Comparison of Treatment Results of Recurrent Aphthous Stomatitis (RAS) with Low- and High-power Laser Irradiation vs a Pharmaceutical Method (5-year Study)

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Purpose: To compare and clinically assess the efficiency of RAS (recurrent aphthous stomatitis) treatment with Solcoseryl (adhesive paste only), low- and high-power laser irradiation, as well as combined therapy with Solcoseryl adhesive paste and low- and high-power laser irradiation.

Materials and Methods: 361 patients (male and female) with recurrent aphthosis were treated over a period of 60 months. All patients were divided into three age groups and five clinical groups. The following devices were used: biostimulation laser, 830 nm wavelength (model CTL 1106MX) with the 200 mW probe, and Nd:YAG laser, 1064 nm wavelength (model CTL 1503) up to 9 W power.

Results: A strategy for use of low- and high-power laser irradiation in routine treatment of recurrent aphthosis was developed. The Nd:YAG laser provided the best results.

Conclusion: In dental surgeries where Nd:YAG laser devices are available, other forms of RAS treatment are not justified, as the use of that laser device provides the greatest clinical effectiveness.

Key words: RAS, Nd:YAG laser, LLLT, laser application technique, regression of lesions, clinical assessment, Solcoseryl.

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Aphthae are eruptions on mucous membranes and have been present in human populations from time immemorial. Hippocrates is said to be the first to have noticed and described these lesions on the mucous membrane of the oral cavity of his contemporaries.[1, 2] It is not certain whether other doctors of ancient Europe or Asia noticed lesions of that type; however, given the insight of masters such as Galen, they must have noticed them, although no proof of that has survived to the present. Some data by anonymous authors describing lesions in different parts of the oral cavity, indicating that they were aphthae, can be found in records written in Europe during the 18th century.

The first specific data on these aphthae were presented by Mikulicz and Kümell in 1888, who presented detailed, clinical descriptions of ulcerations and erosions in the oral cavity in their dissertation „Die Krankenheiten des Mundes".[1]

Despite numerous and multidirectional studies, the etiopathogenesis of RAS remains to be fully explained. It is assumed, however, that the disease is a consequence of various factors of both general and local nature.[3-8]

The current studies indicate that laser therapy of RAS is very effective in terms of analgesia, prevention of recurrence, and promotion of fast healing.[9-12] Before com-

Table 1 Number and percentage of patients in individual age groups

	Female		Male		Total	
Age	Number	%	Number	%	Number	%
Up to 21 years	39	10.8	23	6.4	62	17.2
22 – 41 years	127	35.2	98	27.1	225	62.3
Over 41 years	41	11.4	33	9.1	74	20.5
Total	207	57.4	154	42.6	361	100.0

mencement of RAS laser therapy, a detailed interview should be completed to establish the possible causes. It is also highly recommended to eliminate any local factors, such as the combined influence of metals with different titre, micro-injuries, caries, etc. It is the decision of the doctor whether the applied treatment will consist of laser therapy only or combined treatment by laser irradiation and one of the pharmacological preparations. On the basis of our observations, the best, almost immediate clinical effect is obtained in so-called primary aphthae or "pre-aphtha conditions".[13]

The objectives of the present study were:

- clinical assessment of healing rate in RAS after application of low- and high- power laser irradiation
- identification of the influence of low- and high-power laser irradiation on the remission time of RAS
- clinical assessment of healing rate in RAS after combined treatment with low-power laser irradiation and a pharmacological compound
- clinical assessment of healing rate in RAS in combined treatment with high-power laser irradiation and a pharmacological compound
- determining the time for remission of pain according to subjective patient assessment
- clinical assessment to answer the question of whether the use of laser equipment in treatment of RAS serves any purpose

The methodology applied for clinical assessment was based on:

- comparative analysis of the results of treatment of RAS with low-power laser irradiation vs pharmacological treatment
- comparative analysis of the results of treatment of RAS with high-power Nd:YAG laser irradiation vs pharmacological treatment
- comparison of the clinical effectiveness of treatment of RAS with low- vs high-power laser irradiation
- comparison of the clinical effectiveness of combined treatment of RAS with low- and high-power laser irradiation vs pharmacological treatment
- determination of the degree of effectiveness of low- and high-power laser irradiation in treatment of RAS.

MATERIALS AND METHODS

For the purpose of this study, 361 patients (male and female) with recurrent aphthosis were treated over a period of 60 months.

All patients were divided into three age groups (Table 1):

Group I – up to 21 years of age
Group II – 22 to 41 years of age
Group III – over 41 years of age

The patients were divided into the following clinical groups (Table 2):

Group A – RAS treated pharmacologically only
Group B – RAS treated with low-power laser irradiation only
Group C – RAS treated with low-power laser irradiation and pharmacologically
Group D – RAS treated with high-power laser irradiation only
Group E – RAS treated with high-power laser irradiation and pharmacologically

The number and percentage of aphthae identified in all treated patients from individual age and clinical groups are presented in Table 3.

The credibility of clinical studies, particularly in laser dental surgery, depends among other things on the use

Table 2 Number and percentage of patients treated in individual clinical groups

Group	Female		Male		Total	
	number	%	number	%	number	%
A	41	11.4	30	8.3	71	19.7
B	41	11.4	30	8.3	71	19.7
C	41	11.4	30	8.3	71	19.7
D	41	11.4	30	8.3	71	19.7
E	43	11.8	34	9.4	77	21.2
Total	207	57.4	154	42.6	361	100.0

Table 3 Number and percentage of patients from individual clinical and age groups

Age group	Female		Male	
	number	%	number	%
A – pharmacologically treated group				
I	8	1.9	6	2.2
II	28	6.8	22	5.3
III	9	2.2	7	1.7
B – group treated by low-power laser irradiation				
I	10	2.4	5	1.2
II	27	6.5	23	5.6
III	10	2.4	6	1.4
C – group treated by combination of low-power laser irradiation and Solcoseryl				
I	9	2.2	6	1.4
II	28	6.8	21	5.1
III	8	1.9	8	1.9
D – group treated by high-power laser irradiation				
I	8	1.9	6	1.4
II	26	6.3	23	5.6
III	8	1.9	7	1.7
E – group treated by combination of high-power laser irradiation and Solcoseryl				
I	12	2.9	11	2.7
II	30	7.2	24	5.8
III	8	1.9	7	1.7

of the same devices, preparations, and techniques in all patients, ie, standardization of procedures offers the most objective results.

In all patients examined and treated in this study, laser devices of the same wavelength, power, and frequency were used, as well as the same application techniques and times. In pharmacological RAS treatment, the only preparation used was Solcoseryl (adhesive paste).

Laser Devices

The following devices were used in the study: biostimulation laser generating a wavelength of 830 nm (model CTL 1106MX with the 200 mW probe) (Fig 1), and an Nd:YAG laser generating a wavelength of 1064 nm (model CTL 1503) and up to 9 W (Fig 2). Both lasers are manufactured by CTL – Laserinstruments, Warsaw, Poland.

Fig 1 Biostimulation laser CTL 1106 MX.

Fig 2 Nd:YAG laser CTL 1503.

Laser Application Technique

In applying the low-power laser, the point contact technique was used directly on the aphtha and, depending on the size of the lesion, at 3 or 4 points on the tissue in its nearest vicinity at 2 to 3 J per point for a laser therapy cycle of 3 to 5 days. The power used was 200 mW at 4000 Hz impulse mode.[13] The high-power laser was applied in noncontact mode with an unfocused beam 1 to 3 mm from the aphtha and the tissue in its closest vicinity. The optic fiber (300 microns) was guided by a spiral or scanning motion for 50 to 60 s. The power used was 2 W at 25 Hz.[14]

Clinical Procedure

In all patients, routine clinical procedure was conducted, consisting of an interview, oral cavity examination, choice of treatment method, photographic documentation of the aphthae prior to treatment, laser irradiation, Solcoseryl or combined treatment application, photographic documentation, appointments for visits and post-treatment checkups, and photographic documentation.

Criteria for Final Assessment of Treatment

Treatment was finally assessed as successful or unsuccessful. Nd:YAG laser treatment and treatment combined with Nd:YAG laser irradiation use was considered successful if pain regressed on the day of the first visit, and a total regression of lesions was observed within 48 h. Biostimulation laser irradiation treatment and treatment combined with biostimulation laser irradiation use was considered successful if there was a clear decrease in pain within 12 h, total regression of pain within 48 h, and total regression of lesions within 3 to 6 days. Solcoseryl treatment was classified as successful if pain diminished markedly within 24 h and completely regressed within 48 h, and lesions had healed completely within 7 to 10 days.

Treatment was considered unsuccessful in all cases where pain and regression of lesions took longer than in the success criteria described above.

Statistical Analysis

The clinical data were treated statistically using the "WinStat" and "Statistica" software packages. Because of the different numbers of aphthae treated in individual groups and subgroups, aiming at a comparison of treatment effectiveness between treatment methods taking into consideration the age and gender of the patients, statistical calculations were done according to the representation methodology assuming the number of cases in a given group or subgroup as 100%.

RESULTS

The results of treatment are shown in Tables 4 to 12 and in Figs 3 to 26. The following criteria were applied in assessment of the results:

- perception of idiopathic pain after a specific time
- perception of pain during meals after a specific time
- total regression of lesions after a specific time
- perception of idiopathic pain according to different treatment methods
- perception of pain during meals according to different treatment methods
- total regression of lesions for different methods of treatment

Our results can be summarized as follows:

- There is no difference in the healing of RAS between women and men in all clinical and age groups.
- When RAS was treated with Solcoseryl adhesive paste, the healing time was 6 to 10 days.
- Treatment of RAS with biostimulation laser (830 nm wavelength) takes from 3 to 6 days, that is, it is twice as fast as Solcoseryl alone.
- Combined treatment of RAS with the biostimulation laser and Solcoseryl yields no difference in treatment time compared to biostimulation laser only. The average healing time was 3 to 6 days. There is no need

Table 4 RAS treatment results. Criterion: absence of idiopathic pain. General results without division by gender

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	14	0	0.00	0	0.00	1	7.14	14	100.00	14	100.00
II*	50	0	0.00	0	0.00	4	8.00	49	98.00	50	100.00
III*	16	0	0.00	0	0.00	1	6.25	16	100.00	16	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	15	11	73.33	14	93.33	15	100.00	15	100.00	15	100.00
II*	50	38	76.00	47	94.00	50	100.00	50	100.00	50	100.00
III*	16	11	68.75	15	93.75	16	100.00	16	100.00	16	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	15	11	73.33	14	93.33	15	100.00	15	100.00	15	100.00
II*	49	39	79.59	46	93.88	49	100.00	49	100.00	49	100.00
III*	16	12	75.00	15	93.75	16	100.00	16	100.00	16	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	14	12	85.71	14	100.00	14	100.00	14	100.00	14	100.00
II*	49	44	89.80	49	100.00	49	100.00	49	100.00	49	100.00
III*	15	13	86.67	15	100.00	15	100.00	15	100.00	15	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	23	20	86.96	23	100.00	23	100.00	23	100.00	23	100.00
II*	54	49	90.74	54	100.00	54	100.00	54	100.00	54	100.00
III*	15	13	86.67	15	100.00	15	100.00	15	100.00	15	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

for using this combined method of treatment for recurrent aphthosis.

- In treatment of RAS with Nd:YAG laser, the average healing time was 24 h.
- No advantage in healing time was provided by combined treatment with Nd:YAG laser and Solcoseryl vs treatment with Nd:YAG laser only, so there is no need for using this method of combined treatment for RAS.

Table 5 RAS treatment results. Criterion: absence of pain during consumption of food. General results without division by gender

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	14	0	0.00	0	0.00	0	0.00	12	85.71	14	100.00
II*	50	0	0.00	0	0.00	0	0.00	44	88.00	50	100.00
III*	16	0	0.00	0	0.00	0	0.00	14	87.50	16	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	15	0	0.00	11	73.33	13	86.67	15	100.00	15	100.00
II*	50	0	0.00	39	78.00	44	88.00	50	100.00	50	100.00
III*	16	0	0.00	12	75.00	14	87.50	16	100.00	16	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	15	0	0.00	12	80.00	13	86.67	15	100.00	15	100.00
II*	49	0	0.00	40	81.63	42	85.71	49	100.00	49	100.00
III*	16	0	0.00	12	75.00	13	81.25	16	100.00	16	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	14	7	50.00	13	92.86	14	100.00	14	100.00	14	100.00
II*	49	25	51.02	46	93.88	49	100.00	49	100.00	49	100.00
III*	15	7	46.67	14	93.33	15	100.00	15	100.00	15	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	23	11	47.83	21	91.30	23	100.00	23	100.00	23	100.00
II*	54	28	51.85	51	94.44	54	100.00	54	100.00	54	100.00
III*	15	7	46.67	13	86.67	15	100.00	15	100.00	15	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Table 6 RAS treatment results. Criterion: complete healing of the lesion. General results without division by gender

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	14	0	0.00	0	0.00	0	0.00	11	78.57	14	100.00
II*	50	0	0.00	0	0.00	0	0.00	40	80.00	50	100.00
III*	16	0	0.00	0	0.00	0	0.00	12	75.00	16	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	15	0	0.00	0	0.00	3	20.00	15	100.00	15	100.00
II*	50	0	0.00	0	0.00	11	22.00	50	100.00	50	100.00
III*	16	0	0.00	0	0.00	3	18.75	16	100.00	16	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	15	0	0.00	0	0.00	4	26.67	15	100.00	15	100.00
II*	49	0	0.00	0	0.00	10	20.41	49	100.00	49	100.00
III*	16	0	0.00	0	0.00	4	25.00	16	100.00	16	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	14	0	0.00	3	21.43	12	85.71	14	100.00	14	100.00
II*	49	0	0.00	10	20.41	43	87.76	49	100.00	49	100.00
III*	15	0	0.00	3	20.00	13	86.67	15	100.00	15	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	23	0	0.00	5	21.74	20	86.96	23	100.00	23	100.00
II*	54	0	0.00	11	20.37	47	87.03	54	100.00	54	100.00
III*	15	0	0.00	3	20.00	12	80.00	15	100.00	15	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Table 7 RAS treatment results. Criterion: absence of idiopathic pain. Results for female patients

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	8	0	0.00	0	0.00	1	12.50	8	100.00	8	100.00
II*	28	0	0.00	0	0.00	2	7.14	27	96.43	28	100.00
III*	9	0	0.00	0	0.00	0	0.00	9	100.00	9	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	10	7	70.00	9	90.00	10	100.00	10	100.00	10	100.00
II*	27	20	74.07	25	92.59	27	100.00	27	100.00	27	100.00
III*	10	7	70.00	10	100.00	10	100.00	10	100.00	10	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	9	7	77.78	9	100.00	9	100.00	9	100.00	9	100.00
II*	28	21	75.00	26	92.86	28	100.00	28	100.00	28	100.00
III*	8	6	75.00	7	87.50	8	100.00	8	100.00	8	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	8	7	87.50	8	100.00	8	100.00	8	100.00	8	100.00
II*	26	23	88.46	26	100.00	26	100.00	26	100.00	26	100.00
III*	8	7	87.50	8	100.00	8	100.00	8	100.00	8	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	12	10	83.33	12	100.00	12	100.00	12	100.00	12	100.00
II*	30	27	90.00	30	100.00	30	100.00	30	100.00	30	100.00
III*	8	7	87.50	8	100.00	8	100.00	8	100.00	8	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Table 8 RAS treatment results. Criterion: absence of idiopathic pain. Results for male patients

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	0	0.00	0	0.00	0	0.00	6	100.00	6	100.00
II*	26	0	0.00	0	0.00	2	9.09	22	100.00	26	100.00
III*	7	0	0.00	0	0.00	1	14.29	7	100.00	7	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	5	4	80.00	5	100.00	5	100.00	5	100.00	5	100.00
II*	23	18	78.26	22	95.65	23	100.00	23	100.00	23	100.00
III*	6	4	66.67	5	83.33	6	100.00	6	100.00	6	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	4	66.67	5	83.33	6	100.00	6	100.00	6	100.00
II*	21	18	85.71	20	95.24	21	100.00	21	100.00	21	100.00
III*	8	6	75.00	8	100.00	8	100.00	8	100.00	8	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	5	83.33	6	100.00	6	100.00	6	100.00	6	100.00
II*	23	21	91.30	23	100.00	23	100.00	23	100.00	23	100.00
III*	7	6	85.71	7	100.00	7	100.00	7	100.00	7	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	11	10	90.91	11	100.00	11	100.00	11	100.00	11	100.00
II*	24	22	91.67	24	100.00	24	100.00	24	100.00	24	100.00
III*	7	6	85.71	7	100.00	7	100.00	7	100.00	7	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Table 9 RAS treatment results. Criterion: absence of pain during consumption of food. Results for female patients

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	8	0	0.00	0	0.00	0	0.00	7	87.50	8	100.00
II*	28	0	0.00	0	0.00	0	0.00	24	85.71	28	100.00
III*	9	0	0.00	0	0.00	0	0.00	8	88.89	9	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	10	0	0.00	7	70.00	9	90.00	10	100.00	10	100.00
II*	27	0	0.00	22	81.48	23	85.19	27	100.00	27	100.00
III*	10	0	0.00	7	70.00	9	90.00	10	100.00	10	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	9	0	0.00	7	77.78	8	88.89	9	100.00	9	100.00
II*	28	0	0.00	23	82.14	24	85.71	28	100.00	28	100.00
III*	8	0	0.00	6	75.00	6	75.00	8	100.00	8	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	8	4	50.00	7	87.50	8	100.00	8	100.00	8	100.00
II*	26	14	53.85	24	92.31	26	100.00	26	100.00	26	100.00
III*	8	4	50.00	8	100.00	8	100.00	8	100.00	8	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	12	6	50.00	11	91.67	12	100.00	12	100.00	12	100.00
II*	30	16	53.33	28	93.33	30	100.00	30	100.00	30	100.00
III*	8	4	50.00	7	87.50	8	100.00	8	100.00	8	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Table 10 RAS treatment results. Criterion: absence of pain during consumption of food. Results for male patients

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	0	0.00	0	0.00	0	0.00	5	83.33	6	100.00
II*	26	0	0.00	0	0.00	0	0.00	20	90.91	26	100.00
III*	7	0	0.00	0	0.00	0	0.00	6	85.71	7	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	5	0	0.00	4	80.00	4	80.00	5	100.00	5	100.00
II*	23	0	0.00	17	73.91	21	91.30	23	100.00	23	100.00
III*	6	0	0.00	5	83.33	5	83.33	6	100.00	6	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	0	0.00	5	83.33	5	83.33	6	100.00	6	100.00
II*	21	0	0.00	17	80.95	18	85.71	21	100.00	21	100.00
III*	8	0	0.00	6	75.00	7	87.50	8	100.00	8	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	3	50.00	6	100.00	6	100.00	6	100.00	6	100.00
II*	23	11	47.83	22	95.65	23	100.00	23	100.00	23	100.00
III*	7	3	42.86	6	85.71	7	100.00	7	100.00	7	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	11	5	45.45	10	90.91	11	100.00	11	100.00	11	100.00
II*	24	12	50.00	23	95.83	24	100.00	24	100.00	24	100.00
III*	7	3	42.88	6	85.71	7	100.00	7	100.00	7	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Table 11 RAS treatment results. Criterion: complete healing of the lesion. Results for female patients

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	8	0	0.00	0	0.00	0	0.00	6	75.00	8	100.00
II*	28	0	0.00	0	0.00	0	0.00	22	78.57	28	100.00
III*	9	0	0.00	0	0.00	0	0.00	7	77.78	9	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	10	0	0.00	0	0.00	2	20.00	10	100.00	10	100.00
II*	27	0	0.00	0	0.00	6	22.22	27	100.00	27	100.00
III*	10	0	0.00	0	0.00	2	20.00	10	100.00	10	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	9	0	0.00	0	0.00	3	30.00	9	100.00	9	100.00
II*	28	0	0.00	0	0.00	6	21.43	28	100.00	28	100.00
III*	8	0	0.00	0	0.00	2	25.00	8	100.00	8	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	8	0	0.00	2	25.00	7	87.50	8	100.00	8	100.00
II*	26	0	0.00	5	19.23	23	88.46	26	100.00	26	100.00
III*	8	0	0.00	1	12.50	7	87.50	8	100.00	8	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	12	0	0.00	2	16.67	10	83.33	12	100.00	12	100.00
II*	30	0	0.00	6	20.00	26	86.67	30	100.00	30	100.00
III*	8	0	0.00	2	25.00	7	87.50	8	100.00	8	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Table 12 RAS treatment results. Criterion: complete healing of the lesion. Results for male patients

RAS treated with Solcoseryl only – group A

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	0	0.00	0	0.00	0	0.00	5	83.33	6	100.00
II*	26	0	0.00	0	0.00	0	0.00	18	81.82	26	100.00
III*	7	0	0.00	0	0.00	0	0.00	5	71.42	7	100.00

RAS treated by low-power laser irradiation only – group B

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	5	0	0.00	0	0.00	1	20.00	5	100.00	5	100.00
II*	23	0	0.00	0	0.00	5	21.74	23	100.00	23	100.00
III*	6	0	0.00	0	0.00	1	16.67	6	100.00	6	100.00

RAS treated by combination of low-power laser irradiation and Solcoseryl – group C

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	0	0.00	0	0.00	1	16.67	6	100.00	6	100.00
II*	21	0	0.00	0	0.00	4	19.05	21	100.00	21	100.00
III*	8	0	0.00	0	0.00	2	25.00	8	100.00	8	100.00

RAS treated by high-power laser irradiation only – group D

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	6	0	0.00	1	16.67	5	83.33	6	100.00	6	100.00
II*	23	0	0.00	5	21.74	20	86.96	23	100.00	23	100.00
III*	7	0	0.00	2	28.57	6	85.71	7	100.00	7	100.00

RAS treated by combination of high-power laser irradiation and Solcoseryl – group E

Age group	Total number of aphthae	day 1		day 2		day 3		day 6		day 10	
		number	%	number	%	number	%	number	%	number	%
I*	11	0	0.00	3	27.27	10	90.91	11	100.00	11	100.00
II*	24	0	0.00	5	20.83	21	87.50	24	100.00	24	100.00
III*	7	0	0.00	1	14.29	5	71.43	7	100.00	7	100.00

I* – patients up to 21 years of age, II* – patients from 22 to 41 years of age, III* – patients over 41 years of age.

Group A – RAS treated with Solcoseryl only

Fig 3 Lesion before treatment – lower lip (day 1).

Fig 4 Lesion during treatment with Solcoseryl (day 1).

Fig 5 View of lesion – day 2 of treatment.

Fig 6 View of lesion – day 3 of treatment.

Fig 7 View of mucous membrane – day 6 of treatment.

Group B – RAS treated by low-power laser irradiation only

Fig 8 Lesion before treatment (bottom of oral cavity).

Fig 9 View of lesion during treatment (application of low-power laser irirradiation - day 1).

Fig 10 View of lesion – day 2 of treatment.

Fig 11 View of lesion – day 3 of treatment.

Fig 12 View of mucous membrane – day 6 of treatment.

Group C – RAS treated by low-power laser irradiation and Solcoseryl

Fig 13 View of lesion before treatment (lower lip).

Fig14 View of lesion during treatment (application of low-power laser irradiation - day 1).

Fig 15 View of lesion during treatment (application of Solcoseryl).

Fig 16 View of lesion – day 2 of treatment during application of laser irradiation.

Fig 17 View of lesion – day 3 of treatment.

Fig 18 View of mucous membrane – day 6 of treatment.

Group D – RAS treated by high-power laser irradiation only

Fig 19 View of lesion before treatment (tongue).

Fig 20 View of lesion during Nd:YAG laser irradiation application – day 1.

Fig 21 View of lesion – day 2 of treatment.

Fig 22 View of mucous membrane – day 3 of treatment (complete recovery).

Group E – RAS treated by high-power laser irradiation and Solcoseryl

Fig 23 View of lesion before treatment (lower tongue surface).

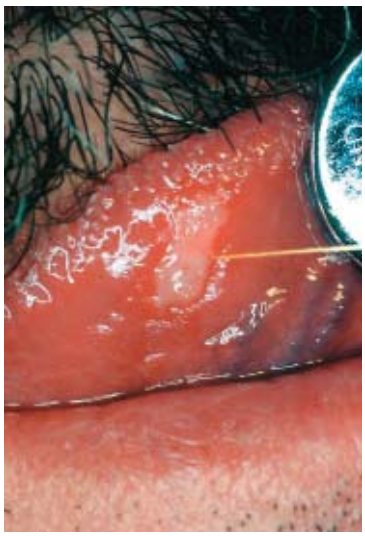

Fig 24 View of lesion during Nd:YAG laser irradiation application (day 1).

Fig 25 View of lesion after combined application of irradiation with Nd:YAG laser and Solcoseryl (day 1).

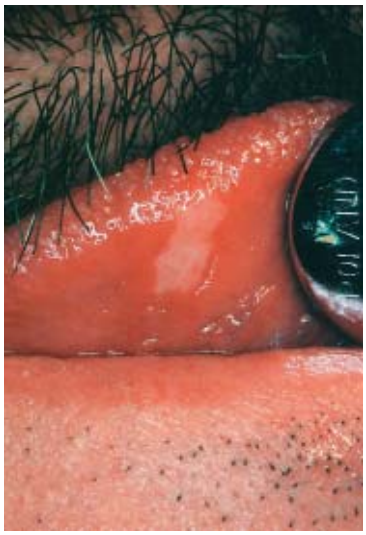

Fig 26 View of mucous membrane on day 2 of treatment.

CONCLUSION

On the basis of the results of this study, a strategy for use of low- and high-power laser irradiation in routine treatment of recurrent aphthosis was developed while the less effective methods were dropped. Only the methods offering the best results were further developed.

Because our results showed that Nd:YAG laser is the most effective clinical instrument for treatment of recurrent aphthosis, we find that in dental surgeries where Nd:YAG laser devices are available, the use of other forms of treatment for RAS is not justified.

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