Journal of
PERIODONTAL RESEARCH

J Periodont Res 2009; 44: 718–725

JOURNAL OF PERIODONTAL RESEARCH
doi:10.1111/j.1600-0765.2008.01183.x

Relationship between periodontal parameters and Behçet's disease and evaluation of different treatments for oral recurrent aphthous stomatitis

T. Arabaci, C. Kara, Y. Çiçek
Department of Periodontology, Faculty of Dentistry, Atatürk University, Erzurum, Turkey

Arabaci T, Kara C, Çiçek Y. Relationship between periodontal parameters and Behçet's disease and evaluation of different treatments for oral recurrent aphthous stomatitis. J Periodont Res 2009; 44: 718–725. © 2008 The Authors. Journal compilation © 2008 Blackwell Munksgaard

Background and Objective: The highest prevalence of Behçet's disease (BD) has been reported in Turkey, and therefore research of relations between BD and other disorders have become important in the Turkish population. Since oral aphthous ulcers impair tooth brushing, reducing complaints about aphthous ulcers will motivate the patient to maintain better oral hygiene performance and will thus reduce plaque accumulation and periodontal scores. The purpose of this controlled case study was to evaluate the relationship between the severity of periodontal scores and Behçet's disease, and to compare the treatment modalities with neodymium-doped yttrium aluminium garnet (Nd:YAG) laser and medication on the recurrent aphthous ulcers in BD patients by considering the degree of pre- and post-treatment pain, discomfort and functional complications.

Material and Methods: The periodontal status of 28 BD patients was evaluated according to periodontal indices. The BD patients were also assessed for clinical severity score as described previously. Levels of pre- and post-treatment pain and functional complications were assessed at patient visits on days 1, 4 and 7.

Results: Periodontal indices, the number of oral ulcers and the daily frequency of tooth brushing were related to the severity scores of BD ($p < 0.001$). The results indicated that BD patients treated with the Nd:YAG laser had less post-treatment pain and fewer functional complications and reported immediate relief of pain and faster healing ($p < 0.001$).

Conclusion: Our results suggest that periodontal status is worse in BD patients and is associated with disease severity; also, the Nd:YAG laser has better patient acceptance, shorter treatment time and lower rates of pain and post-treatment adverse events among BD patients with oral recurrent aphthous stomatitis.

Dr Taner Arabaci, DDS, Atatürk Üniversitesi Diş Hekimliği Fakültesi, Periodontoloji Anabilim Dalı 25240, Erzurum, Turkey
Tel: +904422311902
Fax: +904422122380
e-mail: t-arabaci@hotmail.com

Key words: Behçet's disease; periodontal status; Nd:YAG laser; aphthous stomatitis

Accepted for publication October 9, 2008

Behçet's disease (BD) is a multisystemic chronic disease affecting almost every organ, without exception (1–3). It was originally described by Dr Hulusi Behçet in 1937 as the triple-symptom complex of recurrent oral aphthae, genital ulcerations and relapsing iritis with hypopyon (4). The etiology of the disease is presumed to be multifactorial,

implicating immune system dysregulation, cellular and humoral immune defects, genetic predisposition and endothelial cell dysfunction (5–7). Although BD is particularly prevalent in 'Silk Route' populations, it has a global distribution and geographic variations (8). The highest prevalence of BD has been reported in Turkey (80–370/100,000), and therefore research of relations between BD and other disorders have become important in the Turkish population (9).

Behçet's disease starts mostly from the oral mucosal surfaces, and oral microbial flora has a critical role in the pathogenesis (10,11). Dental interventions or tonsillitis have been indicated as an effective factor in disease attacks such as oral ulcers, as well as activation of other manifestations (12,13). Furthermore, recent studies have demonstrated that oral health is impaired in BD patients and that patients have higher periodontal scores than healthy subjects (14,15). The researchers associate the higher periodontal scores with poor oral hygiene and impaired brushing activity owing to the painful oral ulcers of patients with BD (11,15). The most frequent oral manifestations of BD are recurrent oral aphthous ulcers, characterized by painful recurring oral mucosal lesions (16). The frequent or continuous aphthous ulcers often increase the severity of patient discomfort and cause functional complications, including associated difficulties in speaking, tooth brushing and eating and loss of weight (17–20). Although several agents, such as topical corticosteroids and antibiotics, are used in order to reduce patient complaints about aphthous ulcers, no certain cure has been proven clinically effective (21,22).

Since recurrent aphthous ulcers impair tooth brushing, reducing complaints about aphthous ulcers will motivate the patient to maintain better oral hygiene performance and will thus reduce plaque accumulation and periodontal scores. Therefore, there is a real need for management that reduces the severity of the painful symptoms of the disease. Recently, lasers have been used because they improve the efficacy of wound healing and avoid the potential side-effects of the drugs (23). Neodymium-doped yttrium aluminium garnet (Nd:YAG) lasers have currently been used in a wide range of dental applications, including periodontics, preventive dentistry, oral surgery and endodontics (24–29). However, the use of Nd:YAG laser therapy on oral lesions has not found acceptance by the dental community because of the lack of sufficient numbers of controlled clinical trials.

The purpose of this controlled case study was to evaluate the relationship between the severity of periodontal scores and Behçet's disease and to compare the treatment modalities with Nd:YAG laser and medication on the recurrent aphthous ulcers in BD patients by considering the degree of pre- and post-treatment pain, discomfort and functional complications.

Material and methods

Study design

This study was designed to show the relationship between BD severity and periodontal findings and as a randomized prospective controlled clinical trial to compare the clinical comfort outcomes of recurrent aphthous stomatitis (RAS) therapy of BD patients consisting of medication or Nd:YAG laser procedures. Subjects were informed about the nature of the study, and were required to sign a consent form and fill out a medical history questionnaire. The study was performed according to the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Atatürk University Faculty of Dentistry.

Study population and clinical parameters

Twenty-eight BD patients (17 males, 11 females) with RAS-related oral problems who reported to the department of Periodontology (Atatürk University, Faculty of Dentistry) participated in this study. All patients had between one and five aphthous ulcers of less than 72 h duration, and were of a low-to-moderate socio-economic level. Each patient provided a medical and dental history and signed an informed consent document for the study. Patients who were pregnant or lactating, had concurrent clinical conditions that could pose a health risk (including serious liver, kidney and heart dysfunctions), were smokers or were on any periodontal treatment before the study entry were excluded from the study. To evaluate the different treatment methods for RAS, BD patients were divided into two groups: the aphthous ulcers of patients in group I ($n = 14$) were treated with Nd:YAG laser irradiation, while those in group II ($n = 14$) were treated with medication.

A randomizing table comprising patient numbers (1–28) was created for randomized treatment allocation. Therapy methods were randomly allocated to patients from the randomizing table, with odd numbers included in group I and even numbers included in group II. The periodontists and patients were not blinded with respect to treatments.

For evaluating the relationship between BD and periodontal findings, the severity score of BD patients was determined as described previously (30). This score was calculated as the sum of 1 point each for mild symptoms (oral aphthosis ulcers, genital ulcers, arthralgia and typical skin lesions such as erythema nodosum, papulopustular lesions and folliculitis), 2 points each for moderate symptoms (arthritis, deep vein thrombosis of the legs, anterior uveitis and gastrointestinal involvement) and 3 points each for severe disease manifestations (posterior uveitis/panuveitis, retinal vasculitis, arterial thrombosis, neuro-Behçet's and bowel perforation). The BD patients were categorized according to the disease severity score as follows: severe group, ≥ 7 points ($n = 7$); moderate group, a score between 4 and 6 points ($n = 15$); and mild group, < 4 points ($n = 6$).

Specific objectives

There were two hypotheses tested, as follows: (1) that no relationship existed between BD and periodontal

parameters; and (2) that there was no difference between patient perceptions after RAS management with Nd:YAG laser technique and medication.

Outcome assessment

Primary outcome measures included the plaque index (PI), the gingival index (GI) and clinical attachment level (CAL) of patients' teeth, which were clinically evaluated for periodontal status both before and after treatment. The CAL was measured with a manual periodontal probe (Hu-Friedy manufacturing Inc., Chicago, IL, USA) and rounded down to the lowest whole millimeter. The PI, GI and CAL scores were recorded on four tooth surfaces (mesial, distal, buccal and lingual) for all teeth. The numerical scores were obtained according to the formula:

$$\text{Score per person} = \frac{\text{sum of individual scores}}{\text{number of teeth present for each patients}}$$

and subsequently group score was calculated by adding together the individual scores and dividing the total by the number of patients included.

Secondary outcome measures included evaluation of pre- and post-treatment pain and patient preferences. A visual analog scale (VAS) was used to assess these outcomes. Patients were asked to rate separately their degree of pain and functional complications (discomfort during eating, speaking and brushing) on a 10 cm VAS by marking the position between two fixed end-points. The left end-point of the scale designated 'no pain/no discomfort' and the right end-point designated 'worse pain/severe discomfort.' Levels of post-treatment pain and functional complications were assessed at patient visits on days 1, 4 and 7. All VAS assessments were performed in the same clinic, in an area free of distracting noise, music or conversations. Degree of erythema and exudation were evaluated by the investigators on a 4-point scale (range: 0–3) based, with some modifications, on the methods of Liu *et al.* (31): 0, no erythema/no exudation; 1, light red-pink/light exudation; 2, red but not dark in color/moderate exudation; and 3, very red, dark in color/heavy exudation, with pseudomembrane.

Treatment procedures

Oral hygiene — After baseline parameters were recorded, all patients underwent oral hygiene instruction and scaling with ultrasonic and hand instruments. For the oral hygiene instruction, periodontal diseases and local factors were described. Patients were taught how to brush their teeth correctly. All education and motivation sessions were done face to face. Patients were then placed on a recall maintenance programme and monitored by the periodontists.

Medicine and laser applications — Group I patients' oral RAS were treated using a Nd:YAG laser (Smarty A10; DEKA, Firenze, Italy; free-running pulsed wave laser with a wavelength of 1.064 nm under air cooling) with the following irradiation parameters: power output, 2 W; energy, 100 mJ; frequency, 20 Hz; emission mode, pulsed; and time, 2–3 min (the duration was changed according to the size of the lesion). The laser beam was conducted by optical fiber with 320 μm and by contact mode. After applying a topical anesthetic gel (Xylocain® gel%2, AstraZeneca, Denmark) to the area, articain 4% with a 1:200,000 addition of epinephrine (Ultracain D-S forte, Aventis Pharma, Istanbul, Turkey) was infiltrated around the lesion. The laser hand-piece was then brought into contact with the entire lesion, which was exposed to laser energy until the surface epithelium was ablated. The typical lesion bled slightly, and then coagulated within 5 s. The laser was used to remove as much necrotic tissue as possible, including the inflamed red halo. The Nd:YAG laser produced a relatively thick coagulation layer on the lased lesion surface, owing to the characteristics of penetration and thermogenesis.

Group II was treated with a topical corticosteroid (triamcinolone acetonide 0.1%; Kenacort-A Orabase, Bristol-Myers Squibb Inc., İstanbul, Turkey) applied over the ulcers using a standard-sized applicator, three times daily for 1 week.

Statistical analysis

Statistical analysis was performed using SPSS 11.5 software for Windows (Statistical Program for Social Sciences Inc., Chicago, IL, USA). Chi-squared test, Kruskal–Wallis and Mann–Whitney *U*-tests were used to compare age, sex, BD severity score, periodontal parameters and daily frequency of tooth brushing in each BD severity group. The statistical significance of data for all clinical and VAS scores within and between groups was determined using Student's paired *t*-test. Spearman correlation analysis was used for the association between the clinical variables and BD severity scores. Changes with p-values < 0.05 were considered statistically significant.

Power calculation

In our geographical area, we were able to recruit only 28 patients out of 40 patients who were referred to our clinic with Behçet's disease who agreed to participate in our study in a 1 year period. Therefore, if 40 BD patients are registered in our clinic in this period, 28 of these will be treated. Thus, 28 cases were proposed as a realistic goal.

Results

All 28 patients completed the study, and there were no reported adverse events. As a result of the randomization procedures, the groups were well matched in such demographics as age, sex, medical history, baseline values of ulcer location, number of ulcers and clinical dental variables (Table 1). There were no significant differences in mean age between female and male patients ($p > 0.05$), of whom 61% were female and 39% were male. Most patients presented with two or three ulcers located mainly on non-keratinized labial and buccal mucosa. The daily

Table 1. Mean ± SD demographic features and dental parameters in subjects subset in the two treatment groups

	Group I	Group II	Total	*p*-value (group I vs. group II)
Patients (*n*)				
Male	8	9	17	—
Female	6	5	11	—
Total	14	14	28	—
Age				
Male	30.6 ± 3.5	31.1 ± 4.7	30.6 ± 4.1	NS
Female	29.5 ± 3.1	29.2 ± 4.1	29.4 ± 2.9	NS
Total	29.8 ± 3.2	30.4 ± 4.2	30.1 ± 3.7	NS
Daily tooth brushing (sessions per day)				
Baseline	0.57 ± 0.51[a]	0.57 ± 0.76[a]	0.57 ± 0.64[a]	NS
1 month after treatment	1.71 ± 0.47[a]	1.57 ± 0.51[a]	1.64 ± 0.49[a]	NS
Aphthous ulcers (*n*)				
Location				
Attached gingiva	2	3	5	—
Tongue	3	5	8	—
Buccal-labial mucosa	19	22	41	—
Floor of mouth	9	8	17	—
Total	33	38	71	—
Total (after 1 month)	19	22	41	—
Clinical parameters				
Plaque index				
Baseline	1.20 ± 0.30[a]	1.18 ± 0.32[a]	1.19 ± 0.30[a]	NS
1 month after all treatments	0.27 ± 0.17[a]	0.34 ± 0.25[a]	0.31 ± 0.21[a]	NS
Gingival index				
Baseline	1.48 ± 0.37[a]	1.43 ± 0.36[a]	1.46 ± 0.37[a]	NS
1 mo after all treatments	0.30 ± 0.26[a]	0.31 ± 0.24[a]	0.31 ± 0.25[a]	NS
Clinical attachment level				
Baseline	2.77 ± 0.69[a]	3.00 ± 0.75[a]	2.90 ± 0.71[a]	NS
1 month after all treatments	1.96 ± 0.56[a]	2.03 ± 0.62[a]	1.99 ± 0.58[a]	NS

NS, not statistically significant.
[a]Statistically significant differences within the groups ($p < 0.05$).

frequency of tooth brushing was similar for all BD patients at the beginning of the study, but the differences within each group after 1 month of treatment were statistically significant ($p < 0.001$) (Table 1). The total number of aphthous ulcers was similar between groups. Both groups demonstrated a statistically significant ($p < 0.001$) decrease in clinical index values after periodontal therapy compared with the initial values (Table 1). Patients still had oral ulcers at their 1 month follow-up assessment; however, the number of the ulcers was less than the baseline number (Table 1). We also observed that four patients who were treated with medication alone had recurrences of the oral ulcers in the same areas where they had the ulcers before, but the patients who had laser therapy did not show any recurrence at all.

No statistically significant difference was observed according to age and sex among the groups that were categorized according to the BD severity score. However, when clinical periodontal parameters, the daily frequency of tooth brushing and VAS scores were analyzed according to clinical severity score of BD patients, the scores of periodontal indices and VAS were higher and the daily frequency of tooth brushing was lower in patients with severe and moderate BD symptoms compared with milder ones ($p < 0.001$; Table 2).

The results of Spearman correlation analysis of the factors affecting the severity score of BD patients are presented in Table 3. Periodontal indices, the number of oral recurrent aphthous ulcers and the daily frequency of tooth brushing were related to the severity scores of BD ($p < 0.001$).

The VAS scoring results are presented in Table 4. Mean ulcer pain was well matched in both groups at study entry ($p > 0.05$), but was later significantly relieved in group I ($p < 0.001$). On day 4, mean pain score of group I was much lower than that of group II ($p < 0.001$). On day 7, group I still presented with a significantly lower pain score than group II ($p < 0.001$). In terms of patient satisfaction, patients in group II did not reach the level achieved by those in group I, and post-treatment functional complications (assessed by the chewing, speaking and brushing VAS scores) were significantly lower in group I ($p < 0.001$). On days 4 and 7, only speaking VAS scores were not significantly different ($p > 0.05$).

Erythema and exudation levels improved during the course of the study in both groups, and the between-group difference in erythema was not statistically significant at the end-point ($p > 0.05$); however, group I had significantly lower exudation ($p < 0.05$) than group II at the final patient visit (Table 5).

Table 2. Clinical severity scores according to the Mean ± SD demographic features, VAS scores and dental parameters in the patients with Behçet's disease

	Clinical severity of Behçet's disease			
	Mild (n = 6)	Moderate (n = 15)	Severe (n = 7)	p-value
Age	27.67 ± 3.88	31.07 ± 3.43	30.14 ± 3.53	0.175*
Sex				
Male, n (%)	4 (66.7)	8 (53.3)	5 (71.4)	0.681†
Female, n (%)	2 (33.3)	7 (46.7)	2 (29.6)	
Clinical parameters				
Plaque index	**0.76 ± 0.15**	1.27 ± 0.23	1.37 ± 0.18	0.001*
Gingival index	0.94 ± 0.15	1.51 ± 0.20	1.89 ± 0.16	< 0.001*
Clinical attachment level	1.91 ± 0.33	2.88 ± 0.41	3.72 ± 0.37	< 0.001*
Tooth brushing (n/d)	**1.33 ± 0.52**	0.40 ± 051	0.29 ± 0.49	< 0.001*
VAS scores				
Pain	**6.77 ± 0.64**	7.35 ± 0.98	7.43 ± 0.92	< 0.001*
Chewing	**7.28 ± 0.70**	8.46 ± 0.78	8.52 ± 0.82	< 0.001*
Speaking	2.05 ± 0.92	3.30 ± 1.05	3.95 ± 1.14	< 0.001*
Discomfort at brushing	**6.01 ± 0.82**	7.06 ± 1.01	7.10 ± 1.02	< 0.001*

*The significant differences between the BD severity groups are tested by using Kruskal-Wallis and Mann–Whitney U-test; †Chi-square is used.
The BD severity group exhibiting differences is given in bold.

Table 3. The relationship between severity of Behçet's disease and periodontal parameters at baseline

	BDs	PI	GI	CAL	RAS
PI	0.796*	—	—	—	—
GI	0.957*	0.852*	—	—	—
CAL	0.926*	0.760*	0.905*	—	—
RAS	0.894*	0.692*	0.857*	0.845*	—
Brushing	−0.626*	−0.644*	−0.691*	−0.620*	−0.542*

*Correlation is significant at the 0.001 level (Spearman rank correlation).
Abbreviations: BDs, clinical severity score of Behçet's disease; PI, plaque index; GI, gingival index; CAL, clinical attachment level; and RAS, the number of oral recurrent aphthous ulcers.

Discussion

In recent research, it has been stated that oral health is worse in Behçet's patients and is associated with disease severity (8,11). Studies have shown that there is a positive correlation between periodontal scores and the severity of BD (11,14,15). In addition, periodontitis has been shown to induce a systemic inflammatory process that may contribute to the progression of BD (32). It was observed that the number of extracted or decayed teeth was higher in BD patients than in healthy groups (15). Mumcu *et al.* (11) stated that oral health is impaired in patients with BD compared with healthy control subjects, and they explained these data as the result of limited effective tooth brushing because of painful aphthous ulcers. In contrast, Akman *et al.* (8) did not find significant differences between patients with RAS and healthy control subjects. Moreover, they stated that there was no significant difference between BD and RAS patients with active oral ulcers and patients without oral ulcers at the time of periodontal examination. The difference between the results of the two studies could be explained by the numbers and socio-economic varieties of patients enrolled in these studies.

The present study was performed to investigate the relationship between the severity of BD and age, sex and periodontal clinical parameters, and to evaluate the effect of aphthous ulcer therapy with different techniques on brushing motivation for patients. It was shown that there were no significant differences in mean age between female and male patients in the groups. On the contrary, clinical periodontal parameters of the patients who had severe and moderate BD scores were higher compared with patients who had milder scores. However, the daily frequency of tooth brushing of patients with severe and moderate symptoms was lower than patients with mild symptoms. Periodontal therapy demonstrated a statistically significant ($p < 0.001$) decrease in clinical index values compared with the initial values in both groups. Brushing motivation of all patients was similar before treatments, but there was a statistical difference between brushing activity 1 month after commencing the aphthous ulcer therapies ($p < 0.001$).

Results of this study revealed that periodontal indices, the number of oral recurrent aphthous ulcers and the daily frequency of tooth brushing were related to the severity scores of BD. The VAS scores showed that tooth brushing performance was limited because of painful and active oral ulcers and periodontal scores were increased with the severity of the BD. Since poor oral hygiene is the primary factor for plaque accumulation and periodontal diseases, individual oral hygiene performance is directly related to periodontal scores (33,34). Previous studies (8,11) and our results showed that oral hygiene is impaired in

Table 4. Comparison of the mean ± SD VAS scores of BD patients' perceptions in the two treatment groups

	Group I	Group II	*p*-value (group I vs. group II)
Pain			
Before the treatment	7.12 ± 0.71	7.25 ± 0.58	NS
After the treatment			
1 day	3.19 ± 0.76	6.14 ± 0.76	*
4 days	0.51 ± 0.59	2.68 ± 0.63	*
1 week	0	1.03 ± 0.92	*
Chewing			
Before the treatment	8.34 ± 0.81	7.80 ± 0.70	NS
After the treatment			
1 day	3.62 ± 0.76	6.61 ± 0.89	*
4 days	0.12 ± 0.38	2.12 ± 0.71	*
1 week	0	0.20 ± 0.44	*
Speaking			
Before the treatment	2.10 ± 0.90	4.08 ± 1.20	*
After the treatment			
1 day	2.11 ± 0.84	3.75 ± 0.90	*
4 days	0	0.09 ± 0.20	NS
1 week	0	0	NS
Discomfort at brushing			
Before the treatment	6.38 ± 0.88	7.08 ± 1.02	NS
After the treatment			
1 day	4.01 ± 0.75	6.55 ± 0.94	*
4 days	0	0.49 ± 0.40	NS
1 week	0	0	NS
Satisfaction			
After the treatment	9.80 ± 1.16	7.31 ± 0.91	*

*$p < 0.001$ significant difference; NS, not statistically significant; VAS, visual analog scale.

Table 5. Changes of mean ± SD erythema and exudation scores in the two treatment groups

	Group I ($n = 33$)	Group II ($n = 38$)	*p*-value (group I vs. group II)
Erythema			
Baseline	1.89 ± 0.65	2.16 ± 0.72	*
Post-treatment	0.19 ± 0.22	0.25 ± 0.24	NS
Exudation			
Baseline	2.25 ± 0.81	2.30 ± 0.61	NS
Post-treatment	0.09 ± 0.51	0.44 ± 0.50	*

*$p < 0.001$ significant difference; NS, not statistically significant; and *n*, number of aphthous ulcers.

patients with BD and RAS, so the higher periodontal scores can be associated with the insufficient brushing activity because of painful aphthous ulcers in Behçet's patients (35). Therefore, this study aimed to reduce the painful symptoms of aphthous ulcers by obtaining ideal oral hygiene performance in patients with BD.

Management of aphthous ulcers and reduction of patients' pain using systemic or topical agents is acknowledged as crucial. Pain relief agents include topical glucocorticoids and antibiotics, local analgesics, astringents and laser therapy (31). Although patients have spontaneous healing within 10–14 days (and minor aphthae typically heal in 7–10 days), treatment is indicated to reduce fever and control pain (36,37). Reducing pain and healing time for recurrent aphthous ulcers restores patients' ability to eat, swallow and talk, improving quality of life (38). Several randomized clinical trials have evaluated the use of topical or systemic corticosteroids such as hydrocortisone, triamcinolone acetonide and clobetasol propionate in the treatment of aphthous stomatitis and found them to be effective in reducing lesion duration and severity, although they have no effect on recurrence (38–40). The results of our study demonstrated that treatment with the topical corticosteroid triamcinolone acetonide (0.1%) not only reduced the size, erythema and degree of exudation associated with aphthous stomatitis ulcers, but also resolved patients' pain.

All of these systemic and topical medication therapies have potentially serious adverse effects, including candidiasis, allergic reactions, bitter taste and tooth discoloration, which could negatively affect patient compliance (41,42). Identification of topical agents with higher efficacy and lower incidence of side-effects is therefore a primary concern and area of research for oral medicine specialists who treat RAS.

Since lasers were first introduced into dentistry, investigators have worked to establish the amount of laser energy (wavelength, energy density, continuous or pulsed mode, time of exposure, focal spot) that is simultaneously most useful and least harmful to the soft and hard tissues of the oral cavity (26). Laser dental treatments have served as an alternative or adjunctive treatment to conventional dental therapy because of their many advantages, including ablation or vaporization, hemostasis, sterilization effect, minimal pain and swelling after surgery, less wound contraction during healing and no scaring of mucosal tissue, reduced treatment time, and no damage to adjacent normal tissue. The Nd:YAG lasers, in particular, have demonstrated an excellent soft tissue ablation capability and an adequate hemostatic effect (43,44). In routine clinical dental treatments, pain control is very important in order to maintain patients' physical and mental well-being and for therapy to be effective (24). However, there are very few studies comparing the postopera-

tive effects of laser and conventional techniques (24,45,46). However, reduced postoperative pain from oral surgical procedures has been claimed after laser tissue ablation (24,45).

In our study, patients in group II often experienced pain and discomfort at the beginning of treatment that was reduced significantly after 5 days, while patients in group I reported immediate relief of pain and faster healing.

Some reports have suggested that patients perceive laser dental treatment to be better than conventional techniques in terms of postoperative pain and function (24,44,45), and laser palliation of oral ulcers has been well documented in the literature. Colvard & Kuo (18) showed that CO_2 laser treatment relieved pain on application of laser energy, while Convissar & Massoumi-Sourey (23) found the same results when using Nd:YAG lasers. Toida *et al*. (47) found that low-level laser therapy effectively shortened painful periods when it was used to control symptoms of stomatitis.

Conclusion

In conclusion, periodontal health is impaired by BD and associated with disease severity. Improvement of the periodontal health of BD patients may affect their disease course, leading to a better prognosis. We therefore suggest that maintenance of oral health by effective, regular tooth brushing and dental flossing, regular dental check-ups and dental procedures should also be considered as a part of the therapeutic spectrum of BD. Instructions for tooth brushing and dental flossing, the most effective methods of plaque control, must be given in the clinical evaluations of BD patients. Our results also suggest that the Nd:YAG laser has better patient acceptance, shorter treatment time and lower rates of pain and post-treatment adverse events among patients with RAS. More university-based controlled studies are needed to corroborate these results, but the future use of lasers in dentistry has exciting potential, and research should continue on this promising new tool.

Acknowledgements

The study was self-funded by us and our institution. The authors have no conflict of interests.

References

1. Jorizzo JZ. Behçet's disease. In: Freedberg IM, Eisen AZ, Wolf K, Auston KF, Goldsmith LA, Katz SI, Fitzpatrick TB, eds. *Dermatology in Medicine*, 5th edn. New York: McGraw Hill Company, 1999:2023–2033.
2. Sakane T, Suzuki N, Nagafuchi H. Etiopathology of Behçet's disease: immunological aspects. *Yonsei Med J* 1997;**38:** 350–358.
3. Er H, Evereklioglu C, Cumurcu T *et al*. Serum homocysteine level is increased and correlated with endothelin-1 and nitric oxide in Behçet's disease. *Br J Ophthalmol* 2002;**86:**653–657.
4. Yapişlar H, Aydogan S, Borlu M, Ascioglu O. Decreased nitric oxide and increased platelet aggregation levels in patients with Behçet's disease. *Thromb Res* 2007;**119:**461–465.
5. Gül A. Behçet's disease: an update on the pathogenesis. *Clin Exp Rheumatol* 2001;**19:**6–12.
6. Lehner T. Oral ulceration and Behçet's syndrome. *Gut* 1977;**18:**491–511.
7. Mumcu G, Ergun T, Elbir Y *et al*. Clinical and immunological effects of azithromycin in Behçet's disease. *J Oral Pathol Med* 2005;**34:**13–16.
8. Akman A, Kacaroglu H, Donmez L, Bacanli A, Alpsoy E. Relationship between periodontal findings and Behçet's disease: a controlled study. *J Clin Periodontol* 2007;**34:**485–491.
9. Azizlerli G, Kose AA, Sarica R *et al*. Prevalence of Behçet's disease in Istanbul, Turkey. *Int J Dermatol* 2003;**42:**803–806.
10. Lehner T. The role of heat shock protein, microbial and autoimmune agents in the aetiology of Behçet's disease. *Int Rev Immunol* 1997;**14:**21–32.
11. Mumcu G, Ergun T, Inanc N *et al*. Oral health is impaired in Behçet's disease and is associated with disease severity. *Rheumatology* 2004;**43:**1028–1033.
12. Kaneko F, Oyama N, Nishibu A. Streptococcal infection in the pathogenesis of Behçet's disease and clinical effects of minocycline on the disease symptoms. *Yonsei Med J* 1997;**38:**444–454.
13. Mizushima Y, Matsuda T, Hoshi K, Ohno S. Induction of Behçet's disease symptoms after dental treatment and streptococcal antigen skin test. *J Rheumatol* 1998;**15:** 1029–1030.
14. Nakae K, Agata T, Maeda K, Masuda K, Hashimoto T, Inaba G. *Behçet's Disease, Pathogenic Mechanism and Clinical Future: Case Control Studies on Behçet's Disease*, 1st edn. Tokyo: University of Tokyo Press, 1981: 41–49.
15. Çelenligil-Nazliel H, Kansu E, Ebersole JL. Periodontal findings and systemic antibody responses to oral microorganisms in Behçet's disease. *J Periodontol* 1999;**70:**1449–1456.
16. Al-Otaibi LM, Porter SR, Poate TW. Behçet's disease: a review. *J Dent Res* 2005;**84:**209–222.
17. Barrons RW. Treatment strategies for recurrent oral aphthous ulcers. *Am J Health Syst Pharm* 2001;**58:**41–50.
18. Colvard M, Kuo P. Managing aphthous ulcers: laser treatment applied. *J Am Dent Assoc* 1991;**122:**51–53.
19. Cicek Y, Canakci V, Ozgoz M, Ertas U, Canakci E. Prevalance and handedness correlates of recurrent aphthous stomatitis in the Turkish population. *J Public Health Dent* 2004;**64:**151–156.
20. Porter SR, Hegarty A, Kaliakatsou F, Hodqson TA, Scully C. Recurrent aphthous stomatitis. *Clin Dermatol* 2000;**18:** 569–578.
21. Porter S, Scully C. Aphthous ulcers (recurrent). *Clin Evid* 2005;**13:**1687–1694.
22. Orbak R, Cicek Y, Tezel A. Effects of zinc treatment in patients with recurrent aphthous stomatitis. *Dent Mater* 2003;**22:**21–29.
23. Convissar RA, Massoumi-Sourey M. Recurrent aphthous ulcers: etiology and laser ablation. *Gen Dent* 1992;**40:**512–515.
24. Kara C. Evaluation of frenectomy operations on patient perceptions: a comparison of Nd:YAG laser and conventional techniques. *Photomed Laser Surg* 2008;**26:**147–152.
25. Wigdor HA, Walsh JT Jr, Featherstone JD, Visuri SR, Fried D, Waldvogel JL. Lasers in dentistry. *Lasers Surg Med* 1995;**16:**103–133.
26. White JM, Goodis HE, Rose CL. Use of the pulsed Nd:YAG laser for intraoral soft tissue surgery. *Lasers Surg Med* 1991;**11:**455–461.
27. Tagomori S, Morioka T. Combined effects of laser and fluoride on acid resistance of human dental enamel. *Caries Res* 1989;**23:**225–231.
28. Stabholz A, Khayat A, Ravanshad SH, McCarthy DW, Neev J, Torabinejad M. Effects of Nd:YAG laser on apical seal of teeth after apicoectomy and retrafill. *J Endod* 1992;**18:**371–375.
29. Ito K, Nishikata J, Murai S. Effects of Nd:YAG laser radiation on removal of a root surface smear layer after root planning: a scanning electron microscopic study. *J Periodontol* 1993;**64:**547–552.
30. Krause I, Mader R, Sulkes J *et al*. Behçet's disease in Israel: the influence of ethnic

origin on disease expression and severity. *J Rheumatol* 2001;**28:**1033–1036.
31. Liu J, Zeng X, Chen Q *et al*. An evaluation on the efficacy and safety of amlexanox oral adhesive tablets in the treatment of recurrent minor aphthous ulceration in a Chinese cohort: a randomized, double-blind, vehicle-controlled, unparallel multicenter clinical trial. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;**102:**475–481.
32. Mumcu G, Inanc N, Ergun T *et al*. Oral health related quality of life is affected by disease activity in Behçet's disease. *Oral Dis* 2006;**12:**145–151.
33. Arabaci T, Cicek Y, Ozgöz M, Canakçi V, Canakçi CF, Eltas A. The comparison of the effects of three types of piezoelectric ultrasonic tips and air polishing system on the filling materials: an *in vitro* study. *Int J Dent Hyg* 2007;**5:**205–210.
34. Arabaci T, Çiçek Y, Çanakçı CF. Sonic and ultrasonic scalers in periodontal treatment: a review. *Int J Dent Hyg* 2007;**5:**2–12.
35. Mumcu G, Hayran O, Ozalp DO *et al*. The assessment of oral health-related quality of life by factor analysis in patients with Behçet's disease and recurrent aphthous stomatitis. *J Oral Pathol Med* 2007; **36:**147–152.
36. Jurge S, Kuffer R, Scully C, Porter SR. Mucosal disease series. Number VI. Recurrent aphthous stomatitis. *Oral Dis* 2006;**12:**1–21.
37. Hornstein OP. Aphthae and aphthous lesions of the mouth mucosa [Article in German]. *HNO* 1998;**46:**102–111.
38. Miles DA, Bricker SL, Razmus TF, Potter RH. Triamcinolone acetonide versus chlorhexidine for treatment of recurrent stomatitis. *Oral Surg Oral Med Oral Pathol* 1993;**75:**397–402.
39. Siegel MA. Strategies for management of commonly encountered oral mucosal disorders. *J Calif Dent Assoc* 1999;**27:**210–219.
40. Femiano F, Gombos F, Scully C. Recurrent aphthous stomatitis unresponsive to topical corticosteroids: a study of the comparative therapeutic effects of systemic prednisone and systemic sulodexide. *Int J Dermatol* 2003;**42:**394–397.
41. Kerr AR, Drexel CA, Spielman AI. The efficacy and safety of 50 mg penicillin G potassium troches for recurrent aphthous ulcers. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;**96:**685–694.
42. Natah SS, Konttinen YT, Enattah NS, Ashammakhi N, Sharkey KA, Hayrinen-Immonen R. Recurrent aphthous ulcers today: a review of the growing knowledge. *Int J Oral Maxillofac Surg* 2004;**33:**221–234.
43. Pick RM, Colvard MD. Current status of lasers in soft tissue dental surgery. *J Periodontol* 1993;**64:**589–602.
44. Kara C, Demir T, Orbak R, Tezel A. Effect of Nd: YAG laser irradiation on the treatment of oral malodour associated with chronic periodontitis. *Int Dent J* 2008;**58:**151–158.
45. Abt E. CO_2 laser treatment for gingivectomies reduces hemorrhaging, post-op pain. *Clin Laser Mon* 1992;**10:**8–12.
46. Gaspar L, Szabo G. Manifestations of the disadvantages of using the CO_2 laser in oral surgery. *J Clin Laser Med Surg* 1990;**8:**39–43.
47. Toida M, Watanabe F, Goto K, Shibata S. Usefulness of low-level laser for control of painful stomatitis in patients with hand-foot-and-mouth disease. *J Clin Laser Med Surg* 2003;**21:**363–367.