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Programvezető: Dr. Varga Gábor, egyetemi tanár

Témavezető: Dr. Szabó György, professor emeritus

CURRENT AND FUTURE PERSPECTIVES ON DENTAL AND ORAL SURGICAL CARE FOR PATIENTS REQUIRING SPECIAL NEEDS TREATMENT

PhD thesis

Ilona Szmirnova

Doctoral School of Clinical Medicine

Semmelweis University

Supervisor: György Szabó, MD, D.Sc.

Official reviewers: József Szalma, DMD, D.Sc.

Szabolcs Gyulai- Gaál, DMD, Ph.D

Head of the Complex Examination Committee: István Gera, DMD, D.Sc.

Members of the Complex Examination Committee: Gábor Gerber, DMD, D.Sc.

Zoltán Rakonczay, MD, D.Sc.

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List of Abbreviations

AAP	American Academy of Periodontology
ANOVA	Analysis of Variance
ASA	American Society of Anesthesiologists
BNO	(Hungarian for ICD) International Statistical Classification of Diseases and Related Health Problems
BPE	Basic periodontal examination
CMV	Cytomegalovirus
DMF-T	Decayed, missing, filled teeth
DSM	Diagnostic and Statistical Manual of Mental Disorders
ECG	Electocardiography
EFP	European Federation of Periodontology
HIV	Human immunodeficiency virus
IBM	International Business Machines Corporation
IQ	Intelligence quotient
NY	New York
RI	Restorative index
SPSS	Statistical Package for the Social Sciences
TIVA	Total Intravenous Anesthesia
WHO	World Health Organizatio

1. Introduction

I have chosen the topic of my dissertation based on my own personal experience. During my resident training at the Department of Oro-Maxillofacial Surgery and Stomatology, I had the opportunity to participate in the dental treatment of patients with disabilities. 3 years later, already having my degree as a dento-alveolar specialist, I started to treat these patients. It was noticeable that the differences in the care of patients without disabilities and those with disabilities are a function of not only of the material conditions, but also of the special treatment of patients. Due to the more serious health condition of the patients treated here, more patience, extraordinary problem solving skills, fast and precise work are needed from the dentist. Compared to their healthy counterparts, patients with disabilities have very limited opportunities, which can be spotted in many areas, including the difficulties they face in the field of dental care.

Perhaps the most important and problematic part of the lives of patients with disabilities is their relationship to their environment. This environment includes the natural or built environment, family, social, health, cultural, transport, information, communication, legal, etc. environment. It is extremely rare that society takes into account that fellow human beings with limited vital functions live among them.

Mitigating disadvantages actually means levelling the opportunities. It is a process leading to making the different social and environmental systems accessible to all, including patients with disabilities. As a result, physical and cultural environment, transport, social and health services, education, job opportunities, entertainment and sport become accessible.

The state is obliged to ensure the enforcement of the rights of patients with disabilities and to operate an institutional system that allows for the compensation of disadvantages of patients living with disabilities, in accordance with the specific possibilities of the national economy. In order to ensure equal opportunities, proper assistance should be extended to patients living with disabilites so that their lives become as full as possible.

2. Mental Retardation

According to the Hungarian Central Statistical Office, in 2022 76,006 individuals had intellectual disability in Hungary [1]. The provision of adequate health and dental care for this group of patients represents a growing challenge for the society [2].The increase in the number of these patients, the observation of human rights regarding healthcare success, the increased need for healthcare impose a growing responsibility on the society [3-5].

The issue of prevention possibilities is coming into view internationally [6-8]. Surveys carried out in different countries, experience in the field of prevention and healthcare, as well as recommendations create important support for the practice in Hungary too. Dental care for patients with intellectual disability is a complex challenge, which can be tackled involving not only dentists, but also psychiatrists, carers and social organizations specializing in this field [9-11].

According to the current Hungarian legal description, a disabled person is „someone with permanent or definitive sensory, communication, physical, intellectual psychosocial disability – or any accumulation of the above -, which, in interaction with environmental, social and other significant obstacles, limit or hamper their efficient and equal to others social participation. “The description included in the law fails to reflect the variety of difficulties this group of patients faces” [12].

2.1 Definition of mental retardation

Intellectual behavior and performance significantly below average, combined with the deficiency of adaptive behavior, which can be spotted already during infancy. Its main characteristics are intellectual disability and social incompetence., and it has different levels of seriousness. The level of seriousness is established through the survey of the intelligence quotient and the social adaptive function.” Based on DSM and BNO classification** [13-15].

**: Diagnostic and Statistical Manual of Mental Disorders and BNO (Hungarian for ICD)

2.2 Causes of mental retardation

Genetic (hereditary) causes leading to intellectual disability

1. Chromosome disorders
- Numerical difference (Down's syndrome, Edwards syndrome, Patau syndrome and others)
- Structural disorders (Cri du chat syndrome, anti-Edwards syndrome and others)
2. Syndromes defined by a gene pair
- Autosomal dominant (Beckwith-Wiedemann syndrome, Sclerosis tuberosa, Marfan syndrome neurofibromatosis, von Willebrand disease and others)
- X-chromosome related dominant (Vitamin D resistant rachitis, Melnick-Needles syndrome and others)
- X-chromosome related recessive syndromes (A and B type Haemophilia, Fragile X syndrome and others)
3. Transition between chromosome related disorders and monogene damage chromosomal mechanisms leading to Mendel's syndrome:
- Microdeletion or „Contiguous deletion" syndromes (Williams-Beuren syndrome, adjacent or osculant gene deletion)
- Gene damage caused by translocation (the breakpoint crosses the gene, thus inhibiting the production of gene product)
- Uniparental disomia and "Genomic imprinting"
4. Neurodegenerative diseases (Hallervorden-Spatz syndrome)
5. Mitochondrial hereditary syndromes [14, 16].

Environmental physical disease causes

The main aetiological causes, which together, sometimes with a cumulative effect, lead to brain damage, mental retardation, are:

- Prenatal environmental damage, such as serious maternal disease (diabetes, sepsis, etc) drug and alcohol abuse, intrauterine infection (rubeola, CMV, toxoplasmosis, HIV, inadequate prenatal care. (Asperger's syndrome, autism spectrum disorder)

- Perinatal risk factors may be: early delivery, protracted delivery, umbilical cord winding onto the neck of the fetus. Apart from these, several other infections, such as herpes virus, may lead to a serious disorder.
- Postnatal environmental harm, such as viral or bacterial infections, environmental toxins (lead or mercury), severe malnutrion, may also lead to mental retardation. [15, 17, 18].

Psychosocial cause

Children, deprived of adequate emotional or intellectual motivation, or neglected individuals may fall prey to very serious developmental disorders. Psychosocial causes most often arise in family or school environments. In case their environment is adequate and stimulating, the development of such children may – based on their average capabilities – show a positive curve [13, 17].

2.3 The extent of damage to intellectual development

The denominations different disciplines use for the classification of mental disorders vary. Psychiatric literature differentiates between mild, medium, serious, and very serious mental retardation. The definition of the intellectual level must be based on the results of clinical examinations, on the examination of adaptive behavior and on the performance at psychometric tests, as there may be significant differences regarding the development of different skills.
IQ levels must be established using standardized, personalized intelligence tests, observing local cultural norms. The established IQ levels serve as indications only, they should not be clung to rigidly [19].

Mild deviation of intellectual development (IQ levels 50 to 69)

- Delayed speech, but the majority can develop verbal skills necessary for everyday life
- Such individuals may become independent in self-support and in the field of practical and household skills, their development, however, is a lot slower than normal.

- Quite often, writing and reading may be a challenge. Specific training may be very helpful to develop such skills.
- It is practical, not intellectual work that such individuals can relate more to.
- Quite often, it is combined with epilepsy, autism, and other developmental, behavioral disorders.

Medium deviation of intellectual development (IQ level 35 to 49)

- The verbal and intellectual development of a person with a medium level of retardation is slow, and the level they can reach in these fields is limited.
- Their self-support and mobility skills are retarded, many need lifelong supervision.
- They show limited progress at school, some, however, may acquire the skills needed for reading, writing, or counting.
- At an adult age very, few can lead an independent life.
- Childhood autism or some other pervasive developmental disorders (epilepsy, neurologically or physically compromised conditions) may be present.

Serious deviation of intellectual development (IQ level 20 to 34)

- Motoric skills are also damaged, rather poor vocabulary, restricted communication.
- Self-injurious behavior may also be characteristic of this group.
- Permanent support is needed to perform every day chores. Some of their skills, however, may still be enhanced.

Very serious deviation of intellectual development (IQ level below 20)

- The patient's intellectual capabilities are seriously restricted.
- Their understanding of speech and gestures is very limited. They express themselves mainly non-verbally.
- Apart from the intellectual damage, sensory and motoric damage may also be present, and the latter may significantly hamper their social activities and using of objects.

- They need constant help and supervision. They can acquire the simplest visual and
  spatial skills, and to a limited extent may be able to indulge in practical activities.

In most cases, organic etiology can also be detected. Serious neurological and other physical disabilities, atypical autism is frequent [18, 20, 21].

2.4 Dental care for patients with intellectual disability

Patients with disabilities are barely capable of attending to oral hygiene on their own, therefore their oral cavity condition is regrettably a lot worse than average. Dental care is carried out with the help of a relative or a caregiver. They do not allow brushing, bite, exhibit aggressive behavior. Jaw and tooth disorders associated with various syndromes may also occur. For example, supernumerary teeth and congestion are very difficult to clean. Defects in the structure of the teeth, such as enamel or dentin hypoplasia, may also appear, showing reduced resistance to acids. A pulpy, carbohydrate-rich diet further worsens the condition of the teeth and the condition of the chewing muscles [22]. Patients rarely show up for control tests. Oral hygiene treatments are omitted, tartar, periodontitis, increased tooth mobility are common phenomena within this group of patients. Because of the incompleteness of the indication of pain, the doctor finds the problematic tooth in a very advanced state of decay and cannot save it, the only solution being extraction [23]. In case of poor oral hygiene, we do not choose tooth preservation treatment, but in many cases tooth extraction. Removed teeth are rarely replaced for non-cooperative patients. Removable replacements can be easily swallowed or aspirated, so only cement-fixed caps and bridges can be made. Parafunctional movements apply different forces to existing teeth and restorations which may move, break and lead to the patient's asphyxia or injury [24, 25].

Depending on the condition of the patient different circumstances must be secured for the treatment: a calm, quiet environment might be sufficient. In most of the cases, however, every treatment - including the examinations - must be performed in anesthesia, in one session whenever possible. This takes a lot of prior organization in the field of professional directives, specialist team, nurses, and operational room personnel [26, 27].

In case treatment is carried out in an institution visited by healthy patients as well, it is very important to provide a separate waiting room for this group of patients with a reception. Unknown environment makes most patients with intellectual disability irritated, quite often expressed in the form of shouting, which would then result in tension among the other patients already during waiting for treatment. A separate waiting room makes it impossible that “normal” patients “stare” at patients with intellectual disability. Treating patients with intellectual disability poses a certain challenge for the dentist. Depending on the seriousness of their mental condition, the behavior of the patients may become unpredictable, the treatment thus taking longer [27, 28]. They might hamper the intervention by their aggressive, defensive or protestant, disobedient behavior. In some cases, it might be sufficient to administer - in local anesthesia - a relaxant with a calming effect, which allows for easier work of the dentist by making the patients more manageable and cooperative. Given their calming, anxiolytic and amnesiac effects, these are medications administered not only to patients with disabilities but also ones which are a great help in treating psychologically unstable, phobic, anxious patients and ones with increased pharyngeal reflex [23, 29].

When treating patients in anesthesia, it is important to establish the precise anamnesis (hetero anamnesis) prior to treatment. The general condition of the patient allowing, physical examination, tests (laboratory testing, ECG, chest X-ray), and consultations with the anesthesiologist, eventually with the specialist tending to the patient, should take place. This way we get additional information about adjacent conditions, about the intellectual, motoric, or sensory disabilities of the patient [9, 30].

Special tools are used for treating patients with special needs. An anesthesia machine is indispensable for carrying out general anesthesia and other equipment is also needed for monitoring the patients. Following the treatment, it is important to have dormitory background where the patient can be monitored for 2 to 3 hours. Apart from the above physical requirements, personnel also play an important role in providing smooth care for patients. The approach of personnel significantly influences the success of the treatment. Given the variety of the problems, it is indispensable for the team to find a common language and to be adaptable. Finally, when treating these patients, we pay utmost attention to a quiet environment and to minimizing the waiting time [31, 32].

2.5 Steps of dental care in sedoanalgesia and in general anesthesia

Ranking the patients by risk group is carried out based on the classification by ASA (American Society of Anesthesiologists) (see Table 1.)

Table 1. *ASA Physical Status Classification [31, 33]*

ASA PS Classification	**Patient**
ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease not hampering every day activity (e.g.: hypertonia, obesity, diabetes)
ASA III	A patient with severe systemic disease hampering normal daily activity (e.g.: complicated diabetes)
ASA IV	A patient with a severe systemic disease that is a constant threat to life (e.g.: severe renal insufficiency)
ASA V	A moribund patient, who is not expected to survive without operation (e.g.: bleeding malignant tumors)
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes

ASA Class I and II patients may receive sedation. From ASA Class III upward, as physical condition tends to deteriorate, interventions are performed in general anesthesia. Given the severe condition of patients in ASA Class IV and V, respectively, only emergency interventions are possible.

After the patients receive information, declarations of consent and other documentation are signed by authorized persons (guardian or career) [33].

Sedoanalgesia

Sober sedation

This type of dental treatment is recommended in patients with mild intellectual disability who are cooperative, or who present with dental anxiety, phobias, or pronounced pharyngeal reflexes. Sedative-hypnotics or nitrous oxide in combination with local anesthesia may be used [34-36].

Sedative- hypnotics

In cooperative patients with mild intellectual disability, premedication with an oral anxiolytic-analgosedative may be sufficient. The most commonly used agents belong to the benzodiazepine group. These medications are widely used due to their safety profile and the availability of a specific antidote: flumazenil.[37, 38].

Sedation may be light, where defensive reflexes are preserved and the patient remains conscious and cooperative. In deeper sedation, reflexes are less active. The most frequently used agents include midazolam, alprazolam, and diazepam[38-40].

Nitrous oxide

Nitrous oxide is a mild inhalation anesthetic. It is rarely used as a sole agent but may be used to ease short dental procedures. It contributes to analgesia, anxiolysis, and mild sedation within 30 seconds of inhalation, and is associated with rapid onset and recovery. Patients remain responsive, which allows active cooperation during treatment, qualifying this as a form of sober sedation. The effects of the gas wear off within minutes after administration ends. This technique is typically used for procedures such as filling or the extraction of one or two teeth.[37].

General anesthesia

General anesthesia is used for patients with severe intellectual disability who are uncooperative, or for patients in ASA Classes III and IV. General anesthesia refers to the reversible loss of sensation and consciousness induced by medications. It is achieved through the combined use of:

- opioids
- anesthetic agents
- neuromuscular blocking agents

Main characteristics of general anesthesia:

- Analgesia
- Amnesia
- Unconsciousness
- Skeletal muscle relaxation

Following premedication with a benzodiazepine, anesthesia may be induced:

- Intravenously, using opioid, propofol, and muscle relaxant, or
- By inhalation, using sevoflurane followed by opioid and muscle relaxant

In patients with disabilities, anatomical anomalies associated with their condition may present challenges during intubation [41].

Anesthesia can be maintained by repeated intravenous dosing—referred to as total intravenous anesthesia (TIVA)—or by a combination of inhalation and intravenous agents, known as balanced anesthesia.

- Reversal agents may be administered at the end of anesthesia:
- flumazenil for benzodiazepines
- naloxone for opioids
- neostigmine for non-depolarizing muscle relaxants[42-45].

Advantages of general anesthesia:

- Enables treatment of non-cooperative patients
- Allows most dental procedures to be performed in a single session

- Reduces total treatment time, as patient movement does not hinder intervention.

Indications for general anesthesia in prolonged dental procedures

General anesthesia is considered in complex or prolonged dental and oral surgical procedures where local anesthesia is insufficient, patient cooperation is limited, or the extent of the intervention requires immobility. Indications include:

- Surgical removal of impacted or complicated third molars
- Multiple tooth extractions
- Extensive root canal treatments in uncooperative patients
- Surgical exposure and orthodontic traction of impacted teeth
- Enucleation of cysts and removal of benign jaw lesions
- Surgical management of facial trauma
- Full-mouth dental rehabilitation
- Treatment of patients with intellectual or physical disabilities
- Surgery in cases of severe dental phobia

These procedures often exceed 60–90 minutes or require deep sedation.

Discharge criteria after anesthesia:

- The patient is conscious and oriented (if this was the case preoperatively)
- No dental or postoperative complications (e.g., bleeding)
- No vomiting or adverse events observed during 4 hours of postoperative monitoring
- Stable cardiovascular and respiratory status
- Able to dress and walk independently (if applicable preoperatively)
- Able to urinate independently (if applicable preoperatively)

- A responsible escort is present upon discharge [29, 37, 46].

Medications used during anesthesia

Intravenous anesthesia

General anesthesia was induced using:

- 2 mg midazolam
- 0.5–1 mg/kg propofol (with an additional 20–30 mg bolus if needed)
- Oxygen was administered at 2 L/min via nasal probe
- At the end of the procedure, 0.2 mg flumazenil was administered to reverse the effect of midazolam

Intubation anesthesia

Anesthesia was induced with:

- 2 mg midazolam
- 50–100 µg fentanyl
- 1–1.5 mg/kg propofol
- 0.5 mg/kg atracurium

Maintenance of anesthesia was achieved using sevoflurane inhalation with a mixture of 50% oxygen and 50% nitrous oxide. At the end of the procedure, 0.2 mg flumazenil was administered.

After the procedure and recovery from anesthesia, patients were evaluated by rehabilitation center staff. Most patients returned for routine check-ups every 3–6 months. In case of complications, the center's head coordinated with the caregiver.

Risks and side effects of sedative medications

Sedative agents play a vital role in dental and surgical care but may pose certain risks:

Common side effects:

- Respiratory depression: risk of hypoventilation or apnea
- Cardiovascular effects: hypotension, bradycardia, arrhythmias
- Paradoxical reactions: agitation, disinhibition, especially in pediatric or elderly patients
- Prolonged sedation: delayed recovery, impaired psychomotor function
- Nausea and vomiting: especially with benzodiazepines and opioids
- Aspiration risk: due to loss of protective airway reflexes
- Allergic reactions: rare, but possible
- Tolerance and dependence: particularly with prolonged benzodiazepine use

Special considerations:

- In hepatic or renal impairment, drug metabolism may be altered
- Patients with obstructive sleep apnea are at higher risk for airway obstruction under sedation

3. Objectives

The following have been objectives through the doctoral work:

I. To assess the dental status of patients with intellectual disabilities on the basis of a statistically relevant, larger patient base. To compare the data with those of patients undergoing medical rehabilitation (mainly patients with physical diasbilities) and also those of the general population internationally.

II. Acute treatment: The aim of our retrospective study is to summarize, in a global context, the demographic data, the patient base structure and the therapeutic results of the patients treated at the Department of Oro-Maxillofacial Surgery and Stomatology, Faculty of Dentistry, Semmelweis University between 01.10.2014 and 31.12.2018

III. Prevention: To develop and adapt, respectively, a relatively simple prevention procedure, one that suits the patients' intellectual abilities, and to introduce it within a selected community. To assess the results 3 and 6 months later and to compare such results with literature.

4. Patients and method

4.1 Dental status assessment

For the assessment of oral health status in adults with intellectual disabilities, we included two distinct groups of patients. The first group comprised individuals who sought acute dental care at the Rehabilitation Department of Oro-Maxillofacial Surgery and Stomatology between July 1, 2019, and October 2, 2022. The second group included patients examined at the "Nursing Home and Daycare Institute of the Foundation for Equal Opportunities" ("Egyenlő Esélyekért Alapítvány Fogyatékosok Otthona és Nappali Gondozó").

All participants were adults, as our department does not provide treatment for minors. Patients typically presented with supporting documentation from psychiatric or neurological services. Based on clinical and background information, participants were categorized according to the severity of intellectual disability (mild, moderate, or severe), and by residential status (community-dwelling or institutionalized). Dental examinations were carried out with appropriate ethical approval (IV/8158-3/2020/EKU), and informed consent was obtained from parents or legal guardians where applicable. The collected dental data were compared with national data from the average adult population as well as with published findings on individuals with general disabilities.

Data collection

To allow for the precision of data, physical examination of a given patient was performed by two doctors, independently from one another. The DMF-T score (D = decayed; M = missing; F= filled; T = teeth) was established using dental mirror, probe and test lamp.

Statistical analysis

First, we calculated the mean and standard deviation of the D-, M-, F- and DMF-T indices. The patients' D-, M-, F- and DMF-T values were compared to the corresponding scores of the general population (adjusted for sex and age) using two-sample t-tests. Additionally, a t-test was used to compare the scores of patients living in family environments versus those institutionalized.

The relationship between the level of intellectual disability and the D-, M-, F- and DMF-T indices was assessed using one-way analysis of variance (ANOVA). In cases where ANOVA indicated statistically significant differences between groups, *Tukey's honest significant difference (HSD) post hoc test* was applied to determine which group pairs differed significantly.

A significance level of $p < 0.05$ was considered statistically significant. Statistical analyses were performed using SPSS Statistics version 25.0 (IBM Corporation, Armonk, NY, USA).

4.2 Acute treatment

Since its opening on 01.10.2014., 1717 patients with intellectual disability received treatment under anesthesia at the Rehabilitation Department of the Department of Oro-Maxillofacial Surgery and Stomatology, Faculty of Dentistry, Semmelweis University, during the period until 31.12.2018.

Prior to dental intervention a preliminary examination, a condition assessment could only be carried out if anesthesia was not needed. Dental X-ray examination was possible for technical reasons in patients with mild to moderate intellectual disabilities. Acute treatments included incision and tooth extraction in cases of periostitis, as well as root canal therapy or extraction for pulpitis, depending on clinical indications and the patient's condition. Prior to each intervention, a telephone consultation was conducted between the anesthesiologist and the patient's caregiver. As patients with serious intellectual disabilities are difficult to move, internal medicine, cardiology, neurological and other

examinations were only necessary, if the anesthesiologist found it so based on the phone consultation.

4.3 Prevention

For the prevention activity to be introduced, for the sake of the easier execution of tests and for the faster assessment of results, we chose institutionalized patients. We started our work in May 2021 at the Equal Opportunities Foundation Home and Day Care Institute for the Disabled in Csömör (Csömöri Egyenlő Esélyekért Alapítvány Fogyatékosok Otthona és Nappali Gondozó Intézet) with a permit (IV/8158-3/2020/EKU) approved by the Scientific and Research Ethics Committee of the Health Science Council (Egészségügyi Tudományos Tanács, Tudományos és Kutatásetikai Bizottság)

Patient base

After the first survey, the tests were continued in August 2021 and 3 months later in November. The prevention activity (the training of the patients and the caregivers) started after and during the first meeting. A total of 49 patients were enrolled in the program who lived in the same institution.

Method

The patients were examined by three standardized dentists (always the same). Two of them (independently from each other) established the dental score of the patients. The third doctor was a periodontist and examined periodontal disease. We used artificial light, dental mirror, and probe for patient examination; WHO probe for measuring periodontal pouches.

We started the prevention activity with a training period: according to the patient's intellect, the traditional oral hygiene training program was modified. The complex task of brushing teeth was divided into very simple, separate steps, making it easier for the patients to follow the instructions. Each patient received a toothbrush and toothpaste. During the first session, we only taught how to clean the chewing surfaces with a toothbrush, then we continued with the other surfaces. We found it important to teach the

principles of brushing teeth, mainly in the group of patients with mild to medium level of intellectual disability. At the same time, however, we also paid attention to the fact that prevention in the case of these patients must be individualized, and caregivers must assess the individual needs and abilities of the patient beyond the general oral hygiene routine.

Recording the DMF-T index was also part of the examination. While the DMF-T index is not suitable for measuring such short-term prevention activities, Dental Care Level (restorative index, RI), however, shows the ratio of treated and untreated carious teeth.

It is calculated based on the following formula: $RI = F/(D+F) \times 100$, where F stands for filled, restored teeth, D+F for the sum of decayed and filled and restored teeth.

For the patients we examined, BPE (Basic periodontal examination) was registered at the start and the diagnosis was made based on clinical parameters, according to the classification established by the 2018 EFP (European Federation of Periodontology) and AAP (American Academy of Periodontology).

Statistical evaluation

During the statistical evaluation, we used the IBM SPSS Statistics 26 program package. To compare the groups, we used the *Friedman* test, supplementing the study with a post hoc test.

During the examination of the periodontal values, the values recorded for the given patient were aggregated and compared.

5. Result

5.1 Results – assessment of the dental condition of patients

A total of 325 adult patients with intellectual disabilities were included in the dental status assessment. Of the participants, 53.7% were male. The mean age was 33.77 ± 9.98 years, with a minimum of 18 and a maximum of 69 years. Based on the severity of intellectual disability, the sample included 36 individuals with mild, 247 with moderate, and 42 with severe intellectual disability. Regarding living arrangements, 171 patients lived with their families, while 154 resided in institutional care. The mean ± standard deviation of the total DMF-T index of the 325 intellectually disabled persons: 11.04 ± 7.35; average number of carious teeth: D = 3.66 ± 4.61; average number of missing teeth: M = 5.22 ± 5.74. Tooth-preserving treatment was minimal: mean F = 2.16 ± 3.12 (Table 2.).

Table 2. *Average D-, M-, and F- indices and ± variance of patients with intellectual disability(n=325) [47].*

	n (%)	**DMF-T**	**D**	**M**	**F**
Complete sample	325 (100%)	11,04	3,66	5,22	2,16
Mild	36 (11,1%)	11,00	3,19	5,17	2,64
Medium	247 (76,0%)	10,72	3,41	5,24	2,07
Severe	42 (12,9%)	12,98	5,52	5,14	2,31
ANOVA P- value	-	0,1849	0,0184*	0,9934	0,5627

**One-way analysis of variance (ANOVA), significance level: $p<0.05$.*
DMF-T: decayed, missing, filled tooth;

According to ANOVA, the average number of decayed teeth (D-index) differed significantly between severity groups ($p = 0.0184$). Further analysis using *Tukey's HSD post hoc test* revealed that the difference was statistically significant between the moderately and severely intellectually disabled groups ($p = 0.043$).

At a younger age, the average number of carious teeth is higher, later the average number of removed teeth is dominant (Table 3).

Table 3. *Distribution of patients by gender and age group in relation to D, M, F indices and DMF-T [47].*

Age	Patients	n	DMFT		D		M		F	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
≤19	Male	8	3,00	2,39	2,63	2,39	0,25	0,71	0,13	0,35
	Female	3	14,33	9,71	14,00	10,15	0,33	0,58	0,00	0,00
	Total	11	6,09	7,13	5,73	7,27	0,27	0,65	0,09	0,30
20–34	Male	87	8,99	6,29	3,70	4,70	3,17	3,66	2,11	3,41
	Female	83	9,45	6,41	3,32	3,91	3,82	3,83	2,43	2,85
	Total	170	9,21	6,33	3,51	4,32	3,49	3,75	2,27	3,14
35–44	Male	56	12,02	6,68	3,52	4,28	6,04	4,98	2,46	3,48
	Female	47	11,79	6,94	3,98	5,20	5,30	5,04	2,51	3,15
	Total	103	11,91	6,77	3,73	4,71	5,70	4,99	2,49	3,32
45–64	Male	21	16,38	8,78	3,95	5,43	10,90	8,31	1,52	2,52
	Female	17	17,41	8,05	2,47	3,48	13,12	7,62	1,82	3,09
	Total	38	16,84	8,37	3,29	4,66	11,89	7,98	1,66	2,75
65–74	Male	2	28,00	0,00	9,50	3,54	18,50	3,54	0,00	0,00
	Female	1	28,00	-	0,00	-	28,00	-	0,00	-
	Total	3	28,00	0,00	6,33	6,03	21,67	6,03	0,00	0,00

Student t-test, $p<0.05$

DMF-T = decayed, missing, filled teeth

The darker cells show that the average of the patients there differs significantly from that of the general population matched for gender and age.

There is a difference between the dental status of patients living in an institution and in a family. The teeth of those living in a family are in a significantly better condition, their DMF-T index is: 9,76 ± 6,76 vs. 12,39 ± 7,77 (p = 0,0013) (Table 4.).

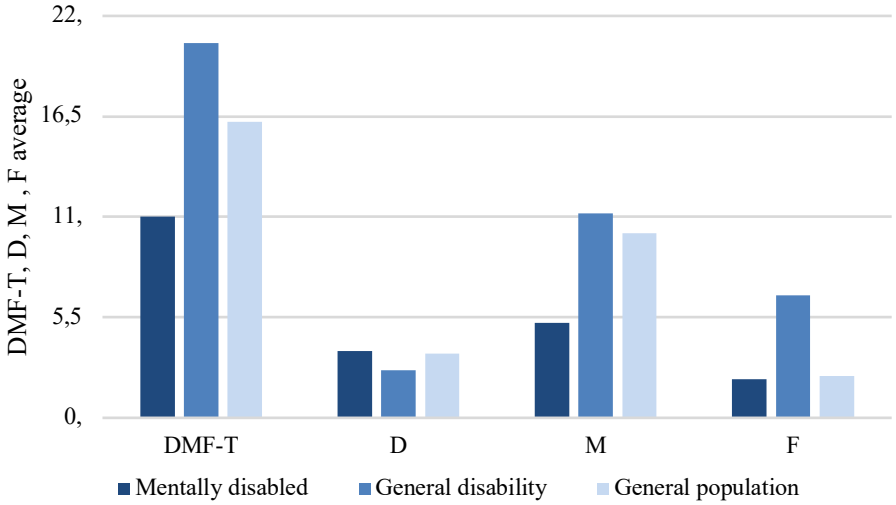
Table 4. *Dental status of patients living in a family environment or being institutionalized [47].*

	Patients living in a family environment (n=171)		**Institutionalized patients (n=154)**		**Two sample t-test P-value**
	Average	Variance	Average	Variance	
D	3,16	4,26	4,22	4,92	0,0392*
M	4,33	4,49	6,21	6,74	0,0037*
F	2,27	3,09	2,04	3,16	0,4970
DMF-T	9,76	6,76	12,39	7,77	0,0013*

**Two-sample t-probe P=0,05 indicates that, except for filled teeth, there is a significant advantage regarding dental status in favor of patients living in a family environment.*

DMF-T = decayed, missing, filled teeth

Figure 1. *Dental status of patients with intellectual disability, patients with general disability and the general population [48].*



Dental status of patients with intellectual disability (n=325); patients with general disability (n=608), and the general population (n=4.606).

DMF-T = decayed, missing, filled teeth

Figure 1. Except for the prevalence of fillings, patients living in a family environment exhibit significantly better overall dental health. Comparing the dental status of patients with intellectual disability, patients with general disability and the general population, we can see that patients with intellectual disability have the most carious teeth, the lowest number of filled teeth and the lowest number of missing teeth [49] [50].

5.2 Results – acute treatment

The most important result is that we have taken a big step forward in the field of acute dental and oral surgery for patients with intellectual disability. Althoug right now we are discussing the activity at the Department of Oro-Maxillofacial Surgery and Stomatology, Faculty of Dentistry, Semmelweis University, Budapest, Hungary, it seems that the 6 centers operating nationwide achieved similar results, albeit with fewer patients. This type of dental and oral surgical treatment has been performed at the clinic for forty years; however, 11 years ago, with the cooperation of the Ministry of Human Capacities, a new

funding system was developed, and in 2014, the Rehabilitation Department was established. Most cases are from patients with mild (125), medium (695) and severe (326) intellectual disabilities. 185 patients had autism. Among the patients with Down's syndrome, there were mild (101) and severe (32) cases. Patients with epilepsy (166) and panic disease (43) also belong here, as their treatment was also carried out in anesthesia, same as the patients with intellectual disability. Among the patients in the group with so-called „other syndromes" 36 patients had Asperger's syndrome, 1 Hallevorden-Spatz syndrome, 2 sclerosis tuberosa, 1 fragile X syndrome, 1 Beckwith-Weideman syndrome, while 3 patients had Williams syndrome. For every patient group, we included gender and average age. 1,115 male and 602 female patients were included in the summary, their average age being 32.8 years. The distribution of patients according to diagnosis can be seen in Table 5.

Table 5. *Breakdown of patients according to diagnosis [23, 48].*

Condition	No. of patients	Male	Female	Average age (years)
Mild level of mental disability	125	84	41	30
Medium level of mental disability	695	393	302	36
Serious level of mental disability	326	284	42	28
Down syndrome mild	101	80	21	33
Down syndrome serious	32	18	14	27
Autism spectrum disorder	185	95	90	29
Asperger's syndrome	36	22	14	29
Hallervorden–Spatz syndrome	1	1	-	31
Sclerosis tuberosa	2	2	-	19
Fragilis X syndrome	1	1	-	21
Williams–Beuren syndrome	3	3	-	25
Beckwith–Wiedemann syndrome	1	-	1	21
Epilepsy	166	124	42	37
Panic disorder	43	8	35	32
Total	**1,717**	**1,115**	**602**	**32,8**

Table 6. shows the nature of the interventions. We can see that most of the interventions were extraction and surgical exploration (4.219 cases, 1.691 patients). That's understandable, because these were acute surgery cases. Dental fillings were usually performed at the same time as acute surgery or at a different time, also under anesthesia. As far as possible, doctors tried to take care of all the decayed teeth, so the 2.616 fillings were performed in 1.610 patients.

Most of the patients had a very neglected dental condition, therefore whenever possible, in most cases scaling was also performed (in 1.184 cases). Cystectomy was performed in 12 patients (10 radicular, 2 follicular cysts). The results of the 12 biopsies: 10 inflammatory lesions and epulis (peripheral giant cell granulomas). Root canal fillings (104 cases) were performed in 87 patients in front teeth, mainly due to acute pulpitis.

Table 6. *Type of dental interventions [23].*

Intervention	No. of interventions
Filling	2,616
Extraction, sculption	4,219
Root canal filling	104
Cystectomy	12
Depuration	1,184
Biopsy	12
Total	**8,147**

After the procedure or anesthesia, the patients were monitored for the necessary period of time by the Rehabilitation Department staff. Most patients were required to undergo regular check-ups (every 3 or six months), if personal control encountered difficulties, the department head contacted the patient's caregiver.

In our study, dental treatment-related complications were recorded in 225 cases, representing approximately 13.1% of all interventions (1,717 cases in total). During surgical interventions, the most common complication was a fracture of the teeth or roots (117 cases). During surgery, bleeding that could not be resolved with sutures did not

occur. Post-operative bleedings were spotted in 12 cases during the observation period and were treated under another anesthesia. Post-operative inflammation (alveolitis) occurred in 41 cases. In most cases, local surgical treatment – primarily excochleation – was sufficient. Systemic antibiotic therapy was required only in 8 cases. After 2,616 fillings, 47 cases of pulpitis resulted in extraction.

During anesthesia, 5 patients had desaturation, 18 patients had agitation. After anesthesia, 80 cases of vomiting or nausea were observed. Shivering was observed in 11 cases.

Complications during dental treatments and anesthesia are listed in Table 7. and 8.

Table 7. *Complications of dental interventions performed under anesthesia [23].*

Complications of dental interventions	**Number of cases**
Intraoperative:	
Fracture of the teeth or roots	117
Postoperative:	
Bleeding	12
Alveolitis	41
Pulpitis	47
Lip or buccal bite injury after anesthesia	8
Total	**225**

Table 8. *Complications during anesthesia [23].*

Complications during general anesthesia	**Number of cases**
Desaturation	5
Vomiting, nausea	80
Agitation	18
Shivers	11
Total	**114**

5.3 Results – Prevention

We can say that our most important result is that our prevention procedure carried out at the Nursing Home and Daycare Institute of the Foundation for Equal Opportunities was successful.

***Figure 2**. Changes of the BPE score [51].*

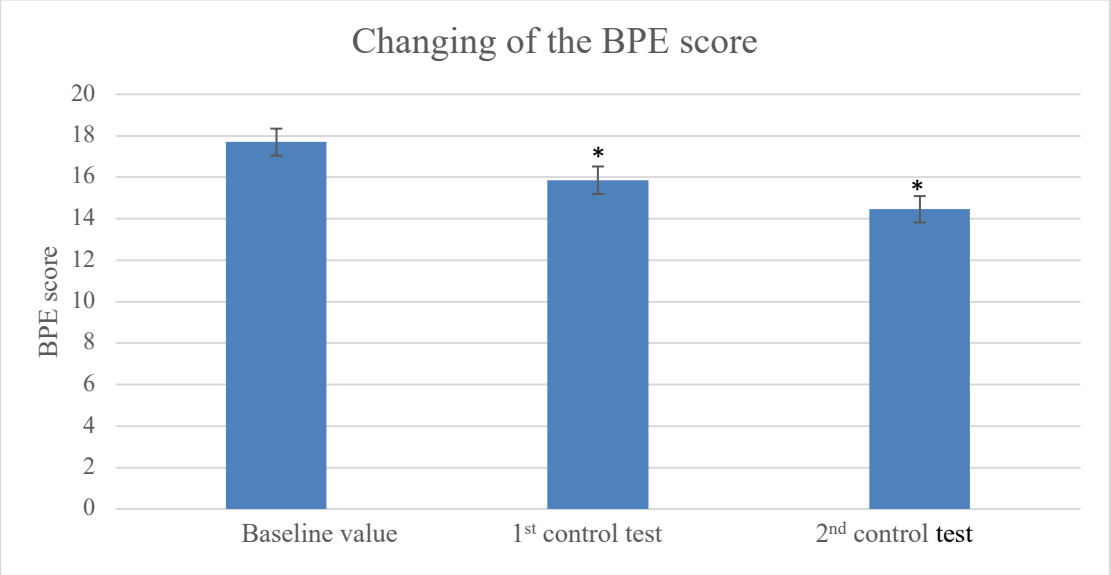


Figure 2. The summary of the values measured for all test patients shows that the improvement of the BPE score compared to the baseline value was significant for both control tests (n = 49). After the first survey, the tests were continued in 3 months. (1st control) 3 months later the 2nd control was. The statistical analysis was the following: baseline value: 17,69 (SEM = 0.65, 1st control: 15.86 (SEM = 0.66), 2nd control: 14.45 (SEM = 0.64). The figure displays the standard error of the mean (SEM).

Values measured for all examined patients. The improvement of the BPE score compared to the baseline value was significant for both control (n=49). Baseline value: 17.69, 1st control test: 15.86, 2nd control test: 14.45. The control tests v. checkups took place every 3 months.

The distribution of patients by gender and age group represents the baseline for 3 months (control test1) and 6 months (control test2) control groups. The improvement of the periodontal status is clearly visible in the control groups. Although the initial periodontal

status of male patients was worse compared to females, an improvement was still observed following preventive interventions. However, the extent of improvement was lower in male patients, as demonstrated in Table 9.

Table 9. *Changes in the BPE score at 3 and 6 months in patients based on the division by sex and age group [51].*

		Starting point	**1. control**	**2. control**	**Level of significance**
	n	Mean	Mean	Mean	
Complete sample	49	17,69	15,86	14,46	p<0.000*
Mild level of intellectual disability	33	17,12	15,48	14,35	p<0.000*
Medium level of intellectual disability	12	19,5	16,75	13,73	p=0.010*
Severe level of intellectual disability	4	17	16,25	17,25	p=0.368

** Paired-samples t-test p < 0.05. The asterisk indicates that there is a significant difference between the values.*

In detail, according to the level of disability, the following results were obtained: in the case of patients with mild intellectual disability, the improvement of the BPE score compared to the baseline value was significant (p=0.000) in the case of the second control test. (n=33) Baseline value: 17.12, test 1: 15.48, 2. test 2: 14.35.

In the case of patients with medium intellectual disability, the improvement of the BPE score compared to the baseline value was significant (p=0.010) in the case of the second control test. (n=12) Baseline value: 19.5, 1. test 1: 16.75, 2. test 2: 13.73.

In the case of patients with severe intellectual disability, due to the small number of patients (4 patients), the values were not indicative, and we did not detect any significant changes compared to the baseline value. The change in BPE score values showed no significant difference. p= (0.368). (n=4) Baseline value: 17,1. test 1: 16.25, test 2: 17.25.

Considering that in such a short period of time (6 months) the change in the DMF-T index could not be expected, instead the change in the RI average was of importance. The change in the average of the RI index was as follows: baseline value: 44.43. test 1: 47.29, test 2: 48.17 values were registered, which means that an improvement took place.

6. Discussion

Assessment of dental status: Although the availability of acute dental care for patients with disabilities has improved significantly in Hungary in recent years—with nearly 3,000 patients treated across five centers over five years—comprehensive dental rehabilitation opportunities remain very limited. As stated in the introduction, progress requires objective data on the oral health of individuals with disabilities. More than 300 patients with intellectual disabilities participated in our study, which is comparable to similar international studies (e.g., 225 patients in India [52], 221 and 207 in Germany [53].)

Our results confirm previous findings *by Micheelis and Schiffner*, who reported that individuals with intellectual disabilities have more decayed and missing teeth, but fewer filled teeth compared to the general population. Their DMF-T index was 13.6 versus 14.5 in the general population[54].

In our cohort (n=325), the mean DMF-T index was 11.04 ± 7.35. The post hoc Tukey HSD test revealed a statistically significant difference in the number of decayed teeth (D index) between patients with moderate and severe intellectual disabilities ($p = 0.043$), but no significant difference was found in the M and F components. This indicates that the worsening dental status observed in the severe group is primarily due to the increased number of untreated decayed teeth, rather than missing or filled teeth.

This is a crucial addition to our interpretation: although the one-way ANOVA suggested an overall difference in the D-index among the three severity groups, only the post hoc test confirmed that this difference is statistically significant between the moderate and severe groups. Therefore, our original statement—"The more severe the degree of intellectual disability, the worse the dental status"—should be interpreted more precisely: a significantly higher number of decayed teeth characterizes the severe disability group compared to the moderate group.

These results align with those of *Pieper et al*., who found worse dental conditions among institutionalized patients with severe intellectual disabilities (mean DMF-T: 19.7)[55].

Our findings also support that patients living in institutions have significantly worse dental health compared to those living with families, which is consistent with several international studies from India and Germany [52, 53].

Patients with disabilities living in the territory of the former German Democratic Republic (including Saxony) have worse dental status than patients living in the Western provinces.

The D-, M- and F-values of patients with disabilities and the age differences clearly show that at a younger age there are more carious teeth that are not treated and that need to be removed later. Thus, in the case of older age groups, missing teeth predominate [53]. Although our original objectives included only the comparison of the dental status of patients with intellectual disability and the general population, we also found it interesting to compare our results with the data of patients with general disabilities (mainly physical disabilities). So how similar or different are the three groups? While the average DMF-T index of the general population (4,606 examined persons) was 16.2, the same was 20.5 for the 608 patients with general disabilities, and the index for the 325 patients with intellectual disabilities was 11.

It is worth comparing the dental condition of patients with intellectual disability, patients with general disability and the general population in the 20-44 age group, considering that more than 85% of the patients examined belonged to this group. The mean ± standard deviation of the DMF-T index in the age group of ≤19 years old of patients with intellectual disability vs. the general population is: 6.09 ± 7.13 vs. 11.24 ± 4.85; 9.21 ± 6.33 vs. 12.76 ± 5.45 in the age group 20–34 years, and 11.91 ± 6.77 vs. 15.40 ± 5.13 in the age group 35-44 years [49].

Breaking down the DMF-T index will help us understand this apparent paradox. The average number of carious teeth is the highest for patients with intellectual disability (D = 3.7). The organization of their dental treatment is more complicated, in most cases it requires anesthesia, so most often only tooth extraction was performed during their care (M = 5.2), and hardly any tooth retention treatment (F = 2.2). In the case of the general population, the average number of filled teeth is F = 2.3, the ratio of carious teeth is the lowest (D = 3.5), and that of missing teeth is M = 10.1. Within the data of patients with general disabilities, the number of missing teeth is predominant (M = 11.2), furthermore,

the number of filled teeth is also higher (F = 6.7), which is why their DMF-T index is so high. This means that in the case of a complaint, extraction is mainly carried out, but tooth retention treatment is also much easier to perform than in the case of patients with intellectual disability (no anesthesia is required).

Acute treatment: In Hungary, there are more than 100,000 patients with intellectual disability whose dental treatment can only be performed under general anesthesia. Between October 1, 2014 and december 31, 2018, nearly 1,800 patients received dental treatment at the Department of Oro-Maxillofacial Surgery and Stomatology, Faculty of Dentistry, Semmelweis University. Between January 2018 and April 2025, a total of 3,513 dental procedures under general anesthesia were performed, including 271 under intubation narcosis (ITN) and 3,242 under intravenous (IV) sedation. Most treatments consisted of tooth extraction, surgical exploration, treatment of inflammatory diseases of the teeth. Given the fact that most of the interventions could only be performed under anesthesia, dental fillings and tooth replacements were only possible in a small number of cases due to time and technical problems compared to the number of patients [23]. The provision of acute care for patients with intellectual disability under anesthesia is a major step forward. Complete dental rehabilitation, however, remains a challenge even in the most developed countries, which is discussed in numerous articles in literature [56] [6, 57, 58]. According to the 2011 census of the Central Statistical Office, there are nearly 100,000 patients with intellectual disability in Hungary who need special care.[59] In order to make progress in the comprehensive dental treatment of patients with intellectual disability, first of all the real needs of the patients had to be assessed. This has not happened in many countries, including Hungary. This is even though *Orsós et al*, conducted a study on the oral health status of patients with general disabilities in *2018.* Among 608 patients with disabilities, involved in their work, there were 13 patients who came from a "Psychosomatic and Psychotherapeutic Rehabilitation Department" [50]. This also confirms the need to separately assess the dental condition of patients with intellectual disability, as their treatment is a bigger and more challenging task than the care of the patients with physical disability [60, 61].

In relation to the treatment of patients with intellectual disability, literature mainly discusses acute care under anesthesia[37, 38, 57]. Some specialists aim for complete

rehabilitation during anesthesia (extraction, filling, replacement), but this prolongs the time of anesthesia and reduces the number of patients *Solanki at al*, reported 200 patients in 10 years [46]. The relevant publications *Wang et al, Corcuera-Flores JR et al, da Rosa et al* emphasize the increased risk factor, since the preoperative examination in patients with severe intellectual disability is much more difficult and complicated than in the case of normal patients [31] [9, 62]. Several authors *McKelvey et al, Wang et al,* emphasize that these patients should be removed from their usual environment for the shortest possible time. Thus, the protocol we use meets international standards [31, 37, 38].

It is interesting to make a comparison regarding intra- and postoperative complications related to anesthesia. After intubating a total of 200 children and adults with intellectual disability, Taiwanese authors *Wang et al* observed nasal bleeding in every sixth patient and agitation in every third case, which was less in the case of intravenous narcosis, but more desaturation, nausea, vomiting, and hypothermia were observed in the latter. In our case, with many more cases of anesthesia, no nasal bleeding was detected (the intratracheal tube was not passed through the nose). There were only a few cases of desaturation and vomiting [37].

Authors from Taiwan *Wang et al* and Spain *Corcuera-Flores JR et al* emphasize that both intravenous and intratracheal anesthesia require constant cooperation between the dentist-oral surgeon and the anesthesiologist [9, 37].

Maeda et al during the sedation of 106 adults with intellectual disability, concluded that intravenous Midazolam leads to a longer awakening phase, and therefore it is not recommended for ambulant treated patients [39].

Sitkin et al sedated 65 children with intellectual disability (ASA II-III) with Sevoflurane. They found that hypoventilation occurred after some time in all patients, and it occurred much more often in overweight patients [42].

According to currently available surveys, in Hungary, between October 2014 and December 2018, approx. 3,000 patients with intellectual disability were cared for. During the treatments, we carried out, it became clear that 90% of the patients would have needed additional tooth-preserving treatment and/or prosthetic treatment, which could only be

performed to a limited extent during the acute care (a total of 2,616 fillings, no replacement).

According to surveys in Hungary *Madléna et al* the caries frequency of the general population is relatively high compared to most European countries: 3.3 DMF-T, 0.8. in the Netherlands [49]. The WHO uses the DMF-T index for the assessment of cariological status for permanent teeth, and dmf-t for milk teeth *[63].*

If we compare the dental condition of patients with intellectual disability to this high DMF-T number of 3.3, we get or would get much worse data. As a matter of fact, there are only a few surveys in Hungarian-language scientific journals about the dental condition of patients with intellectual disability that contain objective data. Internationally, however, there are several publications that compare the state of the dentition and related anatomical structures, jawbones, and temporomandibular joint of intellectually disabled and normal individuals.

Tanboga et al compared the temporomandibular joint conditions of young patients: 64 with intellectual disability and 105 healthy. They found that patients with intellectual disability had significantly more joint problems than healthy individuals [64].

Abeleira et al found significant microdontia of permanent teeth during the survey of 40 patients with Down's syndrome. *Mckinney et al, 2014* assessed the dental status of 2,772 autistic children (aged 15-17) in England. They found that more than 15% did not have access to adequate dental treatment [65].

Chang et al compared the dental status of 102 individuals with intellectual disability with 100 normal individuals. They found that the caries frequency of the former was twice that of normal individuals [66].

Solanki et al carried out the complete dental rehabilitation of 200 intellectually disabled children under anesthesia over ten years. According to their surveys, the more severe the psychiatric illness, the worse the dental status [46, 67].

Naouri et al compared the medical and dental needs of 2,222 institutionalized disabled adults in France with similar needs of the general population. They found that, despite the

much worse dental status, they have five times fewer opportunities to receive appropriate treatment than healthy patients [68].

Chhajed S et al assessed the dental status of 152 mentally retarded Indian children between the ages of 5 and 15 years. They compared the results with the socio-economic situation of the children and the nature of the intellectual disability. They found that the worse the children's social situation is, the worse their dental status is. Children with autism spectrum disorder had better teeth than children with Down's syndrome [52].

Ismailov, *2008* based on the examination of 171 disabled patients, determined that 34% of them suffer from periodontal diseases between the ages of 18 and 25. This number increases to 82% for those over 42 [69].

Mac Giolla Phadraig C et al in a so-called "Delphi Panel" survey in Ireland explored the question of what dental care should do for patients with intellectual disability. Dentists, patients with intellectual disabilities and their representatives participated in the survey. In conclusion, 16 consensus statements were made, which relate to individual treatment options, information flow, training, costs, etc [70].

The most important findings related to the facilities, equipment and staff providing the treatment options. The costs of the treatment were, or would be, largely provided by foundations.

The treatment of patients with intellectual disability is much more difficult, more expensive and the results are less spectacular than those of normal individuals. Healthcare focuses less on these patients. That is why in Hungary, although there has been a big step forward, practically only the issue of acute care has been solved (more or less) [36].

We can observe some (slow) progress in various countries. Suggestions are made, e.g., by *Waldman et al* first, the dental care needs of patients with intellectual disability must be determined through surveys. Based on such surveys, centers should be organized where, in addition to general doctors and psychiatrists, dental care would also be available. Including tooth-retaining treatment and prevention. In addition, private clinics should also be prepared to provide care for patients with intellectual disability. This would be important because while in the 1960s in the United States, a quarter of a million

patients with intellectual disability lived in institutions, 30 years later, with the change in healthcare policy, more than 75% of them were scattered in family homes. Thus, their dental care has become somewhat difficult, because the smaller communities are not prepared to take care of it [10, 27]. All over the world, not only in Hungary, the number of patients in need of not only acute care is far higher than the available capacity (facility, doctors, financial conditions). Therefore, prevention should be prioritized. Several prevention methods have been described, perhaps one of the most spectacular results was reported by *Edwards et al* back in 2002, in the county of Merseyside (near Liverpool in Central-West England), where patients with intellectual disability live scattered. A tender was announced among dentists for the treatment of individuals with intellectual disability. Training programs were organized for the patients and their relatives to teach them the necessary oral care tasks. Doctors were granted special financial assistance, and patients and their relatives could participate in regular, supervised programs. In just a few years, this program significantly reduced the number of patients in need of acute care and brought significant improvements in the dental condition of patients [71] .

Other authors *Montiel-Company& Almerich-Silla et al, Viana et al rinsed* patients' mouths daily with Chlorhexidine spray or Triclosan-zinc solution, which suppressed the persistent gingivitis. Spectacular results were achieved in 2-8 weeks [72, 73].

In some cases, with the development of digital devices, it has become possible for patients with less severe disabilities to receive prosthetic care digitally. In everyday practice, however, traditional and digital processes are used in a mixed manner in such cases [74].

Prevention: Dental treatment of patients with intellectual disability is a difficult task. As mentioned in the introduction most patients can only be treated under anesthesia. Rehabilitation, complete dental rehabilitation takes (would take) a lot of time, so currently we can mainly focus only on acute care. In view of all these circumstances, it would be important to spread the prevention procedures as widely as possible [5, 75].

We can find various methods in literature: at several universities in the United States, it is part of the curriculum, how future doctors should treat patients who require special care (including patients with intellectual disability) [76, 77].

Comparing the brushing habits of normal children and those with intellectual disability of the same age, it was found that the ones with intellectual disability take care of their teeth much less than their healthy peers. Therefore, for the sake of prevention, there is a great need for increased care for patients with intellectual disability [78, 79].

It is also a publication from the United States that children with intellectual disability (the publication reports on the examination of 90 persons) were examined before starting school in the presence of their parents and educated about the necessity of brushing their teeth and oral hygiene in general. The control tests proved that these children later had a much better dental condition than their peers who needed special care [80].

Regarding periodontal diseases, *David Tesini's* survey is interesting: in the United States, the number of mentally impaired patients can be put at 3% (which is roughly the same as the Hungarian data). Due to poor oral hygiene, 90% of them also have periodontal disorders [81].

According to Pakistani author *Wyne,* most patients with intellectual disability have periodontal disease, which is not part of the underlying disease, but rather the consequence of insufficient oral care. The author emphasizes that prevention has absolute priority for the sake of avoiding acute problems and because of the difficulties of rehabilitation. It is necessary to teach these patients (with the involvement of the care staff) about enhanced oral hygiene methods: changing eating habits (less carbohydrates), the use of fluoride toothpaste and mouthwash, etc [82].

Abullais et al, also recommend introducing preventive programs, both for patients treated in institutions and those under family supervision. The programs should preferably be in groups, so they are more effective. Both public and private dentists should participate in state-supported programs. It is very important to remove the plaques that form on the teeth as much as possible. It is the common responsibility of caregivers and dentists to check the effectiveness of the programs [83, 84].

Hungarian authors have several publications where they assess the general and dental diseases of patients with physical disabilities. They also report on their treatment, including the ones carried out in certain institutions. They report on patients treated in rehabilitation institutions for other reasons, draw attention to the importance of their

dental care, without which rehabilitation provided for other reasons cannot be complete. Therefore, it is recommended to launch special programs. These publications are supplemented by our work, the treatment and prevention examination of patients with intellectual disability [50, 85-89].

In the case of our own examinations, the 3- and 6-month control tests did not bring any measurable change (improvement?) in relation to DMT-T. This was not to be expected, because 3-6 months is a short time to make any progress in reducing tooth decay. The welcome (significant) improvement, on the other hand, came about in terms of the periodontal condition. With our relatively simple prevention activity described above, we proved that it is worth continuing our work on a wider scale. Dental care, enhanced (normal) oral hygiene in general, can make a significant difference in a relatively short time. The attitude of the parents or the nursing staff is very important in the implementation of the program.[90-92]The majority of patients with intellectual disability are unable to perform dental care on their own. Others do not yet have the proper motivation to perform oral hygiene tasks. They need help with this [93, 94].

The first part of the rehabilitation is the assessment of needs, the second is the introduction of preventive procedures and the third - the most difficult and expensive - is the carrying out of appropriate surgical and/or tooth-preserving treatments. The first step has been made, the second is in progress, as demonstrated by the current prevention program. The third, partially fulfilled at the level of acute care, has resulted in limited progress regarding tooth retention treatments. That’s where preventive programs help [47].

7. Conclusion- New findings

The new findings of the thesis are the following:

1. The significant and unmet need for preventive and therapeutic dental care in individuals with intellectual disability has been clearly identified.
2. Intellectually disabled patients living in institutions present significantly poorer dental status compared to those living in family settings.
3. No prior comprehensive national survey has been conducted in Hungary to objectively assess the dental care needs of this population.

Based on our own research and international findings, the following conclusions can be drawn:

- The frequency of dental caries and periodontal disease increases with both age and the severity of intellectual disability. Among the components of the DMF-T index, the number of untreated decayed teeth (D) shows the most marked increase in more severe disability groups, while differences in the number of missing (M) and filled (F) teeth are less pronounced.
- Oral hygiene is suboptimal across all disability severity groups.
- Patients with intellectual disability and their caregivers receive limited information and training regarding oral health, and they are often not motivated or adequately supported in maintaining proper oral hygiene.
- Except for acute cases, dental care provision remains insufficient.
- Oral health outcomes could be improved through the implementation of personalized hygiene protocols, such as the use of fluoride-containing toothpaste and therapeutic mouth rinses, along with structured education and motivation of caregivers.

- Effective dental care for this population requires coordinated efforts involving civil organizations, foundations, special education professionals, psychiatrists, and dental professionals.

When compared with data from the general population, the aggregated DMF-T index does not accurately reflect the specific dental challenges faced by individuals with intellectual disabilities. Breaking down the DMF-T index into its components is essential for meaningful comparison: these patients typically have a higher number of untreated decayed teeth (D), an increasing number of missing teeth (M) with age, and fewer filled teeth (F) compared to the general population.

While acute dental care under anesthesia has seen notable improvements, full dental rehabilitation remains severely limited due to logistical and systemic constraints. Therefore, in line with international recommendations, we emphasize the critical role of prevention—both to reduce the need for acute interventions and to compensate for the limited access to restorative procedures requiring anesthesia.

Improved daily oral hygiene and caregiver engagement can lead to substantial positive outcomes, even in the short term. Our findings underscore the urgency of developing new preventive dental care models tailored to this population. These programs should aim to establish long-term oral hygiene habits through patient-centered education and sustained support from both professional and informal caregivers.

8. Summary

Dental care for individuals with intellectual disability presents increasing challenges to modern healthcare systems. In cases of severe impairment, treatment is often only feasible under general anesthesia. Between October 2014 and December 2018, 1,717 adults with intellectual disability were treated under general anesthesia at the Department of Oro-Maxillofacial Surgery and Stomatology, Semmelweis University. To assess their dental status, data from a representative sample of 325 patients were analyzed using the DMF-T index (Decayed, Missing, and Filled Teeth), with comparisons to patients undergoing medical rehabilitation and the general population.

Patients were categorized based on the severity of their disability. A preventive oral health program was launched for 49 residents at the Csömör Nursing Home, with follow-ups at three and six months. While access to acute care has improved, rehabilitation and prevention remain unmet needs. Patients in institutions had worse dental conditions than those living with families, and greater severity of disability was associated with more untreated carious teeth. Although the DMF-T index showed little change over time, periodontal improvement was noted in the prevention group.

No national-level surveys currently exist in Hungary to assess the dental needs of this population. International studies confirm that oral disease prevalence increases with both age and severity of disability. Oral hygiene is generally poor, and patients and caregivers often lack training and motivation. Beyond acute care, services remain insufficient. Interdisciplinary collaboration is essential. The findings confirm that individuals with intellectual disability experience more neglected oral health than the general population, and even small improvements in hygiene can yield significant benefits. Prevention and expanded access to restorative care are vital to improving outcomes in this vulnerable group.

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10. Bibliography of the candidate's publications

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List of tables

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