ISSN 2671-3497 (Online)

INTERNATIONAL JOURNAL

Institute of Knowledge Management

M E D I S

Vol. 3 Issue 4

MEDICAL SCIENCES & RESEARCH

ISSN 2671-3497 (Online)

MEDIS – International Journal of Medical Sciences and Research

Volume 3, Issue 4, December 2024.

https://medisij.com

IMPRESSUM

International Journal of Medical Sciences and Research
(MEDIS IJMSR)
(Volume 3, Issue 4 December 2024.)

Editor in chief:
Prof. d-r Robert Dimitrovski

Publisher:
Institute of Management and Knowledge
Address: Gjuro Gjonovikj, 11/4 , Skopje 1000, Macedonia
Phone: +389 70 207 370, + 381 63 700 4281

http://medisij.com
E-mail: editor@medisij.com

For publisher:
Prof. d-r Robert Dimitrovski

Print:
GRAFOPROM Bitola

Circulation:
50 copies

CONTENTS

DEVELOPMENT OF OCCLUSIVE ARTERIAL DISEASE OF LOWER EXTREMITIES IN PATIENTS WITH DIABETES MELITUS TYPE 2 IN CORRELATION WITH HBA1C LEVEL AND INDEPENDENT RISK FACTOR

Vasileva, D., & Zelnichka, I. (2024). Treatment of peripheral facial paralysis as part of motor neuroreha-bilitation, *MEDIS - Medical Science and Research, 3*(4), 1-6.
doi: 10.35120/medisij030401v UDK: 616.833.17-009.11-085.814.1

TREATMENT OF PERIPHERAL FACIAL PARALYSIS AS PART OF MOTOR NEUROREHABILITATION

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Abstract: The disease of the facial nerve (n.facialis) is in the first place among peripheral neuritis, both in terms of frequency and significance of functional dysfunctions and post-paralytic facial synkinesis can develop in any paralysis of the face and is associated with significant functional and psychosocial consequences for sick patients. The type and severity of nerve injury determine the degree of pathologic change, capacity for regeneration and prognosis for recovery. In the case of facial nerve neuritis, the greatest emphasis is placed on early detection, correct diagnosis of the damage and starting rehabilitation as soon as possible. In addition to drug therapy in the rehabilitation of facial nerve paralysis, the application of physiotherapeutic means, as well as acupressure, a technique from traditional Chinese medicine, has a significant place. Both basic concepts are holistic, with a comprehensive approach to the patient and the determination of treatments based on the differentiation of symptoms. The aim of the research is to analyze the impact of physiotherapeutic means combined with acupressure - a technique from traditional Chinese medicine, in patients with peripheral paralysis of the n.facialis with a moderate degree of functional disorder. Material and methods: Six patients (3 women and 3 men) diagnosed with peripheral paralysis of the facial nerve (4 left side / 2 right side) with a moderate degree of functional impairment are included in the study. For the purposes of the research, the following physiotherapeutic means were applied: thermotherapy, light therapy, electrotherapy - electrophoresis with Novocain and electrostimulation, therapeutic exercises and acupressure on the following points: Zanzhu (BL2), Yangbai (GB14), Taiyang (EX-HN5), Zygoma (SL18), Xiaguan (ST7), Yingxiang (LI20) and Yifeng (TE17). For the purposes of the research, a functional examination with a manual muscle test (MMT) for facial muscles and a test for the subjective feeling of pain is applied to all subjects at the beginning, during the therapies and at the end of the overall motor neurorehabilitation. Results: From the processed results, the influence of physiotherapeutic means in combination with acupressure in patients with peripheral paralysis of n.facialis with a moderate degree of functional disorder on muscle strength and pain intensity is observed and is most pronounced in the first month from the beginning of treatment. Discussion and conclusion: This is a complex research on physiotherapeutic possibilities combined with acupressure as part of modern motor neurorehabilitation to overcome muscle weakness, pain and asymmetry in patients with unilateral peripheral n.facialis. The presence of a positive change in the examined functional parameters is observed after the application of the combination of physiotherapy and acupressure and is most significant in the first month after the beginning of the treatments.

Keywords: physiotherapeutic means, acupressure, peripheral paralysis, facial nerve

Field: Public Health and Medicine

1. INTRODUCTION

The disease of the facial nerve (n.facialis) is in the first place among peripheral neuritis, both in terms of frequency and significance of functional dysfunctions, and post-paralytic facial synkinesis can develop in any paralysis of the face and is associated with significant functional and psychosocial consequences for sick patients.

According to many authors, the main etiological factor for Bell's palsy is viral infection and colds. About 25% of patients with facial neuritis may have persistent moderate to severe facial asymmetry, which has a very serious impact on patients' quality of life. Clinical manifestations are paralysis of the affected facial muscles (hypotonia, hyporeflexia, hypotrophy, fasciculations), enlargement of the eye fissure, inability to close the eyelids, disappearance of forehead lines and ptosis of the labial angle, pain in the ear area, hyperacusis, change of taste, hyperesthesia in the area of the ear and around it, dryness in the oral cavity.

The type and severity of nerve injury determine the degree of pathologic change, capacity for regeneration and prognosis for recovery. In the case of facial nerve neuritis, the greatest emphasis is placed on early detection, correct diagnosis of the damage and starting rehabilitation as soon as possible.

In addition to drug therapy in the rehabilitation of facial nerve paralysis, the application of physiotherapeutic means, as well as acupressure, a technique from traditional Chinese medicine, has a significant place.

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For thousands of years, Chinese medicine has summarized and accumulated a lot of relevant experience in the process of diagnosis and treatment.

Acupressure is a therapy from traditional Chinese medicine that uses stimulation of specific locations (points) on the patient's skin to achieve therapeutic results.

Both basic concepts are holistic, with a comprehensive approach to the patient and the determination of treatments based on the differentiation of symptoms. They are aimed at:

- improvement of blood flow and lymph flow on the affected half of the face.
- improvement of muscle tone and correction of muscle imbalance.
- improvement of nerve conduction and normalization of muscle strength.

2. MATERIAL AND METHODS

Six patients diagnosed with peripheral paralysis of the facial nerve with a moderate degree of functional impairment are included in the study.

Patients are selected according to several inclusion and exclusion criteria, to ensure homogeneity of the research:

- to be between the ages of 25 and 55;
- to be diagnosed with peripheral unilateral paralysis of n. facial,
- to be with stable hemodynamics (arterial pressure and pulse)
- to be without severe insufficiency of the cardiovascular and respiratory systems and
- to be without pronounced cognitive changes

The characteristics of the examined patients are shown in table. 1.

Table.1. Description of patients with peripheral paralysis of n.facialis

Number of patients – gender (women/men)	localization of paralysis left side / right side	Age	Duration of the problem
6 patients (3 w / 3 m)	4 / 2	43,8 ± 12,2	1 months

Source: Authors' own research Vasileva, D. and Zelnichka, I

Physiotherapy methods:

1. Thermotherapy (application method: sterile paraffin masks)
2. Light therapy - Ultraviolet rays and a Bioptron lamp that emits hyperpolarized light.
3. Electrotherapy - electrophoresis with Novocain and electrostimulation
4. Therapeutic exercises for:

- Improvement of blood flow and lymph flow on the affected half of the face. Apply: massage collar, relaxing face massage (on the healthy side) and toning massage (on the affected side).
- Improvement of muscle tone and correction of muscle imbalance. It is applied: treatment with position (the patient should lie on the affected side, which is previously raised) and massage.
- Improving nerve conduction and normalizing muscle strength. Analytical gymnastics is given according to the MMT grade:

• At grade 0, 1, 2 – include: exercises from a relaxed initial position (lying on the back), active exercises with assistance until symmetric with the healthy side, whereby assistance is performed after active muscle contraction, fixation of the healthy side after performing the movement , stimulating techniques – by touch or palpation.

• Above grade 2 – the exercises can be performed from a sitting position, instructions are given for independent performance of the exercises, massage, active exercises with a light load (resistance is given at the beginning of the movement and should not limit the possible range of movement).

5. Acupressure on the following points: Zanzhu (BL2), Yangbai (GB14), Taiyang (EX-HN5), Zygoma (SL18), Xiaguan (ST7), Yingxiang (LI20) and Yifeng (TE17).

Examination and assessment methods:

For the purposes of the research, a functional examination with a manual muscle test (MMT) for facial muscles and a test for the subjective feeling of pain is applied to all subjects at the beginning, during the therapies and at the end of the overall motor neurorehabilitation.

- Manual muscle testing

Manual muscle testing is a functional method of measuring muscle weakness. This facial muscle test has the following 4 grades:

Grade 3 – normal muscle strength and full range of motion
Grade 2 – partial movement, asymmetric of the unaffected facial muscles of the same name
Grade 1 – when trying to move, the muscle shows a slight visible contraction, which is not strong enough for movement
Grade 0 – when trying to move, the muscle does not show visible or palpable contraction

- **Subjective pain test**

The subjective pain test serves to measure the intensity of pain in the patient on a scale from 1 to 10, where score 0 indicates a feeling of no pain, while score 10 - the most pronounced pain..

Statistical methods:

A statistical program is used for quantitative processing of the gifts, where variation (Student-Fisher t-test) and alternative analysis are applied to generalize the changes from the applied treatment.

3. RESULTS

From the processed results, the influence of physiotherapeutic means in combination with acupressure in patients with peripheral paralysis of n.facialis with a moderate degree of functional disorder on muscle strength and pain intensity is observed and is most pronounced in the first month from the beginning of treatment.

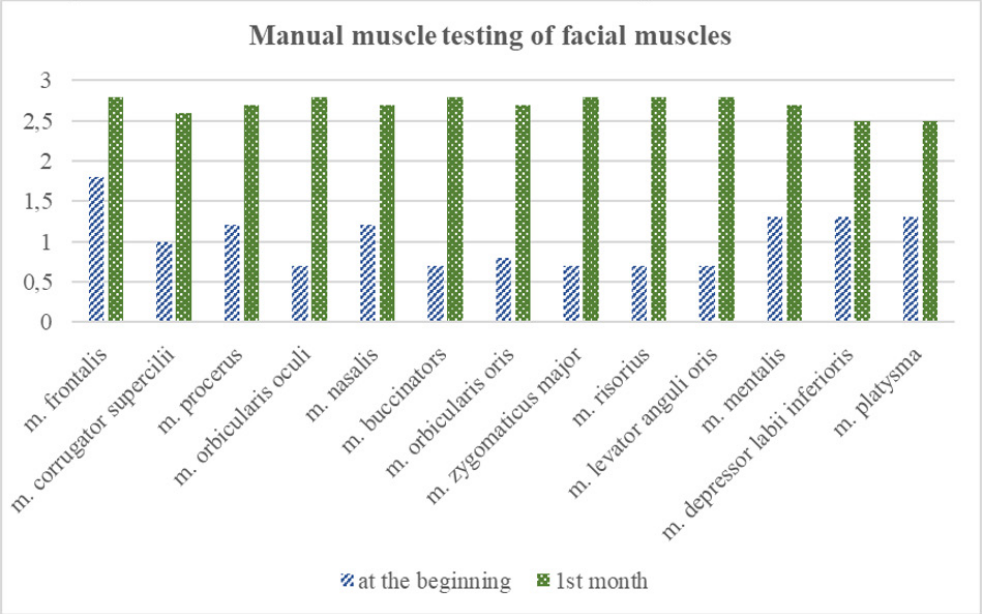
The results of the manual-muscle testing of the affected facial muscles and the changes in the values at the beginning and end of the physiotherapy treatment are shown in table 2, graph 1 and 2.

Tab.2. Presentation of the results of the manual muscle testing of the affected facial muscles

	at the beginning	1st month
m. frontalis	1.8±0.7	2.8±0.2***
m. corrugator supercilii	1.0±0.4	2.6±0.4***
m. procerus	1.2±0.4	2.7±0.2***
m. orbicularis oculi	0.7±0.5	2.8±0.2***
m. nasalis	1.2±0.4	2.7±0.2***
m. buccinators	0.7±0.5	2.8±0.2***
m. orbicularis oris	0.8±0.6	2.7±0.2***
m. zygomaticus major	0.7±0.5	2.8±0.2***
m. risorius	0.7±0.5	2.8±0.2***
m. levator anguli oris	0.7±0.5	2.8±0.2***
m. mentalis	1.3±0.4	2.7±0.3***
m. depressor labii inferioris	1.3±0.6	2.5±0.3***
m. platysma	1.3±0.6	2.5±0.3***

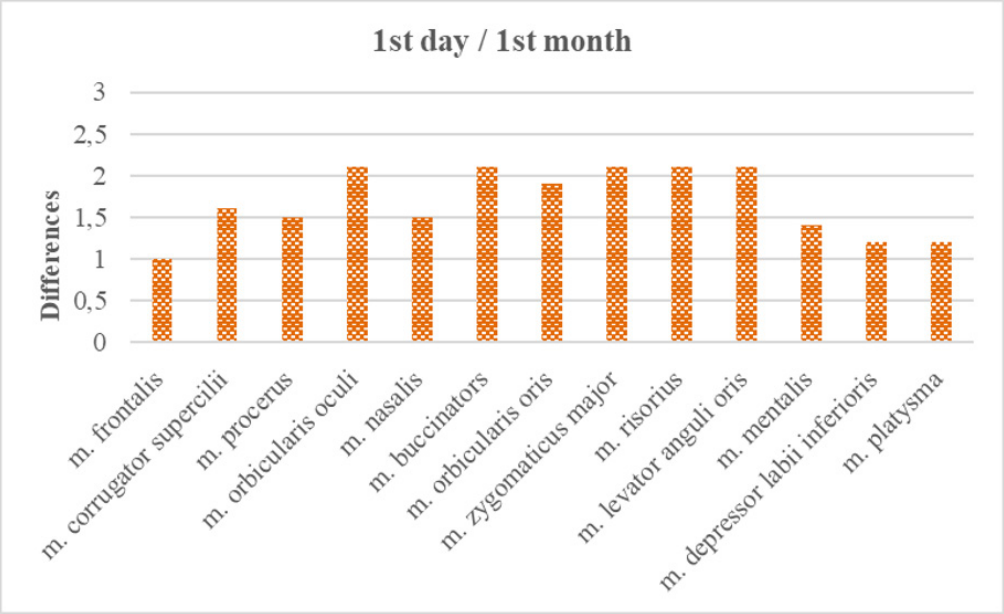
*** p<0,001 – significant changes in changes in manual muscle testing of the affected facial muscles
Source: Authors' own research Vasileva, D. and Zelnichka, I.

Figure 1. Presentation of the results of the manual muscle testing of the affected facial muscles



Source: Authors' own research Vasileva, D. and Zelnichka, I.

Figure 2. Differences in change values from manual muscle testing of facial muscles



Source: Authors' own research Vasileva, D. and Zelnichka, I.

The results of testing the subjective feeling of pain of the affected facial muscles and the changes in the values at the beginning and end of the physiotherapy treatment are shown in table 3, graph 3 and 4.

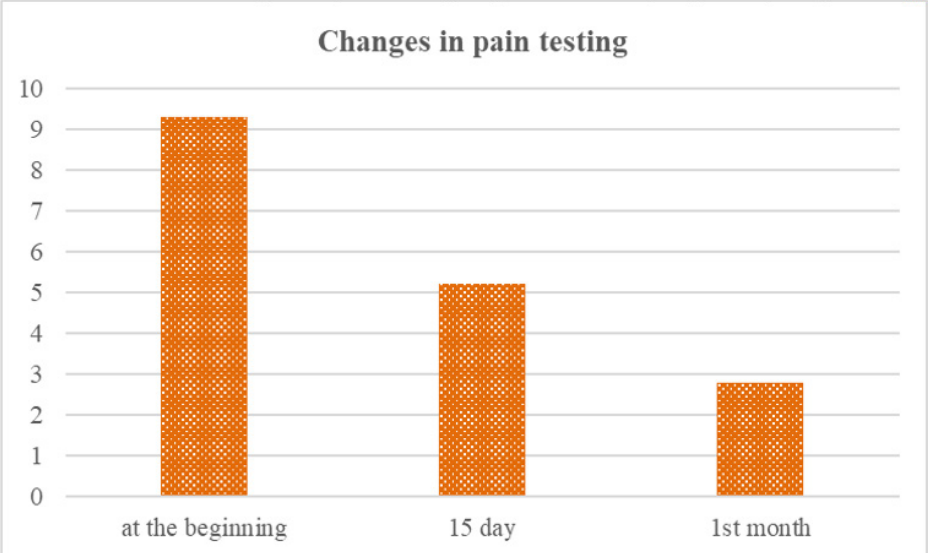
Table 3. Presentation of changes in pain testing in patients with peripheral paralysis of n.facialis

Parameter	At the beginning	15 day	1st month
pain	9.3 ± 0.7	5.2 ± 2.3 ***	2.8± 3.5 ***

*** p<0,001 – significant changes in changes in pain testing

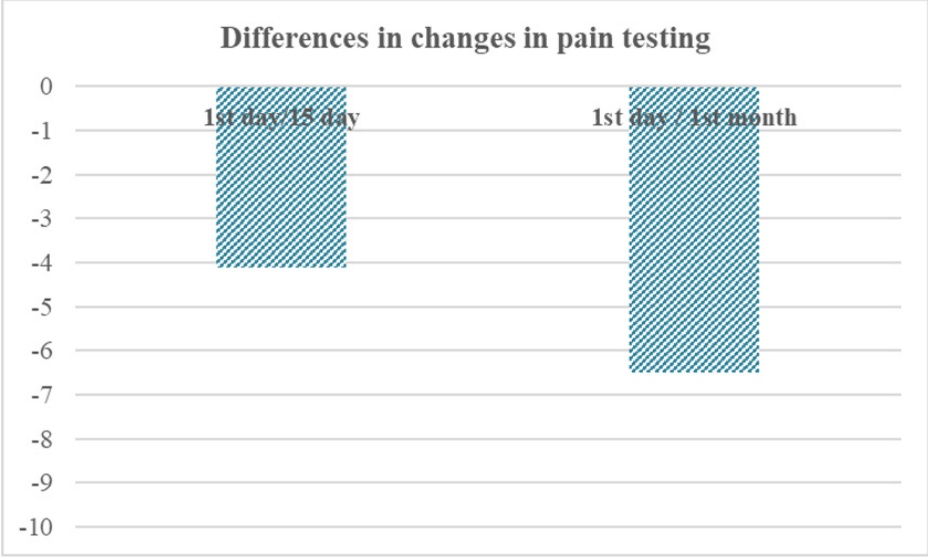
Source: Authors' own research Vasileva, D. and Zelnichka, I.

Figure 3. Presentation of changes in pain testing in patients with peripheral paralysis of n.facialis



Source: Authors' own research Vasileva, D. and Zelnichka, I.

Figure 4. Presentation of differences in changes in pain testing in patients with peripheral paralysis of n.facialis



Source: Authors' own research Vasileva, D. and Zelnichka, I.

4. DISCUSSION AND CONCLUSION

This is a complex research on physiotherapeutic possibilities combined with acupressure as part of modern motor neurorehabilitation to overcome muscle weakness, pain and asymmetry in patients with unilateral peripheral n.facialis. The presence of a positive change in the examined functional parameters is observed after the application of the combination of physiotherapy and acupressure and is most significant in the first month after the beginning of the treatments. Many studies show that the combination of proper

drug therapy, physiotherapy and acupressure are safe, useful and affordable therapies for patients with peripheral paralysis of n.facialis. It is more important that the overall results reduce the treatment time and the incidence of the consequences and complications that can occur as a result of this disease.

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doi: 10.35120/medisij030407d UDK: 616.314.17-008.1-084:614.253.4

AWARENESS OF PERIODONTAL HEALTH AND SYSTEMIC RISK FACTORS AMONG DENTAL STUDENTS – A SURVEY STUDY

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Abstract: Periodontal diseases have significant public health importance due to their widespread prevalence. Periodontitis is a chronic disease with common social determinants and risk factors with a range of systemic diseases and conditions. The relationship between periodontal and systemic health underscores the necessity for dental practitioners to have a thorough understanding and awareness of the impact of systemic risk factors on the development of periodontal diseases. The purpose of this study is to examine the awareness of periodontal diseases and their connection with systemic diseases and conditions among dental students. A sociological research method was employed - a survey conducted among 160 students at the Faculty of Dental Medicine in Sofia. A standardized questionnaire containing 22 questions was used, addressing the causes, progression and consequences of periodontal diseases and associated systemic risk factors. The results showed a good level of awareness among students regarding the etiology, symptoms and treatment of periodontal diseases. At the same time, certain gaps in knowledge were identified, particularly related to the role of systemic risk factors for periodontitis, such as obesity, cardiovascular diseases, emotional stress, genetic predisposition and adverse pregnancy outcomes. This study highlights the importance of awareness regarding periodontal health and its connection to systemic diseases among future dental specialists. Such knowledge would help them provide more informed treatment and participate in public efforts to prevent chronic diseases related to oral health. This study is a part of the project № 8276/27.11.2023 „Study of the awareness of periodontal and systemic health among students of Medical University - Sofia" which is financed by "Grant – 2024" of the Medical University of Sofia.

Keywords: awareness, periodontal disease, risk factors, dental students

Field: Medical Sciences and Health

1. INTRODUCTION

Deteriorating oral health represents a global public health problem with significant social, psychological and economic impacts on individuals, communities and healthcare systems. Poor oral health is characterized by the presence of dental caries, periodontal disease, or even total tooth loss. Recent analyses show that approximately 1.1 billion people worldwide are affected by severe periodontitis (Chen et al., 2021).

Periodontal diseases greatly contribute to poor oral health, yet public health approaches to their control and prevention have not received the level of attention directed towards dental caries. Periodontitis is a chronic disease that shares social determinants and risk factors with other systemic diseases, including cardiovascular diseases, diabetes and chronic respiratory diseases (Herrera et al., 2023). Smoking, obesity, poor diet and lack of physical activity are associated with an increased risk of periodontitis. In their review, Monsarrat et al. reported that periodontitis is linked to 57 systemic diseases and conditions in various studies, including cardiovascular and cerebrovascular diseases, rheumatoid arthritis, pregnancy-related complications, Alzheimer's disease, psycho-emotional stress, depression, anxiety and numerous others (Monsarrat et al., 2016).

The complex nature of periodontal diseases and their potential to influence systemic health underscore the need for a broad range of healthcare professionals, beyond dental practitioners, to be involved in public health programs to inform patients about the risk factors associated with periodontal diseases. Various studies indicate low awareness of periodontal diseases among both the general population and healthcare professionals. According to a study by Deinzer et al., a knowledge rate below 80% in their questionnaire was considered a knowledge deficit (Deinzer et al., 2009). A study by Sudhakar

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et al. found that less than 60% of respondents (from various healthcare professions) correctly answered questions about the etiology, risk factors and treatment of periodontal diseases. Only 15% counsel and advise patients on the significance of oral hygiene for maintaining periodontal health, while 85% expressed a desire to improve their knowledge of personal daily oral hygiene tools and procedures (Sudhakar et al., 2019).

The aim of this study is to explore the awareness of periodontal diseases and their relationship with systemic diseases and conditions among students in the "Dental Medicine" program at the Medical University of Sofia.

2. MATERIALS AND METHODS

Research Object:

The study comprised 160 students from the Faculty of Dental Medicine in 4th and 5th course, including 94 women and 66 men, with an average age of 22.84 years. The students belonged to different courses in their study program which is favorable for the survey of their knowledge in the analyzed field.

An anonymous written survey was conducted using paper-based questionnaires, as well as online, ensuring participant anonymity. A standardized questionnaire was applied, comprising 22 questions and divided thematically into two sections:

- **Demographic Data**
- **Data regarding the knowledge about the Periodontal and Systemic Health and Significance of Risk Factors.**

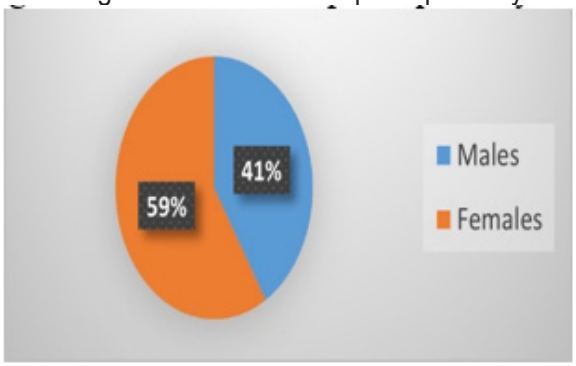
This part included 22 questions regarding the causes, progression, and consequences of periodontal diseases and their associated systemic risk factors.

The questionnaire consisted solely of closed-ended questions with trichotomous responses ("Yes"/"No"/"Don't know"), allowing respondents to complete it quickly and facilitating easier statistical processing and analysis of the results with greater accuracy.

3. RESULTS AND DISCUSSION

Students in the "Dental Medicine" program demonstrated high levels of awareness regarding the etiology and nature of periodontal diseases, as well as the potential consequences if left untreated.

Figure 1. Distribution of participants by sex.



Source: Authors' research

A significant 90.6% of participants were aware that periodontal diseases are caused by microorganisms in the dental biofilm, and 96.9% believed that the main procedure in their non-surgical treatment - calculus removal - does not harm the teeth. Over 90% of respondents understood that periodontitis can lead to tooth loss, which could impair speech and articulation, thus negatively impacting the quality of life for affected patients. Furthermore, 83.7% of students correctly noted that gingivitis is not associated with bone loss.

A positive finding is that 97.5% of respondents considered bleeding gums to be a sign of gingival inflammation. This indicates that students recognize and can detect the earliest manifestation of periodontal diseases - gingival bleeding, positioning future clinicians to provide early treatment and prevention of periodontal diseases. By comparison, studies among practicing dentists showed awareness levels slightly above 80% regarding the clinical signs of periodontal diseases (Stojilković et al., 2023; Feroze et al.,

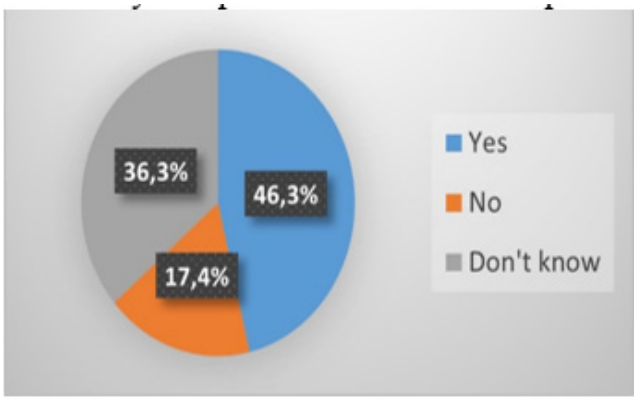
2022).

All participants acknowledged a link between oral and systemic health, though not all were aware of the mechanisms underlying this connection; 83.1% understood that periodontal disease could influence levels of systemic inflammation markers, such as cytokines.

Smoking and diabetes are well-established risk factors for periodontal diseases, modifying the diagnosis of periodontitis by determining its grade, which reflects the biological characteristics of the disease, its progression rate and the possibility of periodontal disease affecting systemic health (Tonetti et al., 2018). Our study found that 99.4% of respondents were informed about the role of smoking as a risk factor for periodontal diseases, while lower awareness was found concerning diabetes, with 80.6% recognizing the link between periodontitis and diabetes.

Obesity, another metabolic disease increasingly linked to more severe periodontal disease, is associated with higher levels of adipokines, leading to chronic low-grade inflammation, immune response dysregulation and the secretion of pro-inflammatory cytokines, resulting in more severe periodontal destruction (Abu-Shawish et al., 2022). Only 46.3% of students in our study correctly identified obesity as a potential risk factor for periodontitis, while 36.3% were uninformed, and 17.4% answered incorrectly. These findings suggest that more emphasis on metabolic diseases during dental education is needed, given their growing prevalence and social significance.

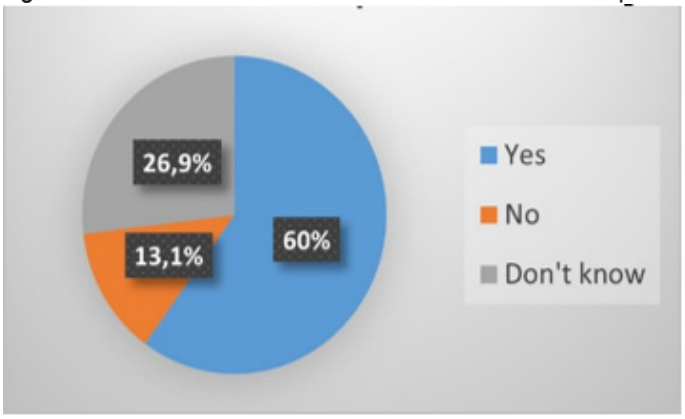
Figure 2. Obesity as a potential risk factor for periodontitis.



Source: Authors' research

Cardiovascular diseases, including hypertension, ischemic heart disease and stroke, are linked to periodontitis through increased systemic inflammation due to periodontitis, the presence of periodontal pathogens in the bloodstream, and their detection in atherosclerotic plaques (Herrera et al., 2023). Our study revealed knowledge gaps among students regarding the connection between cardiovascular and periodontal diseases, with 40% of them unaware of this relationship.

Figure 3. Cardiovascular diseases as a risk factor for periodontitis.

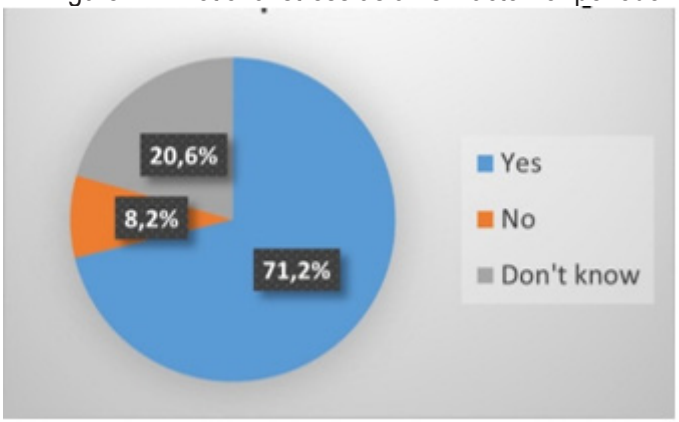


Source: Authors' research

Psycho-emotional stress is considered a risk factor for the development and progression of both periodontitis and other systemic diseases, including obesity, diabetes, hypertension and sleep disorders.

Chronic stress disrupts immune response, increasing susceptibility to the dysbiotic biofilm - the main etiological factor for periodontitis (Macri et al., 2024). This highlights the need for dental specialists to understand the influence of psycho-emotional stress on periodontal health and apply management strategies as part of comprehensive periodontal therapy. Unfortunately, our study found knowledge gaps among dental students, with over a quarter of them unaware of the connection between stress and periodontal diseases, while 71.2% answered correctly.

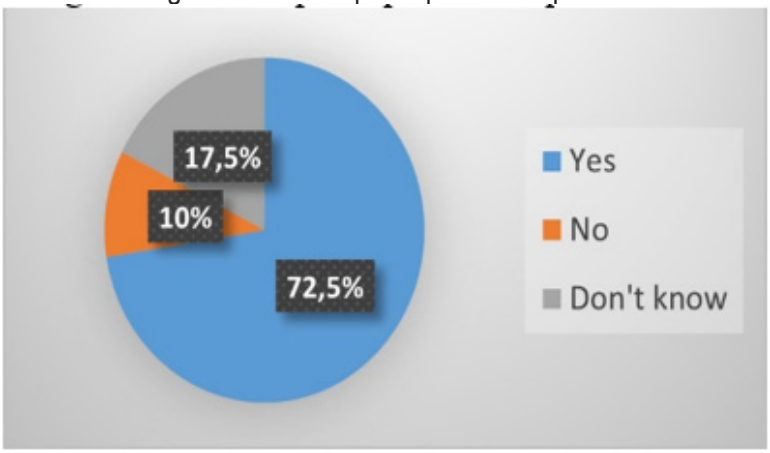
Figure 4. Emotional stress as a risk factor for periodontitis.



Source: Authors' research

A total of 72.5% of survey participants believed there is a genetic predisposition to periodontitis, while 10% did not consider genetic factors related to periodontal diseases, and 17.5% responded with "don't know." Increased awareness of genetic factors' role in periodontitis pathogenesis among dental students is essential. Recent years have highlighted that genetic factors are crucial in determining the risk of periodontal disease progression, as genetic testing may help assess individual susceptibility to periodontitis and the likelihood of tooth loss due to periodontal disease (Nibali et al., 2024).

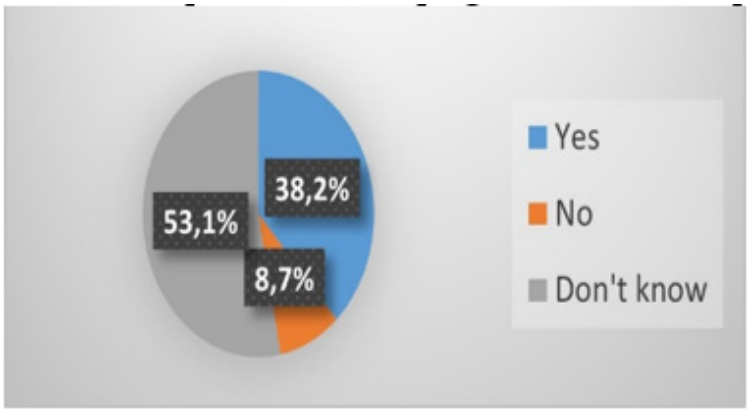
Figure 5. Genetic predisposition to periodontitis.



Source: Authors' research

The most significant knowledge gaps among dental students in this study were related to the association between periodontitis and adverse pregnancy outcomes. A total of 53.1% reported they were unaware of the link between periodontitis and preterm birth or low birth weight, while 8.7% gave incorrect answers, and only 38.2% were informed on this topic. These findings are unsurprising, as studies among practicing dentists and medical doctors showed awareness levels of 46% and 34%, respectively, regarding the link between periodontitis and preterm birth (Stojilković et al., 2023). In contrast, obstetricians and gynecologists demonstrated higher awareness, with 77.5% believing that periodontal disease could affect pregnancy outcomes (Turabi et al., 2022).

Figure 6. A link between periodontitis in pregnant women and preterm birth.



Source: Authors' research

4. CONCLUSION

This study highlights the importance of awareness of periodontal health and its connection to systemic diseases among future dental professionals. The findings reveal that, despite the students' solid overall knowledge of the etiology and treatment of periodontal diseases, significant gaps remain in their awareness of periodontal-systemic diseases interactions, such as the impact of metabolic diseases, stress, genetic factors and pregnancy complications.

These deficits suggest a need for more comprehensive education in periodontal and systemic health. Such knowledge would enable future dental professionals to provide more informed care and contribute to public efforts to prevent chronic diseases related to oral health. This study underscores the significance of incorporating more topics about the role of systemic risk factors for the periodontal diseases into curricula to improve the quality of healthcare and promote oral as well systemic public health.

ACKNOWLEDGEMENTS

The presented study is funded by the Medical Science Council of MU – Sofia under Contract № D-151/29.05.2024.

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A STUDY OF DIABETES MORTALITY AS A PROPORTION OF TOTAL MORTALITY IN EUROPEAN UNION MEMBER STATES

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Abstract: One of the most common chronic diseases in the WHO European Region is diabetes. Europe has the highest burden of type 1 diabetes in the world. Analysts estimate that by 2045, 1 in 10 people living in the region will have diabetes.

The aim of this study is to examine diabetes mortality as a proportion of total mortality in the member states of the European Union, as well as in Norway and Iceland.

Methodology: For processing and analysis of the information received, we used the following methods: Documentary method – source of information are the Health Profiles for 2023 of the 27 Member States of the European Union and Norway and Iceland from the Organization for Economic Co-operation and Development; Method of system analysis; Comparative-analytical method; Mathematical and statistical method; Graphical analysis – to illustrate the results obtained.

Results: From the study it is clear that the relative share of deaths from diabetes is the highest - 8.2% in Croatia, followed by Cyprus - 6.8% and Malta - 5.8%, and the lowest in Slovakia – 1.1% and with 1.2% are in Belgium, Bulgaria and Finland. The EU average is 2.6%.

Discussion: In 2019, deaths in the European region caused by diabetes were approximately 186,000. The number of deaths due to diabetes is increasing and is expected to double from 2005 to 2030. Despite these alarming figures, approximately 1 in 3 people living with diabetes remain undiagnosed, and approximately half of those diagnosed do not meet their treatment goals.

Conclusion: Diabetes is a worldwide disease. An unfavorable trend is that diabetes continues to spread and worsen the quality of life of more and more people. And currently there is no cure for this disease, but medicine is constantly developing and researching new, more effective methods of treatment.

Recommendations: Effective management of diabetes requires not only medication, but also psychological support and individual care for each patient. By feeling the sympathy of society, people with diabetes could more easily take control of their health and life.

Keywords: diabetes, mortality, proportion, quality of life, EU countries
Field: 3) Medical sciences and Health

1. INTRODUCTION

Diabetes is one of the leading causes of death and disability worldwide, affecting people regardless of their place of residence, age, and gender. (Borisova et al., 2024: 135). The International Diabetes Federation reports that in 2021, there were 537 million people with diabetes worldwide, representing 10.5% of the total population. This number is expected to grow to 643 million by 2030 and 783 million by 2045. (Borisova et al., 2024: 135).

Early mortality from diabetes has increased by 5% since 2000, while premature mortality from other major non-communicable diseases has decreased. More people are living with diabetes, and more people with diabetes are dying prematurely than they would have if they had access to high-quality and equitable care and treatment. (https://www.who.int/initiatives/the-who-global-diabetes-compact/the-global-diabetes-compact-forum)

Diabetes is one of the most common chronic diseases in the WHO European region. Europe has the highest burden of type 1 diabetes in the world. Analysts predict that by 2045, 1 in every 10 people in the region will develop diabetes. (https://www.who.int/europe/news-room/events/item/2024/11/14/default-calendar/world-diabetes-day-2024--a-holistic-approach-empowers-people-on-their-diabetes-journey; https://www.who.int/europe/health-topics/diabetes#tab=tab_2)

Various epidemiological studies highlight that the increasing prevalence of diabetes is due to unfavorable lifestyle changes, such as the development of overweight and obesity, chronic stress, decreased physical activity, unbalanced and poor nutrition, and an aging population combined with genetic factors, which is particularly characteristic of EU member states. (Popova, 2015: 118)

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Table 1. Leading causes of death worldwide

Cause	2019	2020
Ischemic heart disease	8,880,000	
Stroke	6,190,000	
COPD	3,220,000	
Infection of the lower respiratory tract	2,590,000	
Neonatal conditions	1,960,000	
COVID 19		1,800,000
Cancer of the trachea, bronchi, lung	1,760,000	
Alzheimer's disease and other dementias	1,590,000	
Diabetes mellitus	1,490,000	
Diarrheal diseases	1,450,000	

Sources: Global Health Estimates 2019 [2] and WHO Covid-19 surveillance dashboard [37]

Table 1 presents a comparison of the total number of deaths from leading causes in the Global Health Goals for 2019 with reported COVID-19 deaths in 2020, showing that diabetes ranks 9th among them.

The significance of this issue arises primarily from the profound social and health needs of people with deteriorated quality of life and increased specific health requirements. Complex psychological and socioeconomic challenges emerge, driven by the progressive prevalence of metabolic disorders—obesity and diabetes—and evidence of a strong trend toward irreversible high disability and mortality. The population in Bulgaria, as well as across the European Union, exhibits an aging demographic profile, with significant social, economic, medical, psychological, and ethical problems and consequences. (Vizeva, 2014: 5-6)

The aim of this study is to examine diabetes mortality as a share of total mortality in European Union member states, as well as in Norway and Iceland.

2. MATERIAL AND METHODS

For processing and analyzing the data, we used the following methods:

- Document analysis – the sources of information include the 2023 Health Profiles of the 27 EU member states and Norway and Iceland from the Organisation for Economic Co-operation and Development;
- Systematic analysis;
- Comparative-analytical method;
- Mathematical-statistical method;
- Graphical analysis – to illustrate the obtained results.

3. RESULTS

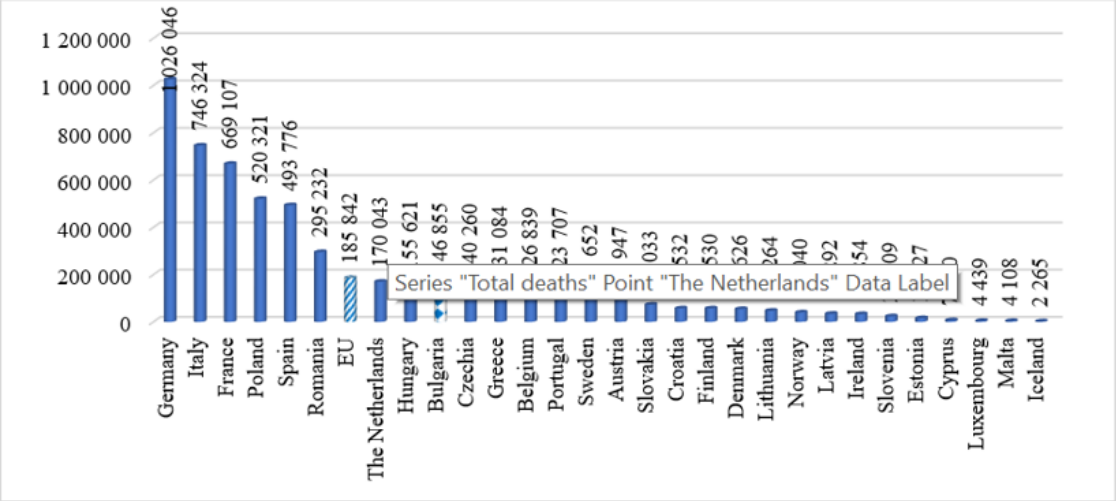

Figure 1. Total mortality in EU countries
Sources: Eurostat Database (the data refer to 2020 or 2021 for the different countries), OECD (2023)

Figure 1 presents the total mortality in EU countries for 2020 and 2021 for the different countries,

according to Eurostat data. The highest numbers are in Germany (1,026,046), followed by Italy (746,324) and France (669,107). The lowest numbers are in countries with smaller populations, namely Iceland (2,265), followed by Malta (4,108) and Luxembourg (4,439). The EU average is 185,842 deaths, with Bulgaria recording a total of 146,855.

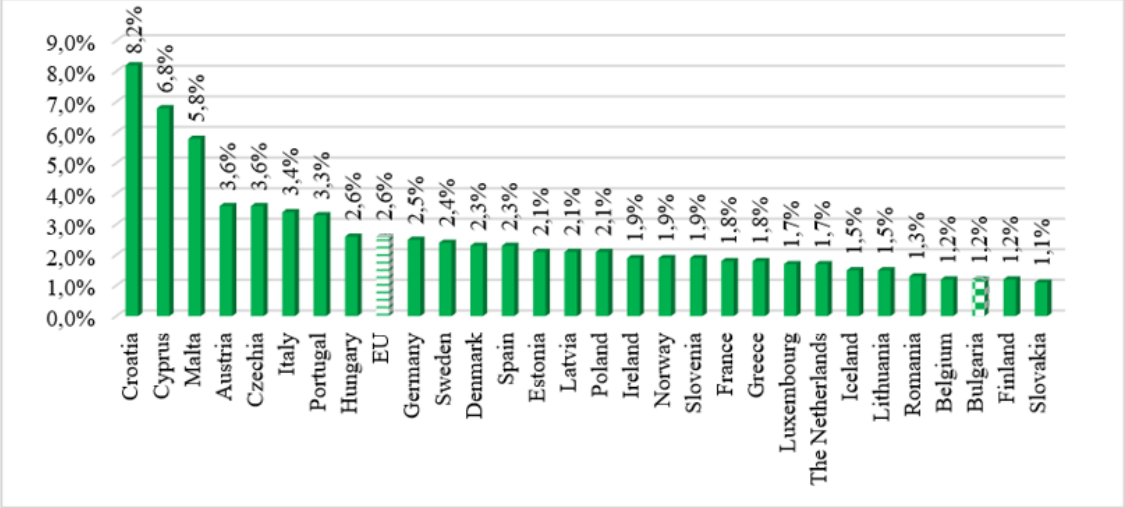

Figure 2. Diabetes-related deaths in EU countries
Sources: Eurostat Database (the data refer to 2020 or 2021 for the different countries), OECD (2023)

Figure 2 shows that in 2021, the highest relative share of diabetes-related deaths was in Croatia (8.2%), followed by Cyprus (6.8%) and Malta (5.8%), while the lowest was in Slovakia (1.1%), and Belgium, Bulgaria, and Finland each had 1.2%. The EU average is 2.6%.

In Croatia, over one in five adults (23%) is obese, significantly above the EU average (16%). (OECD, 2023: Croatia) Obesity is also a growing issue among children and adolescents, with the percentage of overweight and obese 15-year-olds increasing from 18% in 2018 to 24% in 2022, above the EU average (21%). (OECD, 2023: Croatia) (OECD, 2023: Croatia) Croatians are known for high sugar and salt intake, much higher than the EU average of 17%. Twenty-two percent of all deaths are due to risk factors related to poor nutrition.

In Cyprus, childhood obesity is a major public health concern. (OECD, 2023: Cyprus) One in seven adult Cypriots (15%) was obese in 2019, close to the EU average. However, from 2018-2020, 62% of children aged 6-9 were overweight, the highest rate in EU member states (WHO Regional Office for Europe, 2022).

Malta has the highest rate of overweight and obesity among adults and adolescents in the EU, and addressing this issue has been a key government priority over the last decade. (OECD, 2023: Malta)

4. DISCUSSION

In 2019, there were approximately 186,000 diabetes-related deaths in the European region. The number of deaths due to diabetes is increasing and is expected to double from 2005 to 2030. Despite these alarming figures, around one in three people living with diabetes remains undiagnosed, and approximately half of those diagnosed do not meet their treatment goals.

In the WHO European region, the burden of diseases associated with poor nutrition continues to grow. Unhealthy diets, overweight, and obesity contribute to a significant portion of non-communicable diseases, including cardiovascular diseases, type 2 diabetes, and certain cancers, which are the leading causes of death in the region. Numerous national studies in most countries provide data on very high consumption of saturated fats, trans fats, sugar, and salt; meanwhile, there is low consumption of vegetables, fruits, and whole grains, and an increasing number of people are obese. This risky diet not only shortens life expectancy but also negatively impacts the quality of life. (https://www.who.int/europe/health-topics/nutrition/#tab=tab_1)

5. CONCLUSIONS

Diabetes is a disease affecting the entire world. Significant national, regional, local, and individual differences in the volume and quality of medical services remain, despite proven effective interventions

for managing chronic non-communicable diseases, including metabolic disorders.

An unfavorable trend is that diabetes continues to spread and worsen the quality of life for an increasing number of people. While there is currently no cure, medical science is continuously advancing and exploring new, more effective treatment methods. (https://www.who.int/europe/news-room/events/item/2024/11/14/default-calendar/world-diabetes-day-2024--a-holistic-approach-empowers-people-on-their-diabetes-journey)

6. RECOMMENDATIONS

Effective diabetes management requires not only medication but also psychological support and individualized care for each patient. By feeling the empathy of society, people with diabetes can more easily take control of their health and lives.

The development of the global obesity epidemic, type 2 diabetes, and other chronic non-communicable diseases will continue unless society's efforts are directed toward proper nutritional policies, changes in the food system, and thorough education for individuals to become aware of their own healthy micro-environments, different from their current toxic and obesogenic environments. (Popova, 2015: 141)

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doi: 10.35120/medisij030419s UDK: 613.25-084

REDUCING OBESITY RISK: PREVENTION STRATEGIES AND INFLUENCING FACTORS

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Abstract: Obesity, recognized as a chronic and relapsing disease, represents a significant public health issue with a prevalence that continues to rise. Worldwide, 16% of adults over the age of 18 are classified as obese, while 43% are considered overweight. The aim of this work is to highlight the urgent and comprehensive need to address this global challenge, which has profound implications for health systems and demands more effective political and economic decisions by governments. Additionally, it calls for improved communication with and motivation of patients, more effective treatment methods, and efforts to prevent stigmatization, all of which are crucial to ensuring successful treatment outcomes for obese individuals. The increasing prevalence of obesity-related conditions across all age groups necessitates the adoption of new public health measures and supportive actions. Treatment effectiveness and safety must be founded on an individualized approach, which requires consideration of the patient's unique characteristics—such as age, comorbidities, and personal preferences—alongside the properties of medications, particularly their weight-reduction efficacy and safety profile.

Keywords: obesity, overweight, Body Mass Index, prevalence, physical activity
Field: Medical Sciences and Health

1. INTRODUCTION

Obesity is a chronic, relapsing disease and a major risk factor for other non-communicable diseases, including cardiovascular diseases, diabetes, and certain types of cancer (Lim et al., 2024). The global trend of rising obesity rates is alarming, underscoring the vast medical, social, and economic burden it creates and highlighting the urgent need to mobilize all resources to combat this disease. Factors such as high consumption of energy-dense foods, trans fats, and saturated fats, along with increasingly sedentary lifestyles, have significantly contributed to the worldwide increase in obesity rates. People with lower incomes, both women and men, are more likely to be obese, which exacerbates health inequalities (OECD, 2023). The causes of obesity can be categorized as endogenous—such as genetic predisposition, epigenetics, family background, physiological conditions (e.g., pregnancy), and endocrine disorders—and exogenous, including environmental factors, occupation, lifestyle, caloric intake, hypothyroidism, hypercorticism, hypogonadism, acromegaly, as well as lifestyle elements like eating habits, reduced physical activity, smoking cessation, brain injuries, brain tumors, insomnia, depression, anxiety, psychosis, and more (National Guide to Good Clinical Practice, 2022). Rates of overweight and obesity continue to climb among adults and children alike. Between 1990 and 2022, the global prevalence of obesity among children and adolescents aged 5 to 19 quadrupled from 2% to 8%, while the rate among adults aged 18 and over rose from 7% to 16% (WHO, 2024).

In Hungary, obesity and its associated health and economic impacts have posed a substantial challenge in recent decades. Currently, 68% of the Hungarian population is classified as overweight or obese, the highest rate in Europe and the fifth highest globally, following Mexico, the USA, Costa Rica, and New Zealand. The increasing rate of childhood obesity is not only a concern in Hungary but also reflects a broader trend across Europe (Szilágyi et al., 2024).

In 2019, 40.5% of the Serbian population aged 15 and over had a normal weight, while more than half (57.1%) were either overweight or obese, with 36.3% classified as overweight and 20.8% as obese. A significantly higher percentage of obese individuals was recorded in Vojvodina (25.4%) and southern and eastern Serbia (23.1%), particularly among those aged 45 to 84, individuals with lower incomes (25.7%), and those residing in suburban areas (23.6%) (Statistical Office of the Republic of Serbia, 2021).

Bulgaria has made limited progress toward achieving its targets for nutrition-related non-communicable diseases (NCDs): 26.3% of women over 18 and 28.3% of adult men are living with obesity. The prevalence of obesity in Bulgaria is higher than the regional average of 25.3% for women and 24.9%

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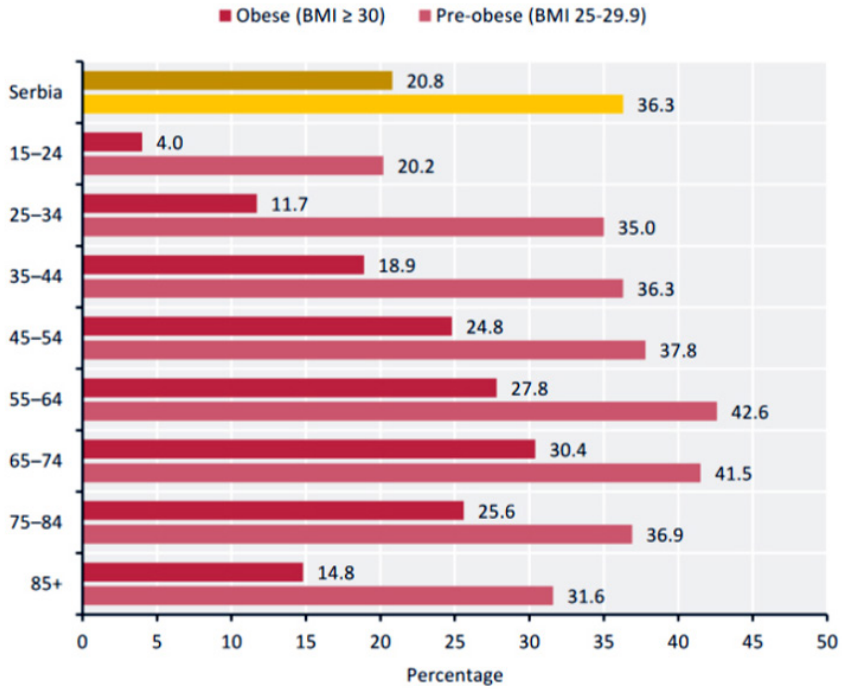
for men. Among children under five, 6.9% are obese, though indicators suggest that Bulgaria is on track to prevent further increases in this rate (The Global Nutrition Report, 2022a).

North Macedonia has also shown limited progress toward its goals for nutrition-related NCDs: 23.9% of women over 18 and 25.1% of adult men are living with obesity. The obesity rate among women is below the regional average, but for men, it is above. The prevalence of obesity in children under five is 11.2%, though North Macedonia is working to prevent this rate from rising (The Global Nutrition Report, 2022b).

Graph 1. Obese and pre-obese population by age groups



Source: Statistical Office of the Republic of Serbia, 2021.

Childhood obesity poses a lifelong health risk, contributing to the development of numerous diseases. Children with obesity often face social disadvantages, have lower self-esteem, and tend to be less successful academically. Alarming rates of overweight and obese children are recorded across Europe, with Croatia ranking high among Mediterranean European countries at seventh place, where one in three children is overweight or obese. The highest rates of childhood overweight and obesity are found in the Adriatic region, with 36.9% of children affected.

The continued increase in obesity prevalence is closely linked to dietary patterns. While there is only a weak correlation with changes in fat and carbohydrate intake, there is a strong association with the widespread consumption of ultra-processed foods (UPF), which are typically high in calories, salt, sugar, and fat but low in whole foods. Sugar intake, particularly from sugar-sweetened beverages (SSB), is especially significant, as these drinks lead to higher energy intake and weight gain due to their relatively low cost and the rising popularity of fast food establishments (Temple, 2022).

Petakov (2024) highlights obesity as a major risk factor for several types of cancer and notes its association with poorer treatment outcomes and higher mortality in malignant diseases. Observational studies indicate that weight reduction in humans, as well as caloric restriction in animal models, diminishes the cancer-promoting effects of obesity, especially in breast and prostate cancer.

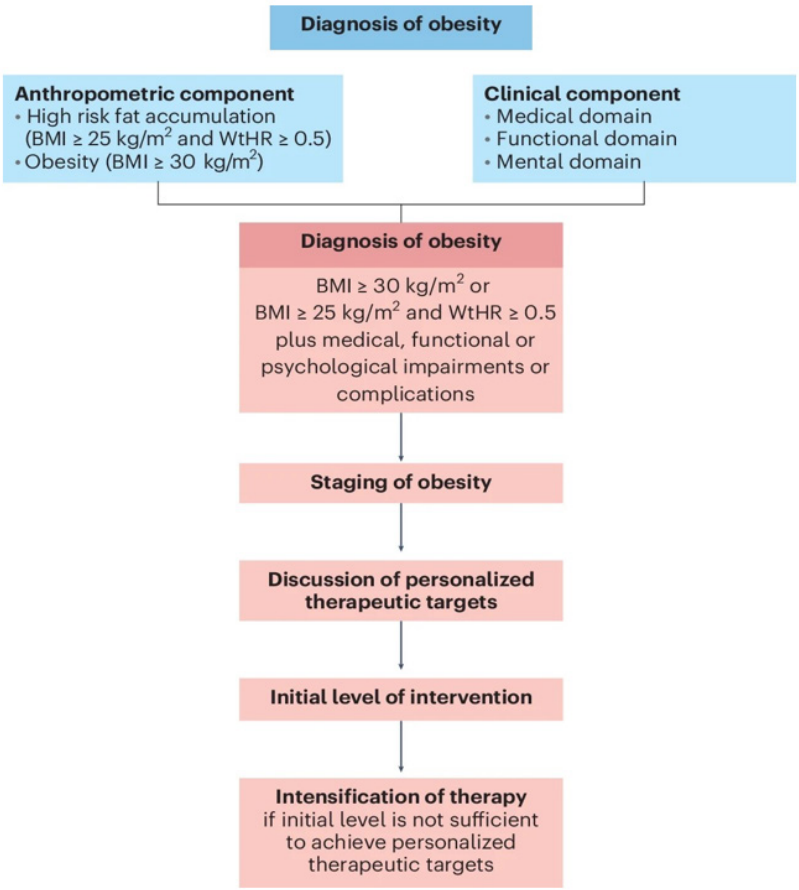
2. CLASSIFICATION OF OBESITY

Overweight and obesity are defined as abnormal or excessive fat accumulation that poses health risks. A body mass index (BMI) above 25 is classified as overweight, while a BMI above 30 is classified as obese (Nuttall, 2015; Flegal et al., 2019). In 2019, it was estimated that around 5 million deaths from non-communicable diseases (NCDs) were attributed to an elevated BMI (WHO, 2024). However, it is important to note that BMI has low sensitivity, with significant inter-individual variability in body fat percentage for

any given BMI value. This variability is partly due to factors like age, gender, and ethnicity: for example, Asians typically have a higher body fat percentage than whites at the same BMI. Solely relying on BMI to assess obesity prevalence could limit the effectiveness of future interventions for obesity prevention and control (Chooi et al., 2018).

Additional indices based on anthropometric measurements are still in use, such as waist circumference (WC), waist-to-height ratio (WtHR), and abdominal bioimpedance, along with equations for estimating visceral adipose tissue (VAT) (Itani El & Ghoch, 2024). The European Association for the Study of Obesity (EASO) has recommended a new framework for diagnosing and treating obesity in adults, proposing a WtHR ≥ 0.5 for individuals with a BMI between 25 kg/m² and 29.9 kg/m² as an indicator of high adiposity across all ethnic groups and both sexes. However, the WtHR cutoff of ≥ 0.5 has not been widely accepted, as its accuracy varies across different populations.

Figure 1. A new framework for the diagnosis, staging and management of obesity in adults



3. DIAGNOSIS AND TREATMENT OF OBESITY

Diagnosis of overweight and obesity is made by measuring a person's weight and height and calculating their body mass index (BMI): weight (kg)/height (m²). BMI acts as an indirect indicator of body fat, while additional measurements, like waist circumference, can help confirm a diagnosis of obesity. BMI categories used to define obesity vary by age and sex for infants, children, and adolescents.

APPROACHES/MEASURES WHICH HAVE BEEN UNDERTAKEN	EXPLANATIONS/REASONS
Improving communication and motivation	Motivation is essential for treatment adherence, and long-term willingness to change will be assessed using motivational interviewing.
Preventing stigmatization in healthcare	Stigmatization is common in healthcare and can lead to increased eating disorders, worsening obesity, and higher rates of depression, suicidal thoughts, and, in severe cases, suicide. Motivational interviewing can help reduce stigmatization.
Measuring waist circumference	Waist circumference is a strong indicator of visceral fat and a valuable predictor of cardiometabolic diseases. Monthly measurements are recommended to monitor visceral fat reduction and manage body weight changes.
Treatment of comorbidities	Comorbidities, particularly cardiometabolic diseases, must be prioritized in treatment to reduce mortality.
Engaging a multidisciplinary team	A multidisciplinary team, working collaboratively, is significantly more effective.
Monitoring body mass reduction	A 5-10% reduction in initial body weight over three to six months is sufficient to lower comorbidities.
Increasing physical activity	Physically active patients have lower overall mortality than sedentary patients with normal body mass. Regular physical activity also reduces the likelihood of regaining weight and minimizes fluctuations after weight loss.
Preventing body mass fluctuations	Following lean mass loss, focus should shift to maintaining the achieved weight reduction and preventing weight regain and fluctuation. Patients should be measured approximately every two weeks; if they gain 3-4 *kg* in a short time, they should consult their primary doctor for further treatment. .

Source: National Guide to Good Clinical Practice, 2022.

Obesity significantly increases the risk of developing non-communicable diseases. Evidence suggests that obesity, particularly in middle and later life, is a major risk factor for cognitive decline, both directly and indirectly, as related hypertension and type 2 diabetes accelerate vascular changes in the brain. Weight gain also poses a considerable challenge for individuals with any level of respiratory impairment, increasing the risk of sleep apnea due to factors like neck circumference and a tendency to obstruct breathing (Knežević & Jandrić-Kočić, 2023).

Laboratory diagnostics play an essential role for physicians in diagnosing obesity and monitoring therapy effects. Determining biochemical parameters is useful in preventing obesity and its related complications. Routinely available biochemical tests are commonly used to diagnose obesity and track the impact of treatment (Milinković et al., 2024).

In many cases, obesity diagnosis relies on BMI cutoffs, which may not account for the impact of adipose tissue distribution and function on disease severity. Therapeutic approaches are primarily based on anthropometric measurements rather than a thorough clinical assessment of the individual, as noted by Busetto et al. (2024).

Treatment involves various interventions, including dietary plans, structured physical activity, behavioral therapy, medication, and/or surgery (National guide for primary care physicians, 2004: 8).

The use of new anti-obesity drugs is on the rise in nearly all European countries. In two-thirds of these countries, however, anti-obesity medications are not covered by health insurance. Slovenia and Denmark are exceptions, reimbursing the costs for most anti-obesity drugs, while in the Netherlands, Setmelanotide is uniquely funded by the Health Insurance Fund (Stević et al., 2024).

In the Republic of Serbia, six drugs have been approved for long-term obesity treatment: orlistat, phentermine/topiramate, naltrexone/bupropion, liraglutide, semaglutide, and tirzepatide. Most of these drugs work by promoting satiety and reducing appetite. Semaglutide and tirzepatide have shown the highest efficacy in reducing body weight (>10%). While all obesity medications have demonstrated positive effects on cardiometabolic risk factors, only liraglutide and semaglutide have been proven to reduce the risk of major cardiovascular events (Sićović & Micov, 2024).

Curcic et al. (2024) examined the relationship between environmental pollutants and obesity, aiming

to provide insight into the complex factors driving the obesity epidemic. Anthropogenic activities such as industrialization, urbanization, agriculture, and transportation have significantly increased environmental pollution. Certain pollutants, termed "obesogens," are believed to disrupt lipid metabolism and thereby promote obesity. The most notable obesogens include bisphenol A (found in plastics, food packaging, and thermal receipt paper), phthalates (used in plastics, personal care products, and food packaging), toxic metals and pesticides (used in agriculture), as well as persistent organic pollutants and pharmaceutical waste.

4. LIFESTYLE CHANGES AND PHYSICAL ACTIVITY

Overweight, obesity, and their related diseases can largely be prevented and managed. By adopting preventive measures, individuals can lower their risk. These measures include the following (WHO, 2024):

- Promote healthy weight gain during pregnancy.
- Practice exclusive breastfeeding for the first six months and continue breastfeeding up to 24 months or longer.
- Encourage healthy behaviors in children related to nutrition, physical activity, limited sedentary time, and sufficient sleep.
- Limit screen time.
- Reduce the intake of sweetened beverages and high-calorie foods.
- Decrease total fat and sugar intake while increasing consumption of fruits and vegetables.
- Engage in regular physical activity.

In most OECD countries, obesity rates continue to rise, with 54% of adults classified as overweight and 18% as obese. While a healthy diet and regular physical activity are essential, only 15% of adults, on average, consume five or more servings of fruits and vegetables daily, and just 40% engage in at least 150 minutes of moderate-to-vigorous physical activity weekly (OECD, 2023).

Regular physical activity helps reduce visceral fat and lowers the risk of associated comorbidities. About 300 minutes per week of moderate-intensity activity, or 150 minutes of more intense exercise, is sufficient to mobilize visceral fat. This activity can be broken down into segments of at least 10 minutes to achieve a positive metabolic effect (National Guide to Good Clinical Practice, 2022).

Developing, adopting, and sustaining healthy lifestyle and eating habits begins in the family environment and continues in institutions where children spend much of their day outside parental supervision. Schools, in particular, should be prioritized as key settings for improving children's nutrition and fostering an environment that supports healthy eating (Dejanović et al., 2024).

5. CONCLUSION

Obesity is a complex, multifactorial, non-communicable disease with a global upward trend. It is closely linked to numerous health problems, increasing the risk of both morbidity and mortality. In this context, early detection and treatment are crucial for achieving favorable outcomes. Although obesity is classified as a chronic disease, there are still no well-defined guidelines that, as with other chronic diseases, align with clinical processes and expected results. Past efforts to reduce obesity prevalence have not met expectations, highlighting the need for a multidisciplinary approach. This approach would enable policymakers to develop more effective, proactive measures and interventions, particularly for children. In children, the consequences of being overweight or obese may not appear immediately but become evident later, when successful treatment is more challenging. Effective obesity treatment requires a broader approach than simply focusing on weight loss; it must prioritize identifying and mitigating risks while simultaneously addressing related diseases and complications.

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HOW TO CREATE A QUALITY DIGITAL MODEL THROUGH EXTRAORAL SCANNING – A NARRATIVE LITERATURE REVIEW

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Abstract: This literature review explores methods for creating high-quality digital models through extraoral scanning, drawing on current scientific and practical literature. It analyzes key factors that affect the quality of digital impressions, including the technical characteristics of scanners and the use of various types of elastomeric impression materials, as well as different extraoral scanning techniques. The main challenges associated with the accuracy and precision of digital models, along with their applicability in dentistry, are also discussed. The review concludes by emphasizing the importance of best practices and technological innovation in scanning to achieve optimal results

Keywords: digital dentistry, digital model, extraoral scanning, accuracy
Field: Medical sciences and Health

1. INTRODUCTION

Digitalization in dentistry has made significant strides and continues to evolve rapidly. Changes in laboratory processes also necessitate adjustments in clinical workflows. Digital technologies were developed to enhance efficiency, save clinicians' time, ensure precision in intricate details, and achieve optimal patient outcomes (Tomova, 2023-1; Tomova, 2024). Modern digital software enables the creation of various dental objects, such as temporary and permanent prosthetic structures, custom trays, surgical guides, occlusal splints, and more (Tomova, 2023-2). However, all of these require a digital model on which to design the necessary constructions. This virtual model can be obtained either through intraoral scanning of the oral cavity or by extraoral scanning of a plaster model or conventional impression using a laboratory scanner (Shopova, 2020).

Since the entire methodology of extraoral scanning relies on an accurate impression of the prosthetic field, the precision of the impression is of paramount importance. Elastomeric impression materials are commonly used in fixed prosthetics (Kissov, 2019). These materials include:

Additive silicones (polyvinyl siloxanes) are a modern type of impression material that does not release by-products during polymerization, resulting in linear and volumetric stability. A notable advantage is their enhanced hydrophilicity. They are highly elastic, exhibit superior recovery from elastic deformation, and are the least susceptible to plastic deformation. Additionally, they maintain volumetric stability after setting, have low creep, and offer a moderately short handling time (Chen, 2004; Wadhwani, 2005).

Condensation silicones undergo a polycondensation reaction that produces a low molecular weight by-product, resulting in shrinkage of 0.23% to 0.6% within 24 hours. Another disadvantage is their hydrophobic nature (Joshi, 2009). Polyethers, on the other hand, undergo an additional polymerization reaction, providing linear and volumetric stability to the impression. They have the highest modulus of elasticity among elastomers, which can limit their use in areas with significant retention or in teeth with high mobility. However, they are easy to spread due to their hydrophilic properties (Endo, 2006). Polysulfide rubbers contain sulfur and lead compounds. They exhibit high elasticity, relative hydrophilicity, and a long handling time. Their polymerization reaction can continue for up to 24 hours after removal from the mouth, resulting in additional shrinkage. The primary disadvantages include a bitter taste and unpleasant odor. Additionally, the presence of lead dioxide, which is known for its toxic and potentially carcinogenic effects, is a significant drawback (O'Brien, 2002).

Hybrid elastomers combine the properties of additive silicones and polyethers, merging their positive attributes. These materials offer high hydrophilicity and excellent flow properties, allowing them to penetrate deep into the gingival sulcus and produce highly accurate impressions (Apinsathanon, 2022).

Elastomers used for fixed prosthetics can be applied using single-layer or double-layer, as well as monophasic and biphasic techniques. The monophasic two-layer technique involves the simultaneous use of two different consistencies of the same type of elastomer. The thicker consistency is first placed in the impression tray, followed by the more fluid one on top. Both consistencies are then pressed together

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onto the prosthetic field and polymerized simultaneously, forming a chemical bond (Varvara, 2015). The double-phasic two-layer technique involves a sequential approach. First, the dough-like, dense consistency is placed and allowed to polymerize independently. In the second stage, the liquid consistency is applied to capture fine details (Gowri, 2015).

The presented article aims to present different variants of extraoral scanning of dental objects and to summarize the available literature data, based mainly on the accuracy of the obtained digital model.

2. MATERIALS AND METHODS

A targeted literature review was conducted to examine the types of extraoral scanning and the accuracy of the resulting digital models. The studies were categorized based on specific criteria as follows: 1) comparative analysis of different types of extraoral scanners, including laser scanners, white light scanners, and blue light scanners; 2) evaluation of different impression materials used in extraoral scanning, such as condensation silicones, additive silicones, and polyvinyl siloxanes; 3) assessment of the accuracy of fixed bridge structures created through extraoral scanning of silicone impressions or plaster models; 4) extraoral scanning of the entire dental arch and three-dimensional accuracy analysis; 5) extraoral scanning of a single tooth and three-dimensional accuracy analysis; and 6) the effect of antireflective powders on the accuracy of the final prosthetic construction.

3. RESULTS AND DISCUSSIONS

At their core, 3D scanners comprise a light source, one or more cameras, and a multi-axis motion system to position the scanned object relative to the light source and cameras. The types of scanners used for scanning impression materials include laser scanners, white light scanners, and blue light scanners. Laser scanners are characterized by slower scanning speeds, higher error rates, and lower initial scan repeatability. White light scanners offer good scanning speed and repeatability, efficiently project a model in two-dimensional (2D) mode, and capture 3D coordinate data more effectively than laser scanners. However, errors with white light scanners can occur when scanning impressions with narrow and deep undercuts. In evaluations of digitized impressions of abutment teeth, blue light scanners demonstrated better repeatability compared to white light scanners (Jeon, 2015). Additionally, blue light scanners have been found to be more accurate than both white light and laser scanners (Emir, 2019).

A high-quality impression of the prosthetic field is essential for successful prosthetic construction and depends on the dimensional stability, accuracy, and flexibility of elastomeric impression materials, as well as the appropriate impression techniques used. Naumovski et al. investigated various silicone impression materials and the factors influencing their stability and dimensional accuracy, including the choice of viscosity type, impression material thickness, impression technique, pre-cast storage time, number of casts, material hydrophilicity, release of by-products, and post-polymerization shrinkage. The study's findings consistently indicate that additive silicones outperform condensation silicones (Naumovski, 2017).

The most significant difference between silicone types lies in the dimensional changes they produce in gypsum tooth stumps. Condensation silicones result in significantly shorter gypsum stumps (-0.24% to -0.37%) compared to additive silicones (-0.08%). The same accuracy of impressions was achieved for all techniques (that is, putty/wash, single mix, and double mix) when addition silicones were used, whereas the putty/wash technique produced the most accurate dies for the condensation silicones. Impressions made using custom trays demonstrated much greater accuracy in vertical dimensions (-0.03%) compared to those made with standard trays (-0.15% to -0.21%). Consequently, even additive silicones, which have relatively minimal polymerization shrinkage, produce dimensionally stable dental impressions, fig.1 (Johnson, 1986).

Fig.1. Different techniques for taking silicone impressions

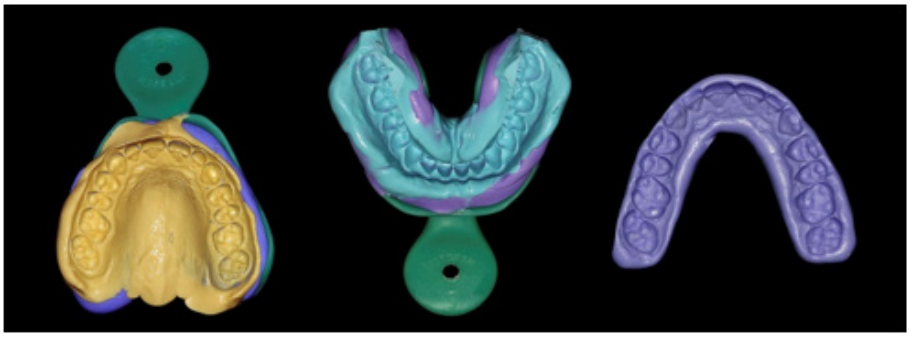
Source: Runkel; Clinical oral investigations, 2020

In their study, Bud et al. evaluated the accuracy of three different impression materials commonly used in dental practice, utilizing a three-dimensional (3D) extraoral scanner. A dental arch model with 16 permanent teeth was 3D-printed and replicated using three materials: alginate, condensation silicone, and addition silicone. The resulting plaster models were digitized and compared for accuracy. The results revealed that addition silicone models exhibited the highest accuracy, followed by condensation silicone, with alginate showing the lowest accuracy. The study also emphasized that the timing of model casting and the method of impression disinfection play crucial roles in preserving accuracy (Bud, 2022). Furthermore, the greatest dimensional changes in addition and condensation silicone impressions were observed within the first hour after separation from the model (Sinobad, 2014).

Additional studies have investigated the hydrophobicity of silicone impression materials, attributed to surface paraffin methyl groups. This characteristic poses a potential drawback, as it can compromise results by encapsulating saliva or blood particles if the field is not adequately dried and prepared (Martins, 2019).

A study by Camardella et al. demonstrated that digital models obtained by laser scanning two types of addition silicones with different viscosities can achieve clinically acceptable accuracy, even when scanned up to 15 days after the impressions were made. The study evaluated the accuracy of digital models created by scanning impressions at intervals of 5, 10, and 15 days using two soft polyvinylsiloxane materials, fig. 2 (Camardella, 2016).

Fig. 2. Polyvinylsiloxane Impressions. Maxillary impression (regular viscosity), mandibular impression (light viscosity), and bite registration.



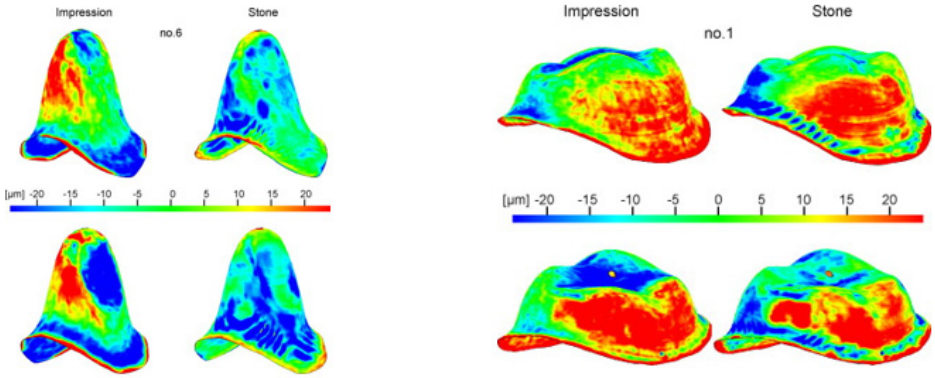
Source: Camardella; American Journal of Orthodontics and Dentofacial Orthopedics, 2016

Labib et al. investigated the accuracy of 3D digital models generated using intraoral and extraoral scanners, comparing them with reference plaster models. The results revealed minimal differences between the digital and plaster models. Accuracy analysis demonstrated good to excellent stability across most measurements. The highest digitization accuracy was achieved with the 3Shape laboratory scanner, whereas the inEos X5 exhibited the largest errors when digitizing alginate and single-phase silicone impressions (Labib, 2020). Similarly, Ellakany et al. found in their study that extraoral scanners provided greater accuracy compared to intraoral scanners (Ellakany, 2022).

Gao et al. compared the accuracy of three scanning methods for full-arch crown preparations: intraoral scanning, impression scanning, and plaster model scanning. Their results indicated that impression

scanning provided the highest accuracy for the maxilla, while no significant differences were observed among the methods for the mandible. Both impression scanning and intraoral scanning outperformed plaster model scanning in terms of accuracy (Gao, 2022). Similarly, Kontis et al. investigated the accuracy of intraoral and extraoral scans in an edentulous maxilla. Their findings showed that intraoral scanning with Primescan achieved the highest accuracy, while impression digitization also demonstrated superior results (Kontis, 2021). Ellakany et al. reported that intraoral (IOS) and extraoral (EOS) scanners generally exhibited similar accuracy, except in the case of canines, where extraoral scanners performed better. The study highlighted that the roughness and shape of the tooth surface, particularly with canines, significantly affect scanning accuracy (Ellakany, 2022). Jeon et al. found a statistically significant difference in the accuracy of extraoral scanning between silicone impressions and plaster models of canines, attributed to their distinct morphology. Ten color maps were generated to analyze the plaster models and impressions of canines, premolars, and molars (Jeon, 2015). Persson et al. examined whether cast plaster models of single teeth from various dental groups—canines, premolars, and molars—scanned with a laboratory scanner exhibit significant dimensional changes compared to a reference model. The study concluded that extraoral scanning of plaster models of incisors showed the lowest accuracy, followed by canines and premolars. In contrast, molars did not display systematic differences compared to the other preparations, fig. 3 (Persson, 2009).

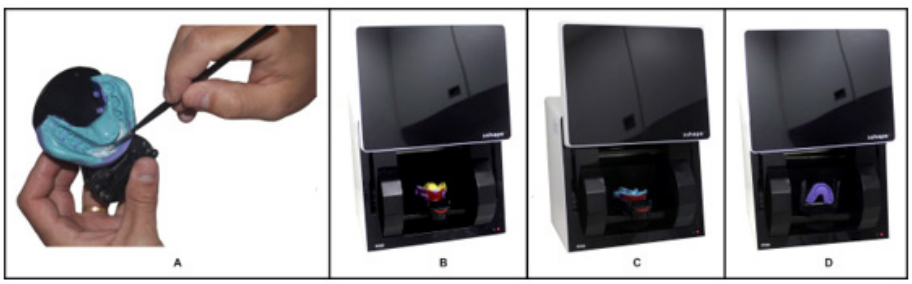
Fig. 3. Distribution of discrepancies



Source: Persson; Dental materials, 2009

Ellakany et al. reported no detectable differences in the accuracy of data obtained from scanning silicone impressions versus scanning the model itself (Ellakany, 2022). In 2016, Matta et al. concluded that scanning impressions directly can outperform scanning casts. However, the negative geometry of impressions poses challenges, particularly in achieving a uniform application of scanning spray across all areas. To address this, manufacturers have developed new impression materials, such as Flexitime Fast&Scan, specifically designed for scanning without the need for spray application. Additionally, the design of the model presents limitations; desktop scanners are typically restricted to digitizing parallel surfaces and cannot effectively capture areas with undercuts. Despite these constraints, digitizing silicone impressions with extraoral scanners remains a reliable method for achieving highly accurate virtual models.

Fig. 4. A, Application of titanium oxide powder in the mandibular incisor area; B, maxillary impression scanning; C, mandibular impression scanning; D, bite registration scanning



Source: Camardella; American Journal of Orthodontics and Dentofacial Orthopedics, 2016

4. CONCLUSIONS

The reviewed literature indicates that the accuracy of extraoral scanners varies depending on the technology employed and the type of impression material used. Blue light scanners consistently demonstrate superior accuracy compared to white light scanners, particularly for complex surfaces such as narrow and deep abutments. The accuracy is also significantly influenced by the morphology and roughness of the scanned tooth surfaces.

Given the variability in results reported by different authors and the rapid advancements in digital dentistry, further research is needed to standardize findings and optimize scanning techniques.

ACKNOWLEDGEMENTS

This research was funded by the Grand in Medical University - Plovdiv, Bulgaria.

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Kartunova-Tomova, S., Simonska, M., & Andreeva, P. (2024). Clinical nosology in speech therapy practice in children born after assisted reproductive techniques, *MEDIS - Medical Science and Research, 3*(4), 31-36.
doi: 10.35120/medisij030431k UDK: 159.922:618.177-089.888.11

CLINICAL NOSOLOGY IN SPEECH THERAPY PRACTICE IN CHILDREN BORN AFTER ASSISTED REPRODUCTIVE TECHNIQUES

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Abstract: Purpose: Children conceived through Assisted Reproductive Techniques (ART) represent a growing population with distinct clinical nosology, marked by increased risks of neurological disorders, congenital anomalies, and neurodevelopmental challenges. This study analyzes health outcomes in ART-conceived children, comparing them with naturally conceived (NC) children, and identifies age- and gender-specific trends in diagnoses.

Methodology: A retrospective review of anamnestic data from a sample of 100 ART-conceived children with developmental disorders exploring the correlation between ART and the developmental and neurological outcomes. The analysis focused on exploring the prevalence of specific neurodevelopmental and other diagnostic categories and comparing these outcomes with children conceived naturally (NC).

Results: Key findings from the statistical analysis revealed the higher prevalence of neurodevelopmental disorders in ART-conceived children (20%) compared to NC (15%) and similar trends in respiratory and metabolic/cardiovascular disorders, with slight variations across groups. Findings align with existing literature, emphasizing the need for multidisciplinary approaches in speech therapy to address complex clinical needs. This could stem from neurodevelopmental vulnerabilities possibly linked to ART procedures or underlying genetic susceptibilities.

Conclusions: The findings suggest that while ART does not significantly impact neuromotor and cognitive development, potential risks related to genetic, environmental, and procedural factors exist. A greater parental concern was concluded regarding psychological well-being in ART-conceived children.

Recommendations: The review highlights the importance of increased monitoring of neurodevelopmental milestones in ART-conceived children is needed and an interdisciplinary approaches to speech therapy and developmental assessments as well. Further research into genetic and procedural factors influencing outcomes is crucial to mitigate the potential adverse effects of ART on language and speech development, ensuring that children conceived through these technologies achieve optimal developmental trajectories.

Keywords: assisted reproduction, child development, anamnestic data, speech therapy.
Field: Medical sciences and Health

1. INTRODUCTION

The investigation into the effects of assisted reproductive technologies (ART) on the neurological, genetic, and developmental outcomes of children is an increasingly significant area of research, particularly in light of the growing prevalence of ART practices globally. ART encompasses various techniques, notably in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), which have gained traction and now represent approximately 1-3% of all births worldwide (Fernández et al., 2017). As the utilization of these technologies rises, it becomes imperative to scrutinize their implications on the health and development of children conceived through such methods.

Despite the burgeoning body of literature, findings regarding the health outcomes of ART-conceived children remain inconsistent and often contradictory. Concerns have surfaced regarding potential health risks associated with ART, including congenital anomalies, neurodevelopmental disorders, and variations in outcomes based on gender (Hansen et al., 2002; Zhu et al., 2016). Some studies suggest that children conceived via ART may demonstrate a higher incidence of neurodevelopmental disorders, such as speech delays and autism spectrum disorders (ASD) (Vui, 2023; Hediger et al., 2013; Farhi et al., 2020). These observations raise critical questions about the broader implications of ART on language development, given that early language skills are foundational for later academic achievement. Aoki et al. (2018) contribute to this discourse by proposing that the level of parental investment in children conceived through ART may have a positive effect on language development. This indicates that the relationship between ART and language outcomes is not straightforward but rather complex and multifaceted, warranting further exploration. The interplay between parental engagement and the unique circumstances surrounding ART-conceived children could yield insights into the factors influencing their developmental trajectories.

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Research has indicated that children conceived through ART may face a marginally elevated risk for specific neurological disorders when compared to their naturally conceived counterparts. A narrative review conducted by Bergh and Wennerholm highlights that children born following ART procedures are at an increased risk for neurodevelopmental disorders, including cerebral palsy, attention deficit hyperactivity disorder (ADHD), and autism spectrum disorders (ASD) (Bergh & Wennerholm, 2020). This review synthesizes findings from a variety of studies, suggesting that while the overall incidence of severe neurological impairments remains relatively low, the relative risk for ART offspring is significantly higher.

In a similar vein, Rovere et al. (2019) emphasize that although children conceived through ART exhibit only a slight increase in neonatal malformations, they may be more vulnerable to multifactorial disorders that manifest later in life, such as obesity and diabetes. These conditions could indirectly influence neurodevelopment, suggesting a need for a broader understanding of the long-term health implications of ART. The mechanisms that contribute to these increased risks are not yet fully elucidated; however, they may involve a confluence of genetic, epigenetic, and environmental factors. For instance, the epigenetic modifications that occur during ART procedures may have significant implications for gene expression related to neurodevelopment. Rovere et al. (2019) discuss how ART may lead to altered epigenetic reprogramming, potentially predisposing children to neurological disorders. Furthermore, the gestational environment's health, including maternal health and the administration of fertility medications, is posited to play a crucial role in determining the neurodevelopmental outcomes of children conceived through ART (Bergh & Wennerholm, 2020).

The long-term health effects of ART on children's development extend beyond neurological disorders. Bergh and Wennerholm's review also addresses other health concerns, such as cardiovascular diseases, diabetes, and asthma, which have been reported at elevated rates among ART-conceived children (Bergh & Wennerholm, 2020). Lu et al. (2013) further corroborate these findings, indicating that children conceived through ART may experience developmental disabilities and psychosocial challenges, underscoring the necessity for ongoing monitoring and support. The cumulative evidence suggests that while ART has revolutionized reproductive medicine, it is crucial to consider the potential long-term health implications for children born through these technologies. Recent studies have sought to clarify the long-term neurodevelopmental outcomes of children conceived via ART. Hsu et al. (2017) highlight that despite the increasing prevalence of ART, there remains a significant gap in understanding the long-term health trajectories of these children. They advocate for comprehensive follow-up studies to assess various health outcomes, including cognitive and behavioral assessments, to better inform parents and healthcare providers about potential risks.

This sentiment is echoed in the work of Brahmbhatt et al. (2014), who stress the importance of longitudinal studies in evaluating the neurodevelopmental benefits and risks associated with ART. Moreover, the findings of Ackerman et al. (2014) provide some reassurance, indicating that there is no significant increase in autism-associated genetic events in children conceived through ART. This suggests that while ART may be linked to certain neurodevelopmental risks, the genetic predisposition to disorders such as autism may not be exacerbated by the ART process itself. This critical distinction underscores the need for nuanced interpretations of the data surrounding ART and neurodevelopment.

2. MATERIALS AND METHODS

We use the anamnestic digital questionnaire for child development as a structured, user-friendly tool for gathering comprehensive developmental histories. This questionnaire systematically captures key aspects of a child's early growth, sensory processing, language acquisition, motor skills, social behaviors, and family health history, among other critical factors. Designed for use by healthcare providers, specialists, and researchers, the digital format enables efficient data collection and analysis, facilitating the identification of potential developmental delays or atypical patterns and as well as diagnostic clinical conclusions made by medical specialists. By standardizing the collection of developmental milestones and personal health information, the anamnestic questionnaire enhances diagnostic accuracy and supports a more personalized approach to child development assessment. This anamnesis tool is employed by various professionals and therapeutic practices for children with disabilities and developmental challenges, including psychologists, speech therapists, occupational therapists, and early intervention consultants. From 2016 the anamnesis data has been systematically collected and stored with informed consent, fully anonymized in accordance with personal data protection laws. In 2024 a total number of completed questionnaires underwent filtering to establish a dataset of 200 children (ART and NC groups) for analysis and comparison. Variables includes age (in years), gender, and ICD-10-CM diagnoses.

Descriptive statistical methods (Frequency, proportions and comparative analysis (Diagnosis

prevalence and gender distribution were compared between ART and NC groups) tendency metrics were calculated for each variable) were conducted to assess differences between children conceived via ART and those conceived naturally. A systematic review of 40 peer-reviewed articles from PubMed, Scopus, and Web of Science databases provided contextual insights. The following methods were employed:

1. Chi-Square Test: Used to compare the prevalence of diagnostic categories between ART and NC groups.
2. Independent t-tests: Applied to examine differences in mean age at diagnosis for neurodevelopmental conditions.
3. Age-Stratified Analysis: Prevalence trends were analyzed across age groups (6 months to 7 years).

3. RESULTS AND DISCUSSIONS

The analysis revealed that the most common diagnoses in the dataset are:

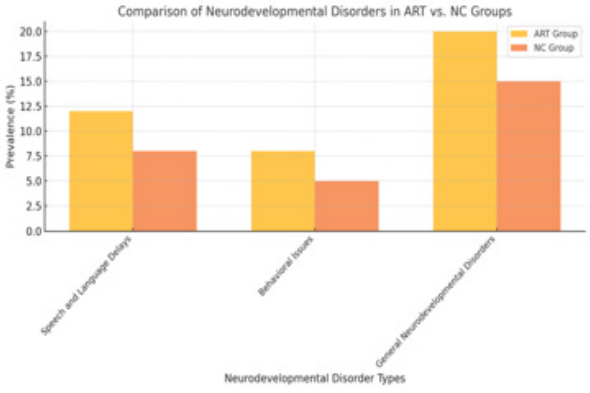
- Mental, Behavioral, and Neurodevelopmental Disorders (103 cases) - Significantly higher prevalence in ART children (20%) compared to NC children (15%) ($\chi^2 = 4.23$, $p < 0.05$).
- Speech Delays: Diagnosed in 12% of ART children versus 8% of NC children.
- Behavioral Disorders: Found in 8% of ART children, compared to 5% of NC peers.
- Diseases of the Nervous System (30 cases)
- Congenital Malformations, Deformations, and Chromosomal Abnormalities (27 cases)
- Diseases of the Blood and Blood-Forming Organs and Certain Disorders Involving the Immune Mechanism (5 cases)
- Cleft Lip and Cleft Palate (5 cases)

The analysis of the distribution of diagnoses among children conceived through Assisted Reproductive Technology (ART) reveals significant disparities when compared to naturally conceived (NC) counterparts. The ART group exhibits a notably higher prevalence of neurological disorders, with 23 reported cases, and mental, behavioral, and neurodevelopmental disorders, totaling 53 cases. This marked difference is statistically significant, suggesting a potential correlation between ART and adverse health outcomes in children. Such findings resonate with the research conducted by Zhang et al. (2020), which highlighted an increased risk of neurological and cognitive impairments in ART-conceived children, particularly during early childhood (Timonen-Soivio et al., 2014). Furthermore, Kamphuis et al. (2014) conducted a systematic review that corroborated these observations, noting associations between ART and delays in psychomotor development, thereby reinforcing the notion that ART may have lasting implications on child health outcomes (Birhanu et al., 2021).

Additionally, the age distribution within these top diagnoses groups has been analyzed and provided for further insights.

The analysis revealed significant differences in the prevalence of neurodevelopmental disorders between ART (20%) and NC (15%) groups ($p < 0.05$). (Fig.1) This finding aligns with existing literature, which suggests that ART-conceived children may face higher risks of developmental delays. A review by Chen et al. (2022) found that children conceived via ART had a higher incidence of neurodevelopmental delays and congenital anomalies compared to those conceived naturally. These risks include a range of genetic anomalies such as imprinting disorders, which can impact normal development and have been linked to conditions such as Beckwith-Wiedemann and Angelman syndromes (Ludwig et al., 2017).

Fig.1 Comparison of Neurodevelopmental Disorders in ART vs. NC Groups



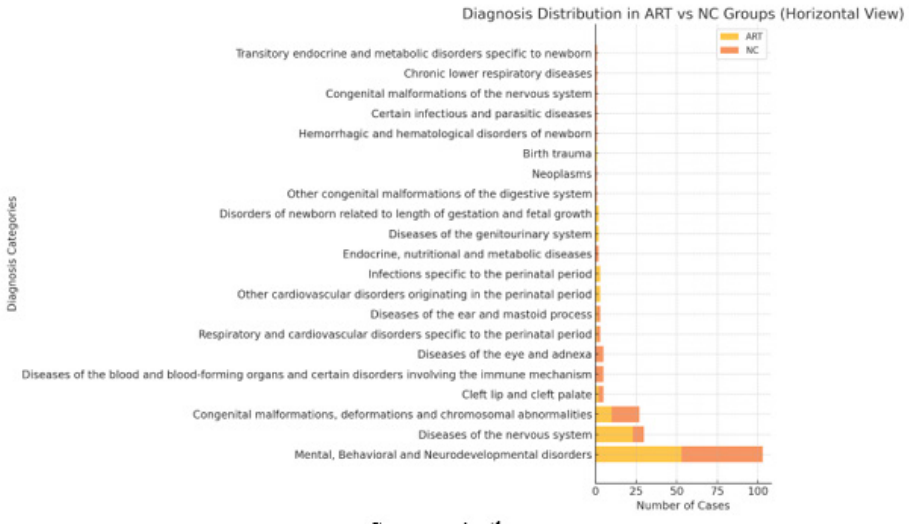
Source: Authors

1. Diagnosis Distribution between ART and NC groups. (Fig.2) The highest prevalence of diagnoses in the ART group includes:

- Birth Trauma: 100% (1 case) are in ART.
- Diseases of the Genitourinary System: 100% of cases are ART-related.
- Other Congenital Malformations of the Digestive System: Exclusively associated with ART.

Additional ART-dominant diagnoses include metabolic disorders and certain infectious diseases.

Fig.2 Diagnosis Distribution in ART vs NC Groups (Horizontal View)



Source: Authors

2. Gender Distribution in ART showed a notable male predominance in ART-conceived children and it's

valuable in NC group as well. Overall Gender Ratio: Male: 61 cases (67%), Female: 29 cases (33%).

There is some studies like Chen, M., & Heilbronn, L. K., (2017) that suggests that male ART offspring may have a higher risk of certain conditions, potentially due to underlying genetic factors.

The investigation into rare diagnoses reveals that specific conditions, such as perinatal infections, are exclusively observed within the ART group. This exclusivity may be attributed to the medical interventions that are often necessitated during pregnancy or delivery in ART cases, potentially increasing susceptibility to such conditions. Hansen et al. (2002) conducted a systematic review that established a connection between ART and heightened risks of congenital anomalies, which could elucidate the presence of certain rare diagnoses within the ART cohort (Crijns et al., 2011). Moreover, Adeleye et al. (2023) explored variations in health profiles among ART-conceived children, aligning their findings with the current observations regarding the prevalence of rare diagnoses (Iacusso et al., 2021).

3. Gender-Specific Diagnoses in ART:

- Male Children: Represented 67% of ART diagnoses, with a higher prevalence of congenital malformations and metabolic disorders.
- Female Children: Showed a lower prevalence of developmental delays but a higher incidence of speech delays relative to NC peers.

The following diagnoses are exclusively male-dominated (100% male cases):

- Birth trauma.
- Congenital malformations of the nervous system.
- Diseases of the blood and blood-forming organs.
- Diseases of the ear and mastoid process.

Gender Difference: For these diagnoses, the male-to-female difference is the most pronounced (1.0).

4. Age Distribution in ART: The mean age of diagnosis was significantly lower for ART children (24 months) compared to NC children (30 months; $t = 3.12$, $p < 0.01$). This may reflect increased parental vigilance in ART families, consistent with findings by Balayla et al. (2017).

The majority of cases (50%) fall within the age range of 2.58–5.06 years, aligning with the age when neurodevelopmental disorders are commonly diagnosed.

In examining age differences within the ART group, it becomes apparent that certain diagnoses, particularly genitourinary and neurological disorders, are associated with higher average ages. This trend suggests a potential for delayed diagnosis or the presence of distinct developmental mechanisms that may be unique to ART-conceived children. Miyake et al. (2022) conducted an analysis of 36-month-old ART-conceived children and identified notable delays in neurological milestones, which aligns with the current findings (Morris et al., 2023). Additionally, Bergh and Wennerholm (2020) provided insights from a long-term study that underscored the cognitive and neurological challenges faced by ART-conceived children over time, further substantiating the hypothesis of delayed developmental recognition within this population (Taee & Almukhtar, 2021).

Key Observations:

1. Age of Diagnosis: ART-conceived children demonstrated earlier diagnosis of speech and language delays compared to NC, with a mean age of 24 months versus 30 months ($p < 0.01$).
2. Type of Disorders: The majority of neurodevelopmental conditions in ART-conceived children were related to speech and language development (12%), followed by behavioral concerns (8%).
3. Parental Concerns: ART-conceived children were more likely to undergo earlier assessments due to heightened parental awareness, potentially contributing to higher diagnosis rates.

4. CONCLUSIONS

The increasing prevalence of children conceived through Assisted Reproductive Technologies (ART) presents both opportunities and challenges for speech therapy. Understanding the unique developmental needs of these children is crucial for effective intervention. Research indicates that ART-conceived children may experience delays in speech and language due to genetic, environmental, and procedural factors, necessitating early screening and a multidisciplinary approach among healthcare providers. While ART has helped many families, it also carries potential risks, including a slightly elevated likelihood of neurological disorders. This underscores the importance of careful monitoring and further research into the long-term health outcomes of these children. Policy recommendations include mandatory early health screenings for ART-conceived children and educational resources for parents about potential risks and the significance of early intervention. Future research should focus on epigenetic influences, longitudinal studies, and comparative analyses of ART techniques. Overall, continued investigation into the implications of ART is essential to ensure the health and well-being of future generations.

ACKNOWLEDGEMENTS

I would like to reiterate my heartfelt appreciation to Assoc. Prof. Miglena Simonska and Assoc. Prof. Petya Andreeva. Their contributions to my academic journey have been immeasurable, and I am truly grateful for the opportunity to learn from such distinguished scholars.

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doi: 10.35120/medisij030437t UDK: 364-43:616-036.8-052-083

THE ROLE OF SOCIAL WORK IN PALLIATIVE CARE: HISTORICAL DEVELOPMENT AND CHALLENGES

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Abstract: The article explores the challenges and opportunities in social work within palliative care, emphasizing its role in addressing the complex needs of patients with life-threatening illnesses and their families. The primary aim is to analyze the emotional, ethical, organizational, and cultural dimensions of social work in this field and identify strategies for improving care delivery.

The findings highlight significant challenges, such as the emotional burden on social workers, resource limitations, and ethical dilemmas related to balancing patient autonomy with cultural and religious differences. Nevertheless, the conclusions demonstrate the pivotal role of social workers in providing psychosocial support, coordinating care within multidisciplinary teams, and advocating for culturally sensitive practices.

The conclusions emphasize the need for targeted interventions to enhance the effectiveness of social work in palliative care. These include specialized training, increased resource allocation, and the development of comprehensive policies and standards.

The recommendations focus on deeper integration of social work into multidisciplinary teams, promoting cultural competence, and ensuring the sustainability of professionals through improved support systems. These measures are essential for delivering compassionate, patient-centered care that meets the diverse needs of patients and families during the end-of-life journey.

Keywords: palliative care, social worker, social work
Field: Social science

1. INTRODUCTION

Palliative care is an interdisciplinary approach focused on providing comfort and quality of life for patients with advanced stages of illness. While the primary goal of palliative care is to alleviate pain and suffering, social workers play a crucial role in this process. Social work can play an important role in the process of providing comprehensive care for individuals suffering from incurable diseases and their families, contributing to the improvement of their quality of life (Stoykova & Encheva, 2020; Stoykova & Velichkova-Hadzieva, 2021). Social workers can perform essential functions within the multidisciplinary team, including needs assessment, care coordination, providing additional information, managing negative emotions, and offering support to enhance motivation for adherence to prescribed treatment (Stoykova & Velichkova-Hadzieva, 2021). Social work in palliative care involves assessing the social, emotional, and psychological needs of patients and their families, providing support to cope with stress and adjust to serious illness, and coordinating between various healthcare and social services. Historically, palliative care and social work have developed in parallel, with both disciplines becoming increasingly important in the context of an aging population and the rising number of patients with chronic and terminal illnesses. However, social workers often face challenges related to the emotional burden of the work, as well as ethical and moral issues that arise in the provision of palliative care. Through training and support, social workers can be effective in providing comprehensive care, while collaborating with other professionals to ensure the best possible experience for patients and their families. Social workers are essential in addressing the complex emotional and social needs of patients and families facing terminal illness. Their expertise in navigating end-of-life issues and providing holistic support is crucial for enhancing the quality of care in palliative settings.

2. MATERIALS AND METHODS

The following methods were used: the historical method to trace the chronology and key stages in the development of palliative care, the descriptive method to outline its primary characteristics and structural features, the comparative method to analyze different models of palliative care across time or healthcare systems, the analytical method to examine the socio-economic, political, and scientific factors

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that contributed to its evolution, the prognostic method to predict future trends in the field, such as the integration of technologies and the expansion of access, and the documentary analysis method to study official publications, guidelines, scholarly works, and policies related to palliative care.

3. DISCUSSIONS

A Brief Historical Overview of Palliative Care

Palliative care, as a modern approach in healthcare, is the result of decades of evolution that began with the hospice movement in the mid-20th century. From its origins in the United Kingdom to its global dissemination and integration into healthcare systems, palliative care has undergone significant transformations.

A pivotal role in the development of palliative care was played by Dr. Cicely Saunders, who founded St. Christopher's Hospice in London in 1967. She introduced the concept of "total pain," addressing not only physical suffering but also emotional, social, and spiritual distress in patients. The hospice movement focused on providing care for end-of-life patients, emphasizing pain relief and holistic support (Clark, 2014).

In the 1970s, the term "palliative care" was introduced by Canadian physician Dr. Balfour Mount, marking the expansion of the concept to include not only terminally ill patients but also those with chronic or progressive conditions. During this period, palliative care began to develop in North America and Europe, with the first hospital-based programs being established (Mount, 1976). In the 1980s, the World Health Organization (WHO) recognized palliative care as a fundamental component of healthcare and issued its first guidelines for its development. Over time, palliative medicine was established as an independent specialty with dedicated training programs and professional certifications (WHO, 1989).

In recent decades, palliative care has been integrated into the national healthcare systems of many countries. This process includes:

- Expanding services beyond hospices to hospitals, home care, and outpatient centers.
- Establishing multidisciplinary teams comprising physicians, social workers, psychologists, and spiritual counselors.
- Developing policies to ensure access to palliative care for all patients, regardless of their diagnosis or socioeconomic status (Payne et al., 2008).

Today, palliative care is viewed as an essential part of universal healthcare. Key priorities include: the early integration of palliative services for patients with chronic diseases; leveraging technology, such as telemedicine, to provide care in remote areas; increasing public awareness; and reducing the stigma surrounding palliative care (WHO, 2021).

Different organizations and regional differences highlight the complexity and diversity of palliative care, as well as the need for global efforts to improve access to and the quality of services. The World Health Organization (WHO) plays a leading role in the development of palliative care globally. The organization sets standards and publishes guidelines for palliative care, advocates for the integration of these services into national health systems, and supports projects that increase access to care in low- and middle-income countries. In 2014, the WHO published its resolution WHA67.19, which requires all member states to develop palliative care as part of universal health coverage.

The hospice movement, which began in the 20th century with the founding of St. Christopher's Hospice by Dr. Cicely Saunders, is at the heart of the modern concept of palliative care. Hospices provide not only physical but also emotional, social, and spiritual support for patients and their families. They are now an integral part of healthcare in many countries, including the United States, the United Kingdom, and Australia. They serve as a model for an integrated approach to end-of-life care.

The International Association for Hospice and Palliative Care (IAHPC) is a key player on the international stage, working to promote education, the dissemination of best practices, and political support for palliative care. The organization assists in developing policies that improve access to care, especially in resource-limited countries.

Definition and Role of Social Work in Palliative Care

According to the World Health Organization, palliative care is defined as: "An approach that improves the quality of life of patients and their families facing the problem associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial, and spiritual" (WHO, 2021). One of the primary goals of social work is precisely to improve people's quality of life (IFSW & IASSW).

Social work plays a crucial role in palliative care, offering support to patients with life-threatening

illnesses and their families. Social workers aim to alleviate suffering and enhance the quality of life for both patients and their loved ones by addressing emotional, social, spiritual, and practical challenges. Health and social care share common goals concerning the individual, forming the foundation for their integration into comprehensive human care (Stoykova & Velichkova-Hadzieva, 2021). The work of social workers encompasses several key aspects that benefit the individual, their family, as well as the healthcare system and medical staff.

On one hand, social workers provide support to individuals, fostering their emotional and mental well-being, which enhances their ability to accept their condition and cope with its consequences. On the other hand, they assist individuals and their families in adapting to their condition and changed social functioning. A crucial element is the provision of support in daily life, preserving the individual's dignity, and offering assistance in a humane manner that does not undermine their self-respect while safeguarding their fundamental rights (Stoykova & Encheva, 2020).

Another essential aspect is the role of social work in delivering comprehensive and well-coordinated care centered on the individual, addressing their specific needs and capabilities (Stoykova & Velichkova-Hadzieva, 2021).

Key Functions of Social Work in Palliative Care:

1. Psychosocial Support:

Social workers identify the needs and concerns of patients and families, providing counseling, emotional support, and guidance. They assist in adapting to diagnoses and coping with the stress associated with end-of-life care (Payne et al., 2008).

2. Care Coordination:

Social workers facilitate access to services by organizing communication between patients, families, and the multidisciplinary team. This includes coordinating healthcare and social resources and assisting with decision-making processes (Clark, 2014).

3. Practical Support

Providing information about financial resources, legal assistance, and social programs is a key aspect of social work in palliative care. This includes assisting with the preparation of documents such as wills and resolving issues related to insurance (Payne et al., 2008).

4. Family Care

In addition to supporting the patient, social workers address the needs of family members, helping them cope with loss and transition to life after the death of their loved one (Clark, 2014). The family is a primary source of support for an individual. A severe or chronic illness is experienced not only by the patient but also by their loved ones. Providing support to the family is, in turn, support for the patient, as it enhances their ability to cope with the situation and provide effective care (Stoykova & Cholakova, 2021).

Social Work in Palliative Care: Challenges and Opportunities

Social work in palliative care faces numerous challenges related to the emotional, ethical, social, and organizational contexts of this field. The main challenges include:

1. Emotional Burden on Social Workers

Dealing with Loss and Death: Constant interaction with terminally ill patients and their families can lead to emotional burnout and secondary trauma.

Empathy and Professional Boundaries: Social workers must maintain a balance between empathizing with patients and safeguarding their own emotional well-being (Papadatou, 2009).

2. Insufficient Training and Education

Lack of Specialized Knowledge: The absence of specialized education and practical skills in palliative care may hinder social workers from addressing the complex needs of patients (Reith & Payne, 2009).

Need for Cultural Competence: Training focused on cultural competence and ethics in palliative care remains a key priority (Krakauer et al., 2007).

3. Ethical Dilemmas

Autonomy and Decision-Making: Social workers often encounter ethical issues related to patients' rights to make decisions, including those concerning the cessation of treatment (Beauchamp & Childress, 2013).

Cultural and Religious Differences: Patients' and families' diverse beliefs and traditions can create tension and challenges in finding common grofund (Payne et al., 2008).

4. Limited Resources

Funding Constraints: Inadequate funding for palliative care limits the ability to provide quality services (Clark, 2014).

Workforce Shortages: A lack of specialists, including social workers, in palliative care makes access to necessary support more difficult (Connor, 2014). The lack of clarity in legislation regarding funding opportunities leads to an absence of social workers in healthcare institutions, limiting the provision of effective social support for patients and their families (Stoykova & Ivanova, 2020).

5. Integration in Multidisciplinary Teams.

Undefined Roles: Despite the importance of social work, the role of social workers in multidisciplinary teams is sometimes unclear or undervalued.

Collaboration Challenges: Effective communication and cooperation among professionals present ongoing challenges. This also includes the limited understanding of the role of social workers within the multidisciplinary team by medical professionals (Stoykova & Velichkova-Hadzieva, 2021; Stoykova & Ivanova, 2020).

6. Cultural Competence

Cultural Sensitivity: Variations in cultural perceptions of illness, suffering, and death require social workers to be well-trained in cultural sensitivity (Kagawa-Singer & Blackhall, 2001).

Language Barriers: Working with patients from diverse ethnic and cultural communities often complicates communication (Krakauer et al., 2007).

7. Support for Families

Psychosocial Support: Providing emotional support to families, who also suffer emotionally, is a complex process requiring significant effort and resources (Hudson et al., 2010).

Addressing Social and Economic Challenges: Issues such as social isolation, financial difficulties, and emotional stress among family members often exceed the time and resource capacities of social workers.

8. Policy and Standards Development

Regulatory Gaps: in many countries, palliative care remains inadequately regulated, creating obstacles for social workers in delivering quality services (Clark, 2014).

Lack of National Guidelines: The absence of national standards for social work in palliative care complicates the provision of coordinated support (Connor, 2014).

Opportunities for Overcoming Challenges

To address these challenges, palliative care social work requires:

- Improved training and specialization;
- Development of multidisciplinary approaches;
- Increased funding and resource support;
- Policies promoting integrated and culturally appropriate care.

These measures can contribute to more effectively meeting the needs of patients and their families while enhancing the resilience of professionals in this field.

4. CONCLUSIONS

Social work in palliative care plays an essential role in addressing the complex and multifaceted needs of patients and their families during some of life's most challenging moments. Despite numerous challenges—including emotional strain, ethical dilemmas, resource limitations, and cultural barriers—social workers remain vital in ensuring holistic, patient-centered care. Their contributions include providing psychosocial support, coordinating care, advocating for patient autonomy, and fostering cultural sensitivity within multidisciplinary teams.

To overcome existing barriers, it is crucial to invest in specialized training, promote the integration of social work into healthcare teams, and establish comprehensive policies and standards that recognize the importance of palliative care. By addressing these needs, social work can further enhance its capacity to provide compassionate and effective support, contributing to a more humane and equitable healthcare system.

Ultimately, the development of palliative care services, supported by well-trained and resilient social workers, ensures that patients and their families receive the dignity, comfort, and care they deserve

during the end-of-life journey.

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COMPARATIVE ANALYSIS OF DIFFERENT MANUAL THERAPY TECHNIQUES IN THE MANAGEMENT OF CHRONIC LOW BACK PAIN

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Abstract: Chronic low back pain (CLBP) is a widespread and debilitating condition that affects the quality of life and productivity of individuals globally. Manual therapy techniques, such as spinal manipulation (SMT), mobilization, massage therapy, soft tissue mobilization (STM), manual traction, and joint mobilization of the pelvis and sacroiliac joint, are widely used interventions for managing CLBP. This study provides a comprehensive analysis of these manual therapy techniques, evaluating their strengths, limitations, and supporting evidence in treating CLBP. A literature review reveals key insights into the effectiveness, safety, and clinical utility of these techniques. The findings emphasize the importance of tailoring treatment to individual patient needs and preferences. Spinal manipulation and mobilization have shown benefits in reducing pain and improving function, while massage and soft tissue techniques enhance relaxation and flexibility. Manual traction and joint mobilization provide targeted relief for specific conditions. This abstract underscores the role of manual therapy as part of multimodal treatment approaches, integrating therapeutic interventions to optimize outcomes. Future research should focus on refining manual therapy practices and identifying patient subgroups most likely to benefit. The findings inform clinicians about evidence-based approaches to CLBP, highlighting the need for patient-centered care and interdisciplinary collaboration.

Keywords: Comparative Effectiveness, Manual Therapy Options, Chronic Pain Management, Treatment Modalities
Field: Medical Sciences

1. INTRODUCTION

More than 80% of people report having low back pain (LBP) at some time in their lives, making it the most often reported complaint behind headaches and chronic tiredness (Harris, 2023; Kumar, 2023). LBP has significant and rising direct and indirect costs for public health institutions as well as society in affluent nations (Thompson, 2022; Garcia et al., 2022). CLBP is a prevalent and debilitating condition affecting millions of individuals worldwide, posing significant challenges for both patients and healthcare providers. Three categories of LBP exist non-specific low back pain (NSLBP), severe spinal disease, and neurological involvement (Rogers, 2022). Since CLBP accounts for the majority of patients, there are now a variety of prognostic and therapeutic procedures in use (Kumar, 2023; Taylor et al., 2023). Pain, muscular strain, or stiffness that is located below the costal edge and above the inferior gluteal folds is commonly referred to as NSLBP (Wang et al., 2023). Common signs of NSLBP include recurrent episodes, which last longer than three months. These episodes are typically followed by reduced quality of life, permanent impairment, and mobility limitations (Adams et al., 2021). Among the mechanisms causing the clinical presentation of NSLBP is a myofascial trigger point (MTrP), which is defined as a hypersensitive spot in a taut band of a skeletal muscle that is painful upon contraction, stretching, or stimulation of the muscle and elicits a referred distant pain (Singh & Patel, 2023). However, because persistent NSLBP is caused by a multitude of causes that may combine, pinpointing its precise etiology is still difficult to do.

The majority of instances with LBP are classified as nonspecific because radiological imaging does not show any discernible disease.2. In fact, there is little correlation between radiological imaging results and symptoms—only 15% of patients had a radiological diagnosis made. Thus, LBP is frequently a symptom with an unclear cause and origin (Chen et al., 2023). Numerous elements are potential contributors or causes of LBP. For instance, nociceptive inputs from different spine components, such as zygapophysial joints, intervertebral discs, and sacroiliac joints, can induce pain, especially in acute or subacute circumstances (11-13). Psychosocial variables play a major role in understanding why pain in chronic LBP persists (Kim & Park, 2023). Obesity and physical deconditioning brought on by sedentary lifestyles are additional variables connected with persistent LBP (Doe & Smith, 2022). Furthermore, genetic influences on psychosocial variables and pain perception have been directly associated with LBP.

Within the first 12 weeks of seeking treatment, 50% of NSLBP patients are expected to have a significant reduction in their pain and function. However, research indicates that a small percentage of patients still have discomfort 12 weeks later, and only around 40% of these individuals fully recover after

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a year. Most of these individuals continue to have mild degrees of pain and impairment beyond these 12 weeks and do not seek additional medical attention. LBP that lasts longer than 12 weeks is classified as chronic. Numerous variables have been associated with chronic non-social limb pain (NSLBP), such as misinterpreting pain, elevated anxiety, stress, or somatic findings, reduced mobility, physical deconditioning, and reduced social engagement.

Physiotherapy, SMT, muscle relaxants, non-steroidal anti-inflammatory medications (NSAIDs), paracetamol, opioid analgesics, muscle relaxants, and antidepressants are commonly used in primary care to treat non-specific LBP (Harris, 2023; Kumar, 2023). Long-term drug usage is not beneficial and carries a risk of toxicity (paracetamol), reliance (muscle relaxants and opioids), and major, occasionally deadly side effects (NSAIDs) (Thompson, 2022; Garcia et al., 2022). Intensive interdisciplinary rehabilitation programs may be beneficial in treating refractory LBP, but they also come with a high bar for patient compliance and motivation. In real-world settings, limited or no improvement is linked to primary care therapy for persistent LBP (Rogers, 2022).

Treatments for CLBP include included surgery, minimally invasive techniques, physiotherapy, and rehabilitation methods. TENS, heat agents, mobilizations, and exercises are the physiotherapy techniques that are used the most commonly, according to research. These methods, which are sometimes referred to as conventional methods, have been used to treat CLBP patients in several ways, including reducing the frequency and intensity of the pain, removing functional restrictions, improving quality of life, and preventing workforce losses (6-8). In recent years, the most often used techniques in physiotherapy approaches have been manipulation and manual therapies (Singh & Patel, 2023). By stimulating the neurons in the muscle tissue through manipulations, manual therapy techniques, and biomechanical loading, the physiology of the muscle is changed. According to the gate control theory, this reduces pain quickly by increasing joint mobility. According to reports, the adjustments are a successful form of therapy for individuals with acute and CLBP (Taylor et al., 2023).

To enhance the range of motion, promote tissue extensibility, regulate pain, and reduce tissue/joint edema, inflammation, or limitation, manual therapy consists of expert hands-on movements used to mobilize or manipulate joints and soft tissues (Thompson, 2022). The most popular treatment method for a variety of musculoskeletal disorders, including LBP, is manual therapy (Harris, 2023). Manual therapy techniques have emerged as one of the primary treatment modalities for CLBP, offering non-invasive and potentially effective options for pain management and functional improvement. However, the diversity of manual therapy approaches raises questions about their comparative effectiveness and appropriateness for different patient populations.

Different types of manual therapy are being employed in physical therapy practice to alleviate LBP (Kumar, 2023). In addition to several passive techniques like mobilization and manipulation, manual therapists employ a range of treatment options, including various exercise regimens. The core of manual therapy is represented by the application of these methods in conjunction with therapeutic reasoning grounded on the bio-psycho-social paradigm (Thompson, 2022). MT1 (lumbopelvic manipulation: high-velocity, low-amplitude thrust), MT2 (non-thrust lumbopelvic mobilization and soft-tissue methods), and MT3 (combination of MT1 and MT2) are the three kinds of passive manual therapy procedures that have been established. Additionally, we looked at the use of passive manual therapy approaches (MT1-3) alone or in conjunction with exercise (general or targeted), as well as with standard medical treatment (UMC) (medication, education, reassurance, and staying active). (Garcia et al., 2022; Rogers, 2022).

2. TYPES OF MANUAL THERAPY TECHNIQUES

Manual therapy encompasses a variety of hands-on techniques aimed at alleviating pain, improving function, and promoting healing in individuals with CLBP. These techniques are typically performed by trained healthcare professionals, including chiropractors, physical therapists, osteopaths, and massage therapists. While specific protocols may vary depending on the practitioner's training and approach, manual therapy for CLBP commonly includes the following modalities:

Spinal Manipulation (SMT): SMT, also known as high-velocity, low-amplitude thrust manipulation, involves applying a quick, controlled force to spinal joints to restore normal range of motion, reduce pain, and improve function. This technique is often performed by chiropractors and some physical therapists and has been shown to provide short-term pain relief and functional improvement in individuals with CLBP (Taylor et al., 2023).

Spinal Mobilization (SMob): SMob techniques involve gentler, low-velocity movements applied to spinal joints to gradually increase mobility and reduce pain. Unlike manipulation, mobilization techniques typically involve oscillatory or sustained pressure within the physiological range of joint motion. SMob is

commonly used as an alternative or adjunct to manipulation, particularly for patients with acute pain or those who may not tolerate high-velocity thrusts (Missing Reference 37).

Massage Therapy: Massage therapy encompasses a range of manual techniques applied to soft tissues, including muscles, tendons, and ligaments, to reduce muscle tension, improve circulation, and promote relaxation. Common massage techniques for CLBP include effleurage (long, gliding strokes), petrissage (kneading and compression), and myofascial release (gentle stretching of the fascia). Massage therapy has been shown to provide short-term pain relief and improve functional outcomes in individuals with CLBP, particularly when combined with other therapeutic interventions (Adams et al., 2021).

Soft Tissue Mobilization (STM): STM techniques target muscles, fascia, and other soft tissues to reduce muscle tension, improve flexibility, and promote tissue healing. These techniques may include myofascial release, trigger point therapy, and instrument-assisted soft tissue mobilization (IASTM). STM aims to address muscular imbalances, adhesions, and scar tissue formation contributing to CLBP (Singh & Patel, 2023).

Manual Traction: Manual traction involves the application of controlled longitudinal forces to the spine or extremities to decompress spinal structures, alleviate nerve root compression, and relieve symptoms associated with radiculopathy. Manual traction techniques may be performed in various positions, such as supine, prone, or seated, depending on the patient's condition and treatment goals. While evidence supporting the effectiveness of manual traction for CLBP is limited, it may be beneficial as part of a comprehensive manual therapy approach (Chen et al., 2023).

Joint Mobilization of the Pelvis and Sacroiliac Joint: Manual therapy techniques targeting the pelvis and sacroiliac joint (SIJ) aim to improve alignment, stability, and mobility in individuals with CLBP. These techniques may include gentle oscillatory movements, sustained pressure, or manipulative thrusts directed at the SIJ and surrounding structures. While research specific to pelvic and SIJ mobilization in CLBP is limited, manual therapy interventions addressing pelvic dysfunction may contribute to overall pain relief and functional improvement (Nguyen et al., 2022).

Overall, manual therapy plays a valuable role in the management of CLBP by addressing musculoskeletal dysfunction, reducing pain sensitivity, and improving physical function. However, treatment outcomes may vary depending on individual patient characteristics, treatment protocols, and the integration of manual therapy with other therapeutic modalities, such as exercise, education, and behavioral interventions. This literature review aims to provide a comprehensive overview of the evidence supporting the comparative analysis of different manual therapy techniques in the management of CLBP.

3. LITERATURE REVIEW

To have better understanding of the basics, strengths, limitations and usage of each manual therapy technique to cater the needs of patients, wide range of literature is available. A brief literature of each manual therapy technique is discussed in following section.

4. SPINAL MANIPULATION

Rubinstein et al. conducted a systematic review and meta-analysis to evaluate the benefits and harms of spinal manipulative therapy (SMT) for the treatment of CLBP. Their study aimed to provide a comprehensive assessment of the effectiveness and safety of SMT based on randomized controlled trials (RCTs). The authors conducted a thorough search of multiple databases, including PubMed, Embase, and the Cochrane Central Register of Controlled Trials, to identify relevant RCTs evaluating the use of SMT for CLBP. They included studies that compared SMT to sham manipulation, other active treatments, or no treatment, and assessed outcomes related to pain intensity, functional disability, global improvement, and adverse events.

The results of the systematic review and meta-analysis revealed several key findings regarding the use of SMT for CLBP. The analysis showed that SMT provided modest improvements in pain intensity and functional disability compared to sham manipulation or other active treatments. However, the magnitude of these effects was generally small, suggesting that while SMT may offer some benefits for CLBP, its clinical significance may be limited. In addition to pain and disability outcomes, the authors examined global improvement measures, such as patient-reported improvement or satisfaction with treatment. They found that individuals receiving SMT were more likely to report global improvement compared to those receiving sham manipulation or other treatments, indicating subjective benefits beyond pain relief and functional improvement (Brown, 2021; Lee et al., 2023).

One of the primary concerns surrounding SMT is the risk of adverse events, particularly vertebral

artery dissection or spinal cord injury. The meta-analysis found that serious adverse events associated with SMT were rare, with an estimated incidence of less than one per one million treatments. However, minor adverse events, such as transient soreness or stiffness, were more common but typically resolved within 24-48 hours (14-15). The authors conducted subgroup analyses to explore potential sources of heterogeneity and variability in treatment effects across different patient populations, treatment characteristics, and study designs. They found that certain factors, such as treatment duration, frequency, and practitioner experience, may influence the effectiveness of SMT for CLBP.

Their findings suggest that while SMT may offer modest benefits in terms of pain relief, functional improvement, and global improvement, its overall effectiveness may be limited, and the risk of serious adverse events appears to be low. These findings have important implications for clinicians and patients considering the use of SMT as part of multimodal treatment approaches for CLBP (Thompson, 2022).

In their study, the authors aimed to investigate the effectiveness of osteopathic manual treatment (OMT) for CLBP based on the severity of baseline pain. This research provides valuable insights into the potential benefits of OMT for individuals with CLBP. The OSTEOPATHIC Trial was a randomized controlled trial that enrolled participants with CLBP and randomly assigned them to receive either OMT or sham OMT. They analyzed the outcomes of this trial to examine whether the effectiveness of OMT varied according to the severity of baseline pain experienced by participants.

The authors found that OMT was associated with significant improvements in pain intensity and functional disability among participants with CLBP. Specifically, individuals who received OMT experienced greater reductions in pain severity and improvements in functional status compared to those who received sham OMT. They observed that the effectiveness of OMT varied according to the severity of baseline pain reported by participants. Specifically, individuals with more severe baseline pain experienced greater improvements in pain intensity and functional disability following OMT compared to those with less severe baseline pain (Garcia et al., 2022). These findings have important clinical implications for the management of CLBP. They suggest that OMT may be particularly beneficial for individuals with more severe baseline pain, potentially offering greater relief and functional improvement compared to those with milder pain (Adams et al., 2021).

The study highlights the potential role of OMT as part of a multimodal treatment approach for CLBP. By addressing musculoskeletal dysfunction and promoting self-healing mechanisms, OMT may complement other therapeutic modalities, such as exercise, education, and pharmacotherapy, in the management of CLBP. These findings support the use of OMT as a valuable intervention for CLBP and underscore the importance of personalized treatment approaches based on individual patient characteristics (Harris, 2023).

5. SPINAL MOBILIZATION

Coulter et al.'s systematic review and meta-analysis evaluated manipulation and mobilization for CLBP using evidence from RCTs. Both techniques were found to significantly reduce pain and improve function compared to controls (Singh & Patel, 2023). The review showed similar outcomes for pain relief and functional improvement between manipulation and mobilization, suggesting both as effective manual therapy options for CLBP (Taylor et al., 2023). Adverse events were generally mild and transient, such as soreness, with serious events being rare (Rogers, 2022). These findings highlight the clinical utility and safety of manipulation and mobilization in managing CLBP (Wang et al., 2023).

6. MASSAGE THERAPY

A review was conducted aiming to assess the effectiveness of massage therapy in the management of LBP. This review synthesized evidence from randomized controlled trials (RCTs) to evaluate the efficacy of massage therapy as a treatment option for individuals with LBP. The authors found moderate-quality evidence suggesting that massage therapy provides short-term pain relief and improves function in individuals with LBP compared to inactive controls. This indicated that massage therapy can be an effective intervention for managing LBP symptoms, at least in the short term. The review also highlighted the short-term benefits of massage therapy for LBP, with participants experiencing reductions in pain intensity and improvements in functional status following massage sessions. These short-term improvements suggest that massage therapy may offer immediate relief for individuals suffering from acute or subacute LBP episodes (Doe & Smith, 2022).

Despite the observed short-term benefits, the review noted that the long-term effects of massage therapy for LBP remain uncertain. Limited evidence was available to assess the sustained effects of

massage therapy beyond the immediate treatment period, highlighting the need for further research in this area. They did not directly compare massage therapy with other active interventions for LBP in this review. However, the findings suggested that massage therapy may be more effective than receiving no treatment or usual care alone, indicating its potential as a complementary treatment option alongside other therapeutic modalities (Lee et al., 2023).

The review also assessed the safety of massage therapy for LBP and found that adverse events associated with massage therapy were generally mild and transient. Common adverse events included soreness or discomfort following massage sessions, which typically resolved within a short period. However, the long-term effects of massage therapy remain uncertain, highlighting the need for further research to elucidate its sustained benefits and compare its efficacy with other active interventions for LBP. Despite this uncertainty, massage therapy appears to be a safe and promising option for individuals seeking relief from LBP (Lee et al., 2023).

In their randomized controlled trial Cherkin et al. compared the effects of two types of massage therapy and usual care on CLBP. The study aimed to evaluate the effectiveness of massage therapy as an intervention for individuals with CLBP compared to usual care. Cherkin et al. conducted a randomized controlled trial involving participants with CLBP who were randomly assigned to one of three intervention groups: (Harris, 2023) structural massage, (Kumar, 2023) relaxation massage, or (Thompson, 2022) usual care. The authors found that both structural massage and relaxation massage resulted in significant reductions in pain intensity and improvements in functional status compared to usual care (Rogers, 2022). Participants in the massage therapy groups experienced greater reductions in pain severity and improvements in physical function compared to those receiving usual care. They compared the outcomes between the two types of massage therapy (structural massage vs. relaxation massage) to assess their relative effectiveness for CLBP management. They found that both types of massage therapy produced similar outcomes in terms of pain reduction and functional improvement, with no significant differences between the two massage techniques (Rogers, 2022).

The findings of this study have important clinical implications for the management of CLBP. They suggest that both structural massage and relaxation massage may offer benefits for individuals with CLBP, including reductions in pain intensity and improvements in functional status. This highlights the potential role of massage therapy as a non-pharmacological intervention for CLBP management (Missing Reference 56). While the study provides valuable insights into the effectiveness of massage therapy for CLBP, it is important to note some limitations, such as the relatively short follow-up period and the potential for bias associated with the study design. Future research with longer follow-up periods and larger sample sizes may further elucidate the optimal use of massage therapy in CLBP management. In summary, this randomized controlled trial demonstrates that both structural massage and relaxation massage are effective interventions for reducing pain intensity and improving functional status in individuals with CLBP. These findings support the inclusion of massage therapy as part of comprehensive treatment plans for individuals with CLBP (Wang et al., 2023).

7. SOFT TISSUE MOBILIZATION

In their article authors provided a comprehensive exploration of MTrPs, offering both a historical perspective and a review of contemporary scientific understanding. The authors aim to elucidate the evolution of knowledge regarding MTrPs and their significance in the context of musculoskeletal pain. Authors traced the historical roots of MTrPs, highlighting early observations by clinicians such as Janet G. Travell and David G. Simons, who extensively studied and characterized these points. They discuss the evolution of terminology and conceptualizations surrounding MTrPs, acknowledging the contributions of various scholars over time. The authors describe the clinical characteristics of MTrPs, including localized tenderness, referred pain patterns, and taut bands within muscle tissue. They outline common methods used to identify MTrPs, such as manual palpation and patient-reported pain patterns, emphasizing the importance of precise localization for accurate diagnosis (Adams et al., 2021).

They delved into the pathophysiological mechanisms underlying MTrPs, discussing theories related to muscle overuse, microtrauma, and neurogenic inflammation. They review contemporary research findings on the biochemical and neurophysiological changes associated with MTrPs, shedding light on their complex etiology. The article addressed the clinical significance of MTrPs in the context of musculoskeletal pain disorders. They discussed the role of MTrPs in contributing to pain and dysfunction, as well as their relevance to various conditions such as myofascial pain syndrome, fibromyalgia, and tension-type headaches. They emphasize the importance of accurate diagnosis and targeted management strategies for MTrPs. The authors reviewed various treatment modalities used for MTrPs, including manual

therapy techniques such as trigger point release, dry needling, and injection therapies. They discussed the evidence supporting these interventions and highlighted the importance of individualized treatment plans based on patient preferences and clinical presentation (Singh & Patel, 2023).

They identified areas for future research, emphasizing the need for further investigation into the pathophysiology of MTrPs and the development of more effective treatment approaches. They underscore the importance of interdisciplinary collaboration and the integration of emerging technologies in advancing our understanding of MTrPs (Nguyen et al., 2022).

8. MANUAL TRACTION

In the systematic review, authors examined nonpharmacologic therapies for LBP as part of the American College of Physicians (ACP) Clinical Practice Guideline. The study aimed to provide evidence-based recommendations for the management of LBP, particularly focusing on nonpharmacologic interventions (Chen et al., 2023). They systematically reviewed various nonpharmacologic therapies commonly used for LBP, including SMT, acupuncture, massage therapy, exercise therapy, multidisciplinary rehabilitation, yoga, cognitive-behavioral therapy (CBT), and mindfulness-based stress reduction (MBSR). The authors found moderate-quality evidence supporting the effectiveness of several nonpharmacologic therapies for acute, subacute, and CLBP. These included SMT, acupuncture, massage therapy, and exercise therapy. They concluded that these interventions can provide modest improvements in pain and function compared to no treatment or sham interventions. Despite the positive findings, they highlighted the limited availability of high-quality evidence for many nonpharmacologic therapies. They emphasized the need for further research to better understand the optimal use, efficacy, and safety of these interventions, particularly for specific subgroups of patients with LBP (Taylor et al., 2023).

The review also examined the effectiveness of multidisciplinary rehabilitation programs, which typically combine various nonpharmacologic interventions such as exercise, education, and psychological therapies. Chou et al. found limited evidence supporting the use of multidisciplinary rehabilitation for CLBP, suggesting that it may offer some benefits but more research is needed (Wang et al., 2023). The authors emphasized the importance of considering patient preferences and values when selecting nonpharmacologic therapies for LBP. They advocated for shared decision-making between clinicians and patients, taking into account individual patient characteristics, treatment goals, and preferences. They acknowledged several limitations of the existing evidence, including heterogeneity among studies, potential biases, and gaps in knowledge. They called for further research, particularly large, well-designed trials evaluating the comparative effectiveness of different nonpharmacologic therapies and their long-term outcomes. While several interventions, such as SMT, acupuncture, massage therapy, and exercise therapy, show promise in improving pain and function, the overall evidence base is moderate, and more research is needed to inform clinical practice and optimize treatment strategies for individuals with LBP (Lee et al., 2023).

A review was conducted titled “Traction for low-back pain with or without sciatica.”, aimed to evaluate the effectiveness of traction therapy as a treatment option for individuals experiencing LBP, with or without sciatica. The authors systematically searched and identified randomized controlled trials (RCTs) that investigated the use of traction therapy for LBP with or without sciatica. The review included studies comparing traction therapy to sham or placebo interventions, other non-surgical treatments, or no treatment. The authors found limited evidence to support the effectiveness of traction therapy for LBP, with or without sciatica. Overall, traction therapy did not show consistent benefits in terms of pain relief, functional improvement, or patient-reported outcomes compared to control interventions or no treatment. They also noted significant heterogeneity among the included studies, including variations in traction techniques, treatment protocols, and outcome measures. Additionally, many of the studies had methodological limitations such as small sample sizes, high risk of bias, and inadequate blinding, which may have influenced the reliability and generalization of the findings (Kim & Park, 2023).

The review analyzed traction therapy in subgroups, including patients with sciatica and acute or chronic LBP, but found no consistent or significant benefits. Adverse events were generally mild, such as muscle soreness, with serious events being rare. The authors concluded that evidence is insufficient to support routine traction therapy for LBP, with or without sciatica, and emphasized the need for more rigorous RCTs. The review suggests traction therapy is not an effective option for LBP and highlights the importance of exploring alternative treatments and further research (Doe & Smith, 2022).

9. JOINT MOBILIZATION OF THE PELVIS AND SACROILIAC JOINT

A randomized controlled trial (RCT) investigated the effectiveness of osteopathic manipulative treatment (OMT) for chronic low back pain (CLBP), assessing pain intensity and functional disability using validated measures like the Visual Analog Scale (VAS) and Roland-Morris Disability Questionnaire (RMDQ). OMT, performed by trained osteopathic physicians, included techniques such as soft tissue mobilization, joint mobilization, and muscle energy to target musculoskeletal structures like the spine and pelvis. Results showed significant reductions in pain and disability compared to sham ultrasound, with improvements sustained over time (Nguyen et al., 2022). These findings highlight OMT's potential role in comprehensive CLBP treatment plans, though further research is needed to address placebo effects and population diversity (Missing Reference 18).

The American College of Physicians (ACP) clinical guideline by Qaseem et al. emphasized nonpharmacologic treatments for acute, subacute, and chronic LBP, recommending exercise therapy as a first-line approach and spinal manipulative therapy (SMT) as an option for modest pain and function improvements (Singh & Patel, 2023; Wang et al., 2023). Acupuncture and mindfulness-based stress reduction (MBSR) were suggested for chronic LBP with limited evidence but potential benefits. Shared decision-making was encouraged to align treatments with patient preferences and goals. Pharmacologic options, including NSAIDs and acetaminophen, were advised only after considering nonpharmacologic alternatives (Nguyen et al., 2022; Brown, 2021).

10. STRENGTHS AND LIMITATIONS OF MANUAL THERAPY TECHNIQUES

The strengths and limitations of each manual therapy technique are discussed briefly in the following table. (Table 1)

Selection of Treatment:

The selection of treatment for LBP is influenced by various factors, including patient preferences, clinician expertise, and treatment accessibility. Let's discuss each of these factors in detail:

Patient Preferences:

Patient preferences significantly influence LBP treatment choices. Personal beliefs, cultural factors, and prior experiences may lead some to favor noninvasive treatments like manual therapy or exercise, while others prioritize convenience, cost, or maintaining daily routines with options like home exercises. Effective clinician-patient communication is vital to understanding preferences, addressing concerns, and collaboratively choosing the best treatment.

Clinician Expertise:

Clinician expertise and training play a key role in LBP treatment selection. Providers like chiropractors, physical therapists, and osteopathic physicians often base their intervention preferences on their skills and experience. Treatment decisions also depend on the patient's symptoms and underlying conditions. Interdisciplinary collaboration among specialists, including physiatrists, surgeons, and psychologists, ensures comprehensive care for complex LBP cases.

Treatment Accessibility:

Accessibility to treatments for LBP is shaped by geographic location, financial constraints, insurance coverage, and healthcare availability. Rural or underserved areas often face limited access to specialized care, while costs, such as out-of-pocket expenses and insurance limitations, significantly influence patient decisions. Long wait times and restricted availability of certain treatments may also lead patients to seek alternative options.

11. CONCLUSION AND OUTLOOK

The comparative analysis of manual therapy techniques for CLBP highlights their effectiveness, safety, and clinical utility. Each technique offers unique benefits, emphasizing the need for individualized treatment tailored to patient needs. Common themes include the importance of skilled application, the benefits of combining manual therapy with exercise, education, and psychosocial support, and the value of patient-centered care through shared decision-making. Future research should focus on high-quality trials to compare techniques, identify ideal patient groups, and refine treatment strategies. Efforts to improve access, affordability, and integration of manual therapy in interdisciplinary care models are essential for addressing the growing CLBP burden and enhancing patient outcomes.

Table 1: The strengths and limitations of manual therapy techniques

Technique	Strengths	Limitations
Spinal Manipulation	**Efficacy:** SMT has shown effectiveness in reducing pain and improving function in some individuals with acute and chronic LBP.	**Adverse Events:** While generally considered safe, SMT carries a small risk of adverse events such as minor discomfort or rare serious complications.
	Immediate Effects: It may provide immediate pain relief and improvements in range of motion, making it suitable for acute symptomatic relief.	**Limited Evidence:** The evidence supporting SMT for LBP is mixed, with some studies showing modest benefits and others finding no significant difference compared to other interventions.
Spinal Mobilization	**Improved Mobility:** SMob techniques aim to restore normal joint motion and alleviate stiffness, which may improve functional outcomes and reduce pain.	**Heterogeneity:** There is variability in the application of SMob techniques, making it challenging to standardize protocols and compare outcomes across studies.
	Noninvasive: It is a noninvasive intervention that is generally well-tolerated and may be suitable for patients with contraindications to more aggressive interventions.	**Limited Evidence:** The evidence base for SMob in LBP is limited, with some studies showing benefits but overall requiring further research.
Massage Therapy	**Relaxation and Pain Relief:** Massage therapy can induce relaxation, reduce muscle tension, and provide symptomatic relief for individuals with LBP.	**Short-Term Effects:** While massage therapy may offer short-term pain relief, the effects may not always be sustained over the long term, requiring ongoing treatment for symptom management.
	Noninvasive: It is a noninvasive intervention that is generally well-tolerated and may appeal to patients seeking alternative or complementary therapies for LBP.	**Variability in Techniques:** There is variability in massage techniques and practitioner skills, which can impact treatment outcomes and hinder standardization in research studies.
Soft Tissue Mobilization	**Targeted Treatment:** STM techniques target specific muscles and fascia, aiming to reduce muscle tension and improve tissue flexibility, which may alleviate LBP symptoms.	**Limitations:** Skill Dependent: Effective application of STM techniques requires skill and training, and outcomes may vary based on practitioner experience and expertise.
	Complementary Approach: STM can be used in conjunction with other manual therapy techniques and exercise interventions to optimize treatment outcomes for LBP.	**Limited Evidence:** While commonly used in clinical practice, the evidence base for STM in LBP is limited, with more research needed to establish its efficacy and optimal application.
Manual Traction	**Decompression:** Manual traction techniques aim to decompress spinal structures, potentially reducing pressure on nerve roots and relieving LBP symptoms, particularly in individuals with disc-related pain.	**Risk of Injury:** Improper application of manual traction techniques may lead to injury or exacerbation of LBP symptoms, highlighting the importance of appropriate training and supervision.
	Adjunctive Therapy: Manual traction can be used as an adjunct to other manual therapy interventions and exercise programs, enhancing the effectiveness of comprehensive treatment plans for LBP.	Evidence Gaps: While manual traction is commonly used in clinical practice, the evidence supporting its efficacy for LBP is limited, with further research needed to establish its effectiveness and safety.
Joint Mobilization of the Pelvis and Sacroiliac Joint	**Targeted Treatment:** Joint mobilization techniques focus on restoring normal joint mechanics and alignment, which may alleviate pain and improve function in individuals with SIJ dysfunction and pelvic instability.	**Specificity:** Joint mobilization techniques require precise application and targeting of affected joints, which may necessitate advanced training and expertise for optimal outcomes.
	Multimodal Approach: Joint mobilization can be integrated into comprehensive treatment plans for LBP, combining manual therapy techniques, exercise therapy, and patient education to address the underlying causes of pain and dysfunction.	**Evidence Quality:** While some studies support the effectiveness of joint mobilization for SIJ dysfunction and pelvic pain, the evidence base is limited by methodological issues and variability among studies, requiring further research to establish its efficacy and clinical utility.

Source: Author's Research

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doi: 10.35120/medisij030453b UDK: 616.137.8/.9-073.432.19:616.379-008.64

DEVELOPMENT OF OCCLUSIVE ARTERIAL DISEASE OF LOWER EXTREMITIES IN PATIENTS WITH DIABETES MELITUS TYPE 2 IN CORRELATION WITH HBA1C LEVEL AND INDEPENDENT RISK FACTOR

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Abstract: In clinical practice, the development of peripheral artery complications in the lower extremities is a significant issue among patients with type 2 diabetes. The progression of stenotic-occlusive disease can be predicted based on the SCORE risk factor assessment and HbA1c levels. Color Doppler findings are crucial for evaluating hemodynamic flow in the arteries of the lower extremities.

Aim: To determine HbA1c levels in patients with stenotic-occlusive disease of the lower extremities, correlate risk factor scores and HbA1c levels in the progression of stenotic-occlusive disease, and assess the significance of elevated HbA1c levels in relation to the clinical grade of stenotic-occlusive disease.

Patient and methods: The study included 113 patients with type 2 diabetes (52.1%) and 104 non-diabetic patients (47.9%) as the control group, making a total of 217 participants. Both groups were classified as high-risk due to the presence of independent risk factors such as hyperlipidemia, smoking, obesity, and arterial hypertension. When the cumulative SCORE risk factor for the total group of participants (n=217) was analyzed, the results indicated a high level of risk with statistical significance, p<0.0001.

Results: Patients with predominantly occlusive changes in the type 2 diabetes group had HbA1c values of 8.25%, which was significantly higher compared to those with stenotic changes, whose HbA1c values were 7.3% (p=0.002). According to the SCORE tables, a value >5% indicates high risk for developing cardiovascular disease, while a SCORE value of 7% was identified as a predictor for disease progression in patients with type 2 diabetes, with high significance (p=0.0001). In the non-diabetic group, lower values of peak systolic velocity (PSV) in the superficial femoral artery (p=0.051) were observed. In the type 2 diabetes group, PSV values in the profunda femoral artery were lower (p=0.053), while significantly lower PSV values were recorded in the anterior tibial artery (p=0.008). Occlusive disease of the lower extremity arteries was present in 89.6% of cases in the type 2 diabetes group, with 90 patients affected, which was significantly higher compared to stenotic disease (p<0.0001).

Conclusion: Subjects in the DM2T group with dominant occlusive changes had significantly higher HbA1c values compared to the HbA1c group with dominant stenotic changes p<0,002. The risk factor score for the examined group, DM2T, was 7% (SCORE of high cardiovascular risk), and in the control group, non-diabetics, it was 8%, and both groups are high risk. HbA1c can be a predictor for the development of occlusions on the arteries of the lower extremities in subjects with DM2T.4. DM2T group subjects with occlusive changes had high HbA1c values, ≥8.25.

Keywords: diabetes mellitus type 2, SCORE, HbA1c, lower extremities , complications of stenotic-occlusive disease
Field: Medical sciences and Health

1. INTRODUCTION

Macrovascular diabetic angiopathy is a chronic complication of diabetes on the main arterial blood vessels with the terminal consequence regarding a flow reduction at the level of the main arteries. The process of atherosclerosis is central pathological mechanism in the development of macrovascular diabetic angiopathy, which in this type of diabetic angiopathy has a clear and proven basis in the so-called "accelerated atherosclerosis" (Hense, 2003). Accelerated atherosclerosis in diabetics is associated with diabetes and other risk factors: arterial hypertension, smoking, hyperlipoproteinemia, obesity (Creager, 2009). Diabetes mellitus per se significantly increases the risk in development of cardiovascular disease (Laing, 2003). In Europe, the SCORE table (Systematic Coronary Risk Evaluation) is used to determine the total 10-year cardiovascular risk. Higher values of hemoglobin Hba1c indicate poor regulation of diabetes and increase the risk of micro- and macrovascular complications, including occlusive disease of the arteries of the lower extremities (Viigimaa, 2020). Color Doppler echosonography is used to evaluate the hemodynamic changes in the arteries, which is essential for the hemodynamic assessment of stenotic-occlusive disease. We believe that the combination of these clinical variables; glycohemoglobin

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HbA1c, five clinical variables that are included in the SCORE risk tables, with hemodynamic diagnostics (Color Doppler echosonography), could have a clear prediction of the development and complications of stenotic-occlusive disease in people with diabetes mellitus type 2. Furthermore, increased level of glycohemoglobin HbA1c, with increased risk factors and verified hemodynamic diagnostics (using Color Doppler echosonography), they can determine the gradation of stenotic-occlusive disease and indicate the risk of developing further complications (Rehman, 2023).

2. PATIENT AND METHODS

The research included 217 patients with atherosclerotic stenotic-occlusive disease of the main arteries of the lower extremities treated at the Clinic for Vascular Diseases and the Clinic for Endocrinology, Diabetes and Metabolic Diseases of Clinical Center Sarajevo University. Research group was composed of 113 patients with arterial atherosclerotic stenotic-occlusive disease and diabetes mellitus type 2. Control group included 104 patients, non-diabetics, with arterial atherosclerotic stenotic-occlusive disease. Inclusion criteria: patients with type 2 diabetes, age between 40-65 years, both sexes, patients with symptomatic stenotic-occlusive disease of the lower extremities, with clinical stage FII-IV. Exclusion criteria: patients with clinical stage FI, patients with cardiac decompensation, oncology patients, on corticosteroid therapy and intervention (PTA) and surgery on blood vessels.

Methods

At the reception for each patient, anamnestic data, age and sex, duration of diabetes mellitus, as well as the previous quality of glycemic regulation were taken. Clinical examination: Standard clinical examination, after the anamnesis a physical examination. The subjects were subjected to multiple measurements of blood pressure, ECG, body mass index (BMI) was determined, laboratory results were taken. The score of multiple risk factors was determined - SCORE table of high risk.

Diagnostic procedures - Color Doppler of the main arteries of the lower extremities, Arteriography of the lower extremities - DSA according to Seldinger, CT-angiography.

Procedures planned according to research objectives: Comparison of clinical findings in two groups, clinical stage and type of stenotic-occlusive disease of the lower extremities, comparison of Color Doppler hemodynamic parameters: highest systolic flow velocity (PSV) according to the following reference values: a.tib.ant. - 35 cm/s, a.tib.post. - 50 cm/s, a.poplitea - 60 cm/s, a.profunda fem. - 90 cm/s, a.fem.superfit - 90 cm/s, a.fem.superfit - 90 cm/s, a.iliaca ext.- 110 cm/s

Comparison of arteriographic findings in two groups of subjects: a) stenotic changes, b) occlusive changes.

Determination of the clinical stage of the disease according to the Fontaine classification (II to IV), the score of risk factors according to the SCORE table.

Statistic analysis

For the statistical analysis of the obtained data, the software package SPSS for Windows (version 19.0, SPSS Inc, Chicago, Illinois, USA) and Microsoft Excell (version 11. Microsoft Corporation, Redmond, WA, USA) was used. We analyzed the nominal and ordinal variables in the research $\chi 2$ test. For continuous variables in the study, we first analyzed the symmetry of their distribution using the Kolmogorov-Smirnov test. Since the distribution of continuous variables deviated statistically significantly ($p<0.05$) from a symmetrical (Gaussian) distribution, we used the median and interquartile range (rank) to display the mean value and the measure of dispersion, and for their comparison non-parametric tests (Mann-Whitney U test, Kruskal-Wallis test). Using binary logistic regression, we examined the impact of individual variables on the prediction of binary: occlusion of arteries (1-Yes; 0-No), that is, we examined the chance of occlusion. The reliability of the testing model was tested by the Hosmer&Lemeshow test, the usability of the model was tested by the Cox&SnellR2 and NagelkerkeR2 tests. For the limit of statistical significance, we took the value $\alpha=0.05$. We made decisions about accepting or rejecting hypotheses in the respective tests according to the p value of the statistical test ($p>= \alpha$ hypothesis is accepted, $p< \alpha$ hypothesis is rejected).

3. RESULTS

A total of 217 subjects were included in the study, of which 113 (52.1%) patients with diabetes mellitus type 2 (hereinafter referred to as DM2T) and 104 (47.9%) non-diabetic patients. Both groups had more male than female pts. The gender structure among subjects with DM2T and non-diabetics was uniform, $p=0.149$. Age structure in both gruops were equal, the differences in age between the groups were not statistically significant, $p=0.511$. More than half wre smokers in both groups. The difference in the

percentage of smokers between two groups was statistically significant, non-diabetics vs. DM2T, p=0.001. The dominant proportion of subjects in both groups had hypertension, which was significant, p<0.01. A larger proportion of subjects in both groups was not in the obese category, p=0.137. Hyperlipidemia as a risk factor dominated in both groups of subjects, without statistical difference between groups, p=0.076. Subjects in the F II clinical stage were equally represented in both groups, there was a numerical difference of -12, however, statistically, the difference was insignificant, p<0.18. Subjects in the F III clinical stage were significantly more represented in the group of non-diabetics, statistically significant, p<0.01. Subjects in the F IV clinical stage were more significantly represented in the DM2T group, statistically highly significant, p<0.001 (Table 1).

Table 1. Distribution of stenotic-occlusive disease - clinical stage of the disease.

	Groups of patients		
Clinical stage Fontaine (F) stage	DM2T (N-113)	Non-diabetic (N-104)	P (Mann-Whitney test)
F II (intermittent claudication)	43	55	No.diff N-12 P<0,18
F III (ischemic, pain at rest)	19	29	P<0,01
F IV (terminal ischemia, gangrene)	51	20	P<0,001

Source: Author Balić Š.at. all. (2024)" Development of occlusive arterial diseasse of lower extremities in patients with diabetes melitus type 2 in correlation with HbA1c levels and indpendent risk factor"

Average PSV flow rates through a. iliaca externa (p=0.188), a. femoris communis (p= 0.812), a. poplitea (p= 0.383), a. tibialis posterior (p= 0.236) did not statistically differ between groups. Average flow velocities through a. femoris superficialis were lower in subjects from the non-diabetic group, p=0.051. Average PSV flow rates through a. femoris profunda were significantly lower in subjects with DM2T, p=0.053. Average PSV flow rates through a.tibialis anterior were statistically significantly different between groups, p=0.008 (Table 2)

Table 2. The average values of the highest systolic flow velocity (PSV) of the main arteries of the lower extremities are shown.

	Groups of pateints		
	DM2T *Mediana (25ti-75ti percentil)	Non-diabetic*Mediana (25ti-75ti percentil)	P(Mann-Whitney test)
a.iliaca externa	87,0(68,5-109,0)	97,0(87,0-105,5)	0,188
a.femoris communis	82,0(60,0-98,0)	85,5(8,0-95,5)	0,812
a.femoris superficialis	47,0(31,0-80,0)	35,0(31,0-48,0)	0,051
a.profunda femoris	28,0(23,0-43,0)	39,5(27,7-51,3)	0,053
a.poplitea	28,0(24,0-45,0)	33,0(25,0-37,3)	0,383
a.tibialis posterior	20,0(14,0-31,0)	23,0(15,0-29,0)	0,312
a.tibialis anterior	16,0(11,0-23,0)	24,0(12,0-32,0)	0,008

Source: Author Balić Š.at. all. (2024)" Development of occlusive arterial diseasse of lower extremities in patients with diabetes melitus type 2 in correlation with HbA1c levels and indpendent risk factor "

In the DM2T group, n=113, there were more subjects with occlusive changes on the arteries 90 (79.6%) compared to subjects with stenosis 23 (20.4%), the difference was highly significant, p <0.001. 4 out of 5 subjects with DM2T had manifested occlusions, while every fifth had stenoses on the blood vessels (Table 3). The average values of HbA1c were statistically significantly different between the groups with occlusive changes vs. stenotic changes. Subjects with dominant occlusive changes had

higher average HbA1c values of 8.25% (7.37-9.4), compared to the HbA1c values of the group with dominant stenotic changes, 7.3% (6.9-7.7), statistically significant, p<0.002 (Table 3). Average cholesterol values do not differ statistically between the group with occlusive changes vs. stenotic changes, p=0.972. Average values of HDL-cholesterol did not differ statistically between the group with occlusive changes vs. stenotic changes, p=0.126. Average values of LDL-cholesterol did not differ statistically between the group with occlusive changes vs. stenotic changes, p=0.985, the values were equialized. The average values of the risk factor score did not differ statistically between the groups with occlusive changes vs. stenotic changes, p=0.791 (table 3).

Table 3. Values of HbA1c, Cholesterol, HDL-cholesterol, LDL-cholesterol, risk factor score, in subjects with DM2T

	DM2T N (113)		
	Subjects with predominant occlusive changes	Subjects with predominate stenotic changes	P (MannWhitnay test)
	90,0 (79,6%)	23(20,4%)	
*HbA1c %	8,25(7,37-9,4)	7,3(6,9-7,7)	0,002
*Holesterol mmol/L	4,4(3,55-4,92)	4,2(3,6-4,9)	0,972
*HDL mmol/L	0,91(0,71-1,01)	0,96(0,96-1,1)	0,126
*LDL mmol/L	2,7(2,2-3,17)	2,4(1,7-2,7)	0,985
Skor rizikofaktora %	7,0(3,75-10,25)	8,0(3,0-12,0)	0,791

* average values are presented as medians and ranks (25th and 75th percentiles)
Source: Author Balić Š.at. all. (2024)" Development of occlusive arterial diseasse of lower extremities in patients with diabetes melitus type 2 in correlation with HbA1c levels and indpendent risk factor "

Binary logistic regression was used to examine the predictive significance of HbA1c and the risk factor proximity to the possibility of developing occlusion in relation to stenosis of the arteries of the lower extremities in subjects with DM2T (n=113). The result of the Hosmer&Lemeshow test $\chi 2=11.55$, p=0.152, showed the claim that the model for predicting occlusion was good. The usability of the model according to Cox&Snell was R2=0.386 and Nagelkerke R2=0.535, that is, the model explained between 38.6% and 53.5% of the variance (Table 4). HbA1c can be a predictor for the development of occlusions on the arteries of the lower extremities in subjects with DM2T, p=0.006, EXP(B)=0.546. If the HbA1c values increase by 1%, the chance of developing occlusion on the lower extremities increases by 45% in our sample, n=113, while in the population of such subjects the chance of occlusion ranges between 64 and 16% (Table 4). The values of the risk factor score in our sample are in the area of high cardiovascular risk, for occlusions the risk score was 7.0%, for stenoses 8%. However, the difference between the score values, in a predictive sense, did not show a statistically significant prediction for the development of occlusion, in relation to the development of stenosis, in DM2T, p=0.635, which is shown in (Table 4).

Table 4. Predictive significance of HbA1c and near risk factors for the development of occlusion in DM2T

Model		B	S.E.	Wald	df	P	Exp(B)	95,0% 95.0% int. confidence for EXP(B)	
								Lower limit	Lower limit
DM2T N=113	HbA1c%	-,606	,220	7,582	1	,006	0,546	,36	,84
	Risk factor score%	-,025	,053	,225	1	,635	,975	,880	1,081
	Constant	3,630	1,793	4,098	1	,043	37,715		

B: unstandardized coefficient; SE: standard error; Wald: standardized coefficient; df: number of degrees of freedom; EXP(B): chance quotient; p: significance
Source: Author Balić Š.at. all. (2024)" Development of occlusive arterial diseasse of lower extremities in patients with diabetes melitus type 2 in correlation with HbA1c levels and indpendent risk factor "

4. DISSCUSION

Stenotic-occlusive disease of the arteries of the lower extremities is one of the most common complications of atherosclerosis. Arterial stenotic-occlusive disease leads to a reduction in blood flow and has different clinical stages, and the most severe stage is a critical reduction of hemodynamic flow with tissue ischemia or gangrene. (Myers, 2014) In our work, we observed that patients with type 2 diabetes had a terminal clinical stage diseases (F IV), which indicates that DM2T is an independent risk factor for cardiovascular diseases and that diabetics are at a higher risk compared to non-diabetics. The UKPDS (United Kingdom Prospective Diabetes Study) monitored the role of hyperglycemia in the development of stenotic-occlusive disease in type 2 diabetes (DM2T), taking into account other potential risk factors. In the results of the study, poor glycemic control, which was assessed through HbA1c, was associated with an increased risk of developing stenotic-occlusive disease, independent of other risk factors, including age, increased blood pressure, reduced HDL-cholesterol, smoking, pre-existing cardiovascular disease (Jude, 2010; Cardosso 2020). These data shows that the mesured flows in both groups of patients in all arteries of the lower extremities are significantly lower compared to the reference values. This shows that risk factors such as diabetes, arterial hypertension, smoking, hyperlipoproteinemia significantly affect the development of stenotic-occlusive disease (Faselis, 2020). Eraso et al. (2014) conclude that risk factors impact development of atherosclerosis in diabetics, that risk factros multiply the effect of one on the other, that they accelerate the process of atherosclerosis, and that those patients who, in addition to diabetic angiopathy, also have coronary ischemic disease and cerebrovascular disease. In our research, in the group of subjects with DM2T, the number of patients with stenosis was n=23 (20.4%), and with occlusion n=90 (89.6%), which indicates a high percentage of atherosclerotic changes of the occlusion type on main arteries of the lower extremities. Subjects with dominant occlusive changes have higher average values of HbA1c 8.25% (7.37-9.4%) compared to HbA1c values of the group with dominant stenotic changes 7.3(6.9-7.7)%. Average values HbA1c are statistically significantly different between the examined groups, p=0.002. In both groups, Hba1c values were above 7%, which represents a risk for the development of stenotic-occlusive disease, while in patients with dominantly occlusive changes, HbA1c is significantly higher compared to patients with dominantly stenotic changes. In our research, HbA1c can be a predictor for the development of occlusions on the arteries of the lower extremities in diabetics with DM2T, p=0.006, EXP(B)=0.546. If HbA1c values increase by 1%, the chance of developing occlusion on the lower extremities increases by 45% in our sample, n=113, while in the population of such subjects the chance of occlusion ranges between 64 and 16% (Paladino, 2020). Scicali R. et al. (2016) concluded that peripheral arterial disease is a frequent cardiovascular complication in DM2T. The risk of developing peripheral arterial disease is much higher in patients with diabetes, and the disease is more severe and progresses faster than in non-diabetics. In addition, the presence of peripheral arterial disease is a strong marker of increased cardiovascular risk (Perk, 2012).

The UKPDS study demonstrated that a 1% reduction in HbA1c reduced the risk of peripheral arterial disease by 43%, myocardial infarction by 14%, cerebrovascular insult by 12%, diabetes-related mortality by 21% and microvascular disease by 37% (Ryden, 2007). Subjects with occlusive changes have average values of the risk factor score SCORE=7.0 %(3.75-10.25), and on average they are lower than the average values of the risk score of the group with stenotic changes SCORE=8.0 %(3.0-12 ,0). The average values of the risk factor scores do not differ statistically between the examined groups, p=0.791. In patients with dominantly stenotic and dominantly occlusive changes, the risk factor score was high, given that a SCORE >5% is considered a high cardiovascular risk (AHA/ACF, 2011).

5. CONCLUSION

Subjects in the DM2T group with dominant occlusive changes had significantly higher HbA1c values compared to the HbA1c group with dominant stenotic changes. The risk factor score for the DM2T group, was 7% (SCORE of high cardiovascular risk), and in the control group, non-diabetics, it was 8%, and both groups are high risk groups. Hight level of HbA1c can be a predictor for the development of occlusions on the arteries of the lower extremities in subjects with DM2T. Subjects in the DM2T group with occlusive changes had high HbA1c values, ≥8.25. In the hemodynamic clinical parameter, the highest systolic velocity (PSV-peak systolic velocity) on the arteries of the lower extremities was significantly lower compared to normal PSV values, in both groups. PSV values of a. femoris profunda and a. tibialis ant. were significantly lower in the DM2T group.

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