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Integrated Management of Oral Complications in Chronic Diffuse Liver Disease

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Abstract This study focuses on evaluating the dental status of the oral cavity and enhancing treatment outcomes in patients with chronic diffuse liver diseases (CDL). A total of 94 patients participated in the research and were categorized into groups with liver fibrosis, chronic hepatitis, and liver cirrhosis according to the underlying pathology. Two therapeutic strategies were applied: standard dental care and a comprehensive treatment protocol proposed by the author, which included the use of the herbal preparation Rotokan, vitamin C electrophoresis, and UHF (ultra-high-frequency) therapy. The findings demonstrated that the progression of liver disease is associated with worsening dental indices (GI, PMA, KE). In contrast, patients who received the comprehensive treatment exhibited a twofold faster reduction in periodontal inflammation, restoration of enamel resistance, and stabilization of caries progression. Overall, the study provides scientific evidence supporting the high pathogenetic efficacy of an integrated multidisciplinary approach combined with physiotherapeutic modalities in the management of patients with liver-related systemic disorders.

Keywords Chronic diffuse liver diseases, Liver cirrhosis, Chronic hepatitis, Periodontal disease, Dental caries, Rotokan, Physiotherapy, Dental indices

1. Introduction

Epidemiological data indicate an increase in the number of patients with HDL worldwide, especially as HDL combined with metabolic syndrome has reached the level of a global pandemic. Chronic viral hepatitis is considered one of the most common causes of chronic liver inflammation. According to WHO data, 257 million people worldwide are living with chronic HBV infection. While the probability of chronic HBV infection in adults is less than 5%, in cases of perinatal transmission, this figure reaches 90%. Chronic hepatitis B is a major factor in the development of cirrhosis and HCC [6,7].

Chronic diffuse liver diseases (CDL) are a pressing global medical and social problem, the main etiological factors of which are chronic viral hepatitis (B and C), alcoholic liver disease (ALD), and the increasingly widespread fatty liver disease (FLD) associated with metabolic dysfunction. Chronic diffuse liver diseases are characterized by chronic inflammation of the liver parenchyma, necrosis, and progression into liver fibrosis, which ultimately leads to liver cirrhosis and hepatocellular insufficiency [7,10]. The development of the disease is directly linked to the development of severe complications, such as a decrease in the protein-synthetic function of the liver (impaired synthesis of albumin and coagulation factors), impaired detoxification function (accumulation of ammonia), as well as portal hypertension and hemorrhagic syndrome [9].

WHO statistics confirm that 71 million people worldwide have a chronic HCV infection. The main risk is that 55% to 85% of patients with acute HCV infection develop a chronic form, which is the leading cause of liver cirrhosis and the need for transplantation [6,9,10].

Purpose of the study. The aim of this study was to evaluate the clinical efficacy of a comprehensive treatment and prevention protocol specifically designed for patients suffering from chronic diffuse liver diseases.

2. Materials and Methods

Taking into account various principles of modern scientific knowledge, we have developed our research methodology with a sufficiently defined objective. Planned and conducted research based on general scientific and specific methods was aimed at solving the set tasks. Within the framework of this study, 94 patients with chronic diffuse liver disease (CDL) were included. The control group consisted of 23 conditionally healthy patients. In turn, patients with JSDK were divided into 3 groups depending on the type of disease.

In turn, patients were further divided into 2 groups according to the treatment method: group I (n=44): traditional dental

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treatment. Group II (n=50): comprehensive treatment (Rotokan preparation and physiotherapy in addition to traditional treatment).

For the purpose of traditional dental treatment, traditional mechanical cleaning and filling of carious tooth cavities with standard filling materials, standard antiseptic treatment and filling of the root canals, cleaning of the oral cavity from dental stones and deposits using traditional methods, and treatment of the gums and periodontal tissues with standard anti-inflammatory ointments, gels (Metrogil Denta), and antiseptics were performed.

In complex treatment, in addition to traditional treatment, liquid extract of the medicinal plant Rotokan (composition: extract of chamomile, carnation, and buckwheat) and physiotherapy (electrophoresis with Vitamin C and ultra-high frequency therapy) were used.

Rotokan is not used in its pure form; it was diluted with water before use. 1 teaspoon (5 ml) of Rotokan was dissolved in 1 cup (200 ml) of warm water. It was prescribed to be rinsed 3-4 times a day for 1-2 minutes. The cotton swab (turunda) is dipped in the solution and placed on the gum margin for 15-20 minutes. The water temperature must be 35-40 ℃, as cold water can increase vascular spasms observed in liver pathology, while very hot water can increase bleeding. Course duration: 7–10 days. A total of 5–15 treatments (depending on the severity of the disease).

For the purpose of physiotherapy (electrophoresis), a 5% ascorbic acid solution was used. Cotton swabs moistened with the solution are placed on the gums and connected to the anode (+) pole. Current strength: 2...5 mA (depending on the patient's individual sensitivity, up to a "light itch" sensation). The first procedures begin at 10 minutes and are gradually increased to 15-20 minutes. Course duration: 10-12 treatments, daily or every other day. Ultra-high frequency therapy (UHF). An oligothermic dose (where weak heat is felt) is used. The power for the jaw area was set at around 20-30 W. Bilaterally or transversely to the affected area of the jaw. Air gap 1...1.5 cm. Duration: 8–10 minutes. Course duration: 5–8 treatments.

It is recommended to perform these two procedures on the same day, one after the other, to achieve the maximum effect in LSDK. First, UVCH therapy: this procedure generates heat in the tissues, dilates the capillaries, and accelerates blood flow. After UVCH, tissue permeability increases, resulting in better absorption of ascorbic acid into the deep layers of the periodontium.

3. Results and Discussion

The patients were analyzed by age categories, and the results are shown in Table 1. The distribution of the 94 patients participating in the study by type of liver pathology and the treatment methods used indicates a consistency between the groups. Specifically, out of 35 patients with liver fibrosis, 45.7% (16 patients) were assigned to Group I with comprehensive treatment, while 54.3% (19 patients) were assigned to Group II with traditional treatment.

The distribution among respondents diagnosed with chronic hepatitis (31 patients) and liver cirrhosis (28 patients) was similar: 48.3% (15 patients) and 46.4% (13 patients) in Group I, and 51.7% (16 patients) and 53.6% (15 patients) in Group II, respectively.

It was established that dental indices before treatment in the study groups deteriorated proportionally to the severity of the liver pathology. In particular, the GI indicator was 2.2±0.14 points in liver fibrosis, while in liver cirrhosis, this value increased to 3.6±0.22 points (Table 1). In Group I, where the developed complex treatment method was used, a significant improvement in hygienic status was observed: in patients with liver cirrhosis, the GI index decreased to 1.9±0.15 points, while in Group II, where traditional treatment was used, this indicator remained high (2.8±0.21 points). This intergroup difference was statistically significant in all cases (from $p<0.05$ to $p<0.01$), confirming the priority of a comprehensive approach in restoring oral hygiene.

Regarding the PMA index, which characterizes the inflammatory process in periodontal tissues, the highest positive dynamics were also recorded in Group I. In patients with chronic hepatitis, the PMA index decreased from 44.2% to 18.2% after complex treatment, whereas with the traditional method, this indicator decreased to only 34.6% ($p<0.001$). In the cirrhosis group, the results of Group I (24.6%) were twice as effective as in Group II (48.2%) ($p<0.001$).

Table 1. Comparative analysis of key dental indices in patients with LSD after treatment

Research groups	Indicators	Hygienic index (GI, points)	PMA Index (%)
Liver fibrosis (n=35)	Before treatment	2.2±0.14	28.6±2.1
	Group I (Complex)	1.4±0.12	14.5±1.8
	Group II (Traditional)	1.8±0.15	22.4±2.3
Chronic hepatitis (n=31)	Before treatment	2.9±0.16	44.2±3.4
	Group I (Complex)	1.6±0.14	18.2±2.5
	Group II (Traditional)	2.3±0.18	34.6±3.1
Liver cirrhosis (n=28)	Before treatment	3.6±0.22	62.8±4.5
	Group I (Complex)	1.9±0.15	24.6±3.2
	Group II (Traditional)	2.8±0.21	48.2±4.2

As the severity of chronic diffuse liver diseases increased, dental enamel resistance significantly decreased compared to the control group (2.1±0.14 points). Specifically, in the pre-treatment period, the TER score was 3.8±0.18 points for liver fibrosis, 5.4±0.22 points for chronic hepatitis, and 7.2±0.25 points for liver cirrhosis, where the lowest level of resistance was noted (Table 2). This condition scientifically substantiates the impairment of the mineralizing function of the oral fluid and the intensification of enamel demineralization under the influence of systemic pathology.

According to the results of the comparative analysis, the restoration of enamel resistance in Group I using the complex treatment method was statistically significantly higher ($p<0.05$ and $p<0.01$) than in Group II using the traditional method. For example, in Group I patients with liver cirrhosis, the TER index improved to 4.3±0.21 points, while in Group II, this value remained at 6.1±0.24 points. In the chronic hepatitis group, Group I results (3.1±0.18) were also significantly more effective than the traditional approach (4.5±0.20). This confirms the high pathogenetic effectiveness of the developed comprehensive treatment and prevention algorithm in increasing the resistance of dental hard tissues.

Table 2. Dental enamel resistance test (TER) indicators in patients with LSD

Indicator	Control group (n=23)		
TER score (score, M±m)	2.1±0.14		
	Liver fibrosis (n=35)		
	Before treatment	Group I	Group II
TER score (score, M±m)	3.8±0.18	2.4±0.15	3.2±0.17
	Chronic hepatitis (n=31)		
TER score (score, M±m)	5.4±0.22	3.1±0.18	4.5±0.20
	Liver cirrhosis (n=28)		
TER score (score, M±m)	7.2±0.25	4.3±0.21	6.1±0.24

The intensity of caries in the patients was significantly higher than in the control group (3.2±0.24), which intensified as the pathology worsened. In the pre-treatment period, the CE indicator was 5.8±0.31 in liver fibrosis, rising to 8.4±0.42 in chronic hepatitis, and to 12.6±0.55 in liver cirrhosis, representing a decompensated state (Table 3).

Table 3. Indicators of caries intensity (CI) in patients with LSD.

Indicator	Control group (n=23)		
Intensity of caries (KE, M±m)	3.2±0.24		
	Liver fibrosis (n=35)		
	Before treatment	Group I	Group II
Intensity of caries (KE, M±m)	5.8±0.31	3.4±0.21	4.9±0.28
	Chronic hepatitis (n=31)		
Intensity of caries (KE, M±m)	8.4±0.42	5.2±0.33	7.1±0.38
	Liver cirrhosis (n=28)		
Intensity of caries (KE, M±m)	12.6±0.55	7.8±0.46	7.8±0.46

In Group I, where the developed comprehensive treatment method was used in the course of treatment, statistically significant results were recorded in stopping the increase in caries intensity and stabilizing the dental condition compared to the traditional method (Group II) ($p<0.05$ and $p<0.01$). Specifically, in the chronic hepatitis group, the results of Group I (5.2±0.33) were more positive than in Group II (7.1±0.38), indicating a slowing of the pathological process. In patients with liver cirrhosis, as a result of a comprehensive approach, the CE indicator stabilized at 7.8±0.46. The obtained data confirm the high effectiveness of the proposed multidisciplinary prevention and treatment algorithm in reducing carious destruction of dental hard tissues in patients with DFS.

The presented ultrasound Dopplerography results indicate that blood supply to the periodontal tissues in patients with chronic diffuse liver diseases (CDLD) is significantly impaired compared to the control group (Table 4). Prior to treatment, it was observed that as the severity of the pathology increases, the peak systolic velocity (Vmax) decreases by 2.2 times—from 18.4±1.2 cm/sec in the control group to 8.2±0.7 cm/sec in the liver cirrhosis group. Simultaneously, the volume flow rate (Qam) reached its lowest value (0.09±0.01 ml/min) in the cirrhosis group. This scientifically substantiates that systemic hemodynamic changes in the liver induce profound ischemia and hypoxia within periodontal tissues.

Table 4. Results of Ultrasound Dopplerography of Periodontal Tissues in Patients with CDLD

Group / Indicators	**Vmax (cm/s)**	**Qam (mL/min)**	**RI**
Control group (n=23)	18.4±1.2	0.24±0.02	0.62±0.04
Liver fibrosis (n=35)			
Before treatment	14.2±1.1	0.18±0.02	0.71±0.05
Group I (complex treatment)	17.1±1.0	0.22±0.02	0.64±0.03
Group II (traditional treatment)	15.4±1.2	0.19±0.02	0.68±0.04
Chronic hepatitis (n=31)			
Before treatment	11.5±0.9	0.14±0.01	0.78±0.06
Group I (complex treatment)	15.8±1.1	0.20±0.02	0.67±0.04
Group II (traditional treatment)	13.1±1.0	0.16±0.01	0.74±0.05
Liver cirrhosis (n=28)			
Before treatment	8.2±0.7	0.09±0.01	0.85±0.07
Group I (complex treatment)	13.4±0.8	0.16±0.02	0.70±0.05
Group II (traditional treatment)	10.2±0.9	0.12±0.01	0.79±0.06

The dynamics of the Resistive Index (RI) further confirm microcirculatory disturbances in the periodontium. While this indicator was 0.62±0.04 in the control group, it rose to 0.85±0.07 in patients with liver cirrhosis. Such a high resistance index indicates vasospasm of the small vessels in the gingival tissues and increased peripheral resistance. This condition deteriorates periodontal nutrition, creating a direct foundation for the acceleration of inflammatory-destructive processes and bone tissue resorption.

In Group I, where the developed comprehensive treatment

method was applied, the recovery of blood circulation parameters was expressed with higher statistical significance ($p<0.05$ and $p<0.01$) compared to Group II (traditional method). For instance, in patients with chronic hepatitis, the Vmax increased to 15.8±1.1 cm/sec after comprehensive treatment, whereas in the traditional method, this value was only 13.1±1.0 cm/sec. Furthermore, the convergence of the resistive index toward normal values (0.67±0.04) in Group I demonstrates the high efficacy of the proposed multidisciplinary approach in managing vascular tone and improving microcirculation.

Final analysis shows that in patients with liver cirrhosis in Group I, the volume flow rate (Qam) reached 0.16±0.02 ml/min after treatment, while it remained low (0.12±0.01 ml/min) in Group II ($p<0.01$). This confirms that in treating dental diseases against the background of CDLD, it is crucial not to limit interventions to local procedures alone; applying comprehensive therapy that improves blood circulation is decisive in restoring the functional state of periodontal tissues. The Dopplerography results fully prove the high pathogenetic effectiveness of the developed treatment algorithm and its ability to prevent the development of complications.

4. Conclusions

The conducted study demonstrated that in patients with chronic diffuse liver diseases, the severity of hepatic pathology is directly associated with deterioration of periodontal status, including worsening hygienic indices (GI), increased inflammatory activity (PMA), decreased enamel resistance (TER), and higher caries intensity (KE). Additionally, Doppler ultrasonography findings revealed significant impairment of periodontal microcirculation, characterized by reduced blood flow velocity (Vmax), decreased volumetric blood flow (Qam), and increased vascular resistance (RI), which indicates the development of ischemic-hypoxic processes in periodontal tissues. These findings confirm the systemic impact of liver pathology on oral health and substantiate the pathogenetic link between hepatic dysfunction and periodontal tissue damage.

The application of the developed comprehensive treatment approach, including herbal therapy (Rotokan) and physiotherapeutic modalities (vitamin C electrophoresis and UHF therapy), demonstrated significantly higher clinical efficacy compared to conventional dental treatment. This was evidenced by a more pronounced improvement in periodontal indices, restoration of enamel resistance, stabilization of caries progression, and normalization of microcirculatory parameters (Vmax, Qam, RI). The obtained results scientifically substantiate that a multidisciplinary, pathogenetically oriented treatment strategy plays a decisive role in improving therapeutic outcomes and preventing complications in patients with chronic diffuse liver diseases.

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