic interventions in the pro-prosthetic and pro-implant stage was evaluated. **Results:** Significantly higher percentage of edentulous arches in Group B (90.9%) experienced severe bone resorption compared to Group A (45.6%). Temporomandibular joint pathology was notably more prevalent in Group B (94.4%) than in Group A (51.0%) (p <0.001\*\*). Group B had a higher prevalence of muscular disorders (77.8%) compared to Group A (32.3%) (p <0.001\*\*). Mandibular-cranial misalignments were significantly more common in Group B (88.9%) than in Group A (52.1%) (p <0.001\*\*). Temporomandibular disorders were significantly more prevalent higher in patients from Group B (94.4%) when compared to Group A (54.2%) (p <0.001\*\*). **Conclusions:** Patients eligible for hybrid prostheses consisting of removable dentures retained by fixed implant-supported bridges have significantly higher percentages of complications and need for pro-implant therapeutic interventions than patients eligible for removable dentures retained by fixed implant-supported bridges. **Keywords:** EDENTULISM, COMPLICATIONS, HYBRID PROSTHESIS.

Edentulism is a global concern, with projections indicating an increasing need for complete dentures and removable den-

tures in the future. Complete edentulism is the final result of a multifactorial process involving both biological and patient-

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related factors. Among older adults, an increase in the number of comorbidities was found to be predictive of the onset of edentulism, with this pattern of association observed consistently across two longitudinal study periods. As the number of comorbidities rises, older adults may face a greater likelihood of tooth loss over time (1). Nonregular dental attenders were more likely than regular dental attenders to become edentulous, while smokers were more likely than non-smokers to become edentulous (2). Patients who are completely edentulous were found to be at higher risk for several health issues, including poor nutrition, coronary artery plaque formation, smoking, diabetes, rheumatoid arthritis, and various cancers (3). An increased number of missing teeth to be replaced, increases the likelihood of a removable restoration (4). Modern treatments based on combination of teeth-supported fixed bridges and hybrid removable dentures as well as implant-supported hybrid dentures helps both in minimizing the loss of residual alveolar ridges, rehabilitation of the masticatory and aesthetic functions, and the social reintegration (5).

Designing a hybrid prosthesis requires a thoughtful and systematic approach, grounded in strong clinical and technological expertise. The treatment of partially extended edentulism demands a comprehensive understanding of the case, including clinical indications and elements of maintenance, support, and stability (6). The treatment plan must take into account the aesthetic aspects, the remaining teeth on the dental arches and the tissues of the prosthetic field (7). The extraoral clinical examination reveals aspects that individualize the prosthetic treatment plan by identifying pre-existing conditions such as muscle dysfunction and temporo-

mandibular joint (TMJ) pathology, which may restrict mouth opening and cause lateral deviation. It is crucial to assess the origin of these disorders, their etiology, and the extent of morphological and functional impairment (8). A successful hybrid prosthetic treatment requires effective approach of complications of partial and complete edentulism in the pre-prosthetic, pro-prosthetic and pro-implant stages. While residual ridge resorption remains the primary intraoral complication of edentulism, the planning of the treatment of the edentulous patient candidate to hybrid prosthetic treatment must approach complications such as need for grafting of the severe resorbed alveolar bone, and occlusal rehabilitation and rehabilitation of the cranio-mandibular relationships (5). To improve planning of the treatment of the edentulous patients in the pre- and pro-prosthetic stages, as well as in the pro-implant stages, clinical-biological indices (systemic status, dental support, periodontal support, mucosal support, alveolar bone support, occlusion, cranio-mandibular relationships) must be assessed (5). Management of the full and partially edentulous arch requires also a thorough understanding of the vertical and horizontal restorative space needed for various types of hybrid prostheses. The restorative space specific for each type of hybrid restoration should be carefully considered during treatment planning to avoid lack of stability, aesthetics compromise, and inadequate contours of the future denture. For patient candidate to implant-supported hybrid prosthetic treatment, the minimum vertical space needed is as follows: fixed screw-retained (implant level): 4-5 mm; fixed screw-retained (abutment level): 7.5 mm; bar overdenture: 11 mm; fixed screw-retained hybrid: 15 mm. Regarding horizontal space, calculations must

be addressed to the discrepancy between implant and tooth positions (9). In cases of patients with complete edentulism, the physiological mandibular position must be established before proceeding with immediate loading. The use of interim removable prostheses for a few weeks can be beneficial to test the new occlusion in centric relation and to validate the prosthetic plan. Once the correct intermaxillary relationships are achieved, transferring them from provisional to final prostheses can be challenging, as impressions or scans of edentulous arches lack reference points for intermaxillary records. Anthropometric indices may be used to improve aesthetic outcome, due to reproducible results related to perioral and overall facial morphology as well as the occlusal vertical dimension (10).

Expert system-based applications allow for the integration of data from medical history, along with information gathered from clinical and paraclinical examinations, to initially evaluate the parameters of the prosthetic field. Following the pre-prosthetic, pre-implant, and pro-implant stages, as well as after completing temporary prosthetics, these applications conduct a secondary evaluation before the final prosthetic treatment to compare the prosthetic field indices recorded during the initial and secondary evaluations (11). The software applications and expert systems utilized for assessing mucosal and osseous support parameters, as well as for planning the surgical implant stage, rely on data derived from CBCT images. Applications based on CBCT image processing have demonstrated significant value in preoperative diagnostics and the planning of techniques for implant site rehabilitation, including the dental implant insertion phase (12-15). Digital workflow allows for the adjustment of the vertical dimension of

occlusion, while ensuring excellent adaptation of the prosthesis to the soft tissues, and decreases the number of sessions required to install the definitive implant-supported hybrid prosthesis (16-18).

The aim of our study was to find out the distribution of the edentulism complications that can impair biomechanical stability of the prosthetic treatment in patients eligible for hybrid prostheses.

## MATERIALS AND METHODS

Study groups included a total number of 150 subjects with partial extended or complete edentulism (gender: 82 males, 68 females; mean age 61.54 +/- 8.99 yrs.), selected from Clinical Learning Base of Faculty of Dental Medicine, "Grigore T. Popa" University of Medicine and Pharmacy Iasi, Romania, between 30.02.2023 and 30.05.2024 (tab. I). All patients were eligible for hybrid prosthetic therapy. Patients were divided in two groups: Group A (H-PFR/T) (n=96): patients with partial reduced or extended edentulism that were eligible to hybrid prosthetic therapy (maxillary and/or mandibular hybrid prosthesis using a substructure of metal covered by acrylic teeth, retained by fixed teeth-supported prosthetic restorations); Group B (H-PFR/IP) (n=54): patients with total or subtotal edentulism that were eligible to implant-supported hybrid prosthetic therapy (maxillary and/or mandibular hybrid prosthesis using a substructure of metal covered by porcelain fused to metal teeth, retained by fixed implant-supported prosthetic restorations).

Clinical and paraclinical evaluations were performed for each patient. Data were collected regarding the type of edentulism and Kennedy class, number of missing teeth, absence or presence of malocclusion, temporo-mandibular joint pathology, mus-

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cular disorders, status of the cranial-mandibular relationships. Each patient was diagnosed for the presence or absence of the stomatognathic system disorders

(TMD- temporo-mandibular disorders). The same methodology, clinical procedures, and evaluation criteria were used for patients in both study groups.

**TABLE I.  
Socio-demographic parameters of patients eligible to hybrid prosthetic treatment**

		n	%
Gender	F	68	45.3
	M	82	54.7
Age groups	41-50	13	8.7
	51-60	50	33.3
	61-70	60	40.0
	71-80	27	18.0
Type of hybrid prosthesis	H-PFR	96	64.0
	H-PFR/IP	54	36.0
Total		150	100.0

**Statistical analysis.** Statistical analyses were conducted using *Microsoft Excel* and *SPSS version 29.0*. For qualitative data (where values represent categories), frequency distributions were created. The determined values were graphically represented using histograms (in various forms), and for qualitative variables, Pie Charts were also used. For numerical data, we calculated descriptive statistics parameters, including the mean, standard error of the mean, standard deviation, and minimum, maximum, and median values. The t-Student test was used for comparisons between samples, after verifying that the value distribution follows a normal distribution using the Kolmogorov-Smirnov goodness-of-fit test. The threshold of statistical significance was  $p < 0.05$ .

**RESULTS**

Table II compares features and complications of edentulism in patients eligible for hybrid prosthetic therapy between Group A (H-PFR/D) and Group B (PFR/IP). Table III exposes features and edentulism complications related to the

maxillary and mandibular arches. Percentages of patients eligible for hybrid prosthetic treatments were higher for males (54,7%) when compared with females (45,3%), with similar proportions intra-groups ( $p=0.870$ ). In group A percentages of patients were highest in age group 51-60 yrs. (42,7%), followed by age group 61-70 yrs. (40,6%). In group B percentages of patients were highest in age group 61-70 yrs. (38,9%), followed by age group 71-80 yrs. (44,4%). Highly significant differences regarding the distribution of patients according to age were found between groups ( $p < 0.001^{**}$ ). Group B had a significantly higher percentage of patients with mandibular edentulism (33.3%) compared to Group A (17.7%), while higher percentage (44,4%) of patients from Group B had maxillary edentulism when compared to patients from Group A (29,2%). Additionally, maxillary and mandibular combined edentulism was more prevalent in Group A (53.1%) than in Group B (22.2%), with a p-value of  $0.001^{**}$ .

TABLE II.

**Features and edentulism complications of patients eligible for hybrid prosthetic therapy**

		GROUP A (H-PFR/T)		GROUP B (H-PFR/IP)		Total		Chi-squared	p-value
		N	%	N	%	N	%		
<i>Demographics</i>									
Gender	F	44	45.8%	24	44.4%	68	45.3%	0.027	0.870
	M	52	54.2%	30	55.6%	82	54.7%		
Age groups	41-50	13	13.5%			13	8.7%	47.150	<0.001**
	51-60	41	42.7%	9	16.7%	50	33.3%		
	61-70	39	40.6%	21	38.9%	60	40.0%		
	71-80	3	3.1%	24	44.4%	27	18.0%		
<i>Edentulism parameters</i>									
Edentulous arch	MD	17	17.7%	18	33.3%	35	23.3%	13.801	0.001**
	MX	28	29.2%	24	44.4%	52	34.7%		
	MX + MD	51	53.1%	12	22.2%	63	42.0%		
Edentulism type	PEE	85	88.5%			85	56.7%	141.689	<0.001**
	PRE	9	9.4%			9	6.0%		
	TE	2	2.1%	45	83.3%	47	31.3%		
	SE			9	16.7%	9	6.0%		
Kennedy class	I	33	34.4%						
	I + I	30	31.3%						
	I + II	12	12.5%						
	I + IV	6	6.3%						
	II	12	12.5%						
	II + II	3	3.1%						
<i>Edentulism complications</i>									
Medium/advanced bone resorption	Yes	47	49.0%	48	88.9%	95	63.3%	23.729	<0.001**
	No	49	51.0%	6	11.1%	55	36.7%		
Malocclusion	Yes	79	82.3%	54	100.0%	133	88.7%	10.785	0.001**
	No	17	17.7%			17	11.3%		
TMJ pathology	Yes	49	51.0%	51	94.4%	100	66.7%	29.297	<0.001**
	No	47	49.0%	3	5.6%	50	33.3%		
Muscular disorders	Yes	31	32.3%	42	77.8%	73	48.7%	28.622	<0.001**
	No	65	67.7%	12	22.2%	77	51.3%		
M-C misalignments	Yes	50	52.1%	48	88.9%	98	65.3%	20.671	<0.001**
	No	46	47.9%	6	11.1%	52	34.7%		
Dishomeostasis	Yes	40	41.7%	30	55.6%	70	46.7%	2.679	0.102
	No	56	58.3%	24	44.4%	80	53.3%		
TMD	Yes	52	54.2%	51	94.4%	103	68.7%	26.059	<0.001**
	No	44	45.8%	3	5.6%	47	31.3%		
Total		96	100.0%	54	100.0%	150	100.0%		

PEE- partial extended edentulism; PRE- partial reduced edentulism; SE- subtotal edentulism; TE- total edentulism

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**TABLE III.  
Distribution of the maxillary and mandibular arches  
in patients eligible for hybrid prosthetic therapy**

		GROUP A (H-PFR/T)		GROUP B (H-PFR/IP)		Total		Chi-squared	p-value
		N	%	N	%	N	%		
Gender	F	66	44.9%	27	40.9%	93	43.7%	0.295	0.587
	M	81	55.1%	39	59.1%	120	56.3%		
Age group	41-50	23	15.6%			23	10.8%	71.344	<0.001**
	51-60	62	42.2%	15	22.7%	77	36.2%		
	61-70	59	40.1%	21	31.8%	80	37.6%		
	71-80	3	2.0%	30	45.5%	33	15.5%		
Arch	MD	68	46.3%	30	45.5%	98	46.0%	0.012	0.913
	MX	79	53.7%	36	54.5%	115	54.0%		
Edentulism type	PEE	130	88.4%			130	61.0%	204.022	<0.001**
	PRE	15	10.2%			15	7.0%		
	TE	2	1.4%	48	72.7%	50	23.5%		
	SE			18	27.3%	18	8.5%		
Kennedy class	I	111	75.5%						
	II	30	20.4%						
	IV	6	4.1%						
Moderate/severe bone resorption	Yes	67	45.6%	60	90.9%	127	59.6%	38.880	<0.001**
	No	80	54.4%	6	9.1%	86	40.4%		
Total		147	100.0%	66	100.0%	213	100.0%		

Group A predominantly consisted of patients with partial extended edentulism (88.5%), whereas Group B had a higher prevalence of total edentulism (83.3%). The difference was statistically significant with a p-value of <0.001\*\*. Regarding the distribution of the severe alveolar bone resorption, a significantly higher percentage of patients in Group B (88.9%) experienced advanced bone resorption compared to Group A (49.0%), with a p-value of <0.001\*\*. All patients in Group B (100%) exhibited malocclusion, compared to 82.3% in Group A, with a significant difference (p-value of 0.001\*\*). TMJ pathology was notably more prevalent in Group B (94.4%) than in Group A (51.0%), reflected by a p-value of <0.001\*\*. Group B had a

higher prevalence of muscular disorders (77.8%) compared to Group A (32.3%), with a significant p-value of <0.001\*\*. Mandibular-cranial misalignments were significantly more common in Group B (88.9%) than in Group A (52.1%), with a p-value of <0.001\*\*. Temporomandibular Disorders were significantly more prevalent higher in patients from Group B (94.4%) when compared to Group A (54.2%), with a p-value of <0.001\*\*. No significant statistical difference was found in the incidence of dishomeostasis between the groups (p-value = 0.102). The comparison of parameters and edentulism complications related to the edentulous maxillary and mandibular arches, between Group A (H-PFR/T) and Group B (H-PFR/IP), ob-

served highly significant statistical differences ( $p < 0.001^{**}$ ) between the groups in the distribution according to age, edentulism type, and presence of moderate/advanced alveolar bone resorption. According to age, Group B had a notably higher percentage of edentulous arches in the 71-80 age group (45.5%) compared to Group A (2.0%), while Group A had a higher representation in the 51-60 and 61-70 age groups. According to the edentulism type, Group A predominantly consisted of arches with extended partial edentulism (88.4%), while Group B had a much higher proportion of total edentulism (72.7%). Significantly higher percentage of edentulous arches in Group B (90.9%) experienced severe bone resorption compared to Group A (45.6%).

## DISCUSSION

The objectives of our study were to investigate edentulism complications that can impair biomechanical stability of the future hybrid prosthetic treatment.

In a comparative analysis between patients from Group A (hybrid removable prostheses retained by fixed teeth-supported bridges) and Group B (hybrid removable prostheses retained by implant-supported bridges), it was observed that Group B exhibited a notably higher prevalence of several edentulism complications compared to Group A. Specifically, a substantially larger proportion of patients in Group B experienced medium to advanced alveolar bone resorption. Additionally, every patient in Group B showed signs of malocclusion, whereas a smaller portion of Group A was affected. TMJ pathology was markedly more common in Group B, with

nearly all patients being affected, in contrast to a significantly lower proportion in Group A. Similarly, muscular disorders were more frequently observed in Group B, where the prevalence was more than double that seen in Group A. Mandibular-cranial misalignments were also more prevalent in Group B, with a significant difference when compared to Group A. Lastly, Temporomandibular Disorders were observed much more frequently in Group B, with the prevalence being almost twice as high as in Group A. The statistical significance of these findings underscores the considerable disparity in the health profiles of the two groups. Number and position of missing teeth, occlusal relationships, periodontal health of the remaining teeth, and the movement pattern or size of the tongue are considered local factors, while systemic factors include neuromuscular control, age, psychological status, and overall health resilience (19). Oral cavity and temporomandibular joint (TMJ), a mechanically demanding and biochemically dynamic environment, requires therapeutic approaches that can not only restore joint functionality but also adapt to ongoing changes within the joint (20). While multifactorial theory was considered to explain TMJ disorders, various treatment approaches, should be aimed to resolve possible etiology from different aspects (21). Prosthetics specialists must design a comprehensive plan of definitive hybrid prosthetic treatment, while considering the loss of occlusal relationship and adverse effects on the stomatognathic system in patients with extended partial edentulism or complete edentulism. Temporomandibular joint, as a significant component of this system, may also

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be affected by edentulism in the process of supporting mandibular movement. Considering the interrelationship between the components of the stomatognathic system, the impairment of one component often leads to the damage of the others, or at least some of them, while mandibular-cranial misalignment exacerbates the severity of dysfunction, making mandibular recovery more challenging and sometimes limiting therapeutic options (22).

### **CONCLUSIONS**

Most edentulous patients eligible have edentulism complications that will impair biomechanical stability of the future hybrid

prosthetic treatments. Patients eligible for hybrid prostheses consisting of removable dentures retained by fixed implant-supported bridges have significantly higher percentages of complications (medium/advanced alveolar bone resorptions, temporo-mandibular disorders) than patients eligible for removable dentures retained by fixed implant-supported bridges.

### **CONFLICT OF INTEREST AND FUNDING**

The authors declare that there is no conflict of interest, and they received no specific funding regarding this scientific research.

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