Gingival overgrowth approached using recent mechanical and laser technologies: A case report

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Abstract. Gingival enlargement is a side effect of different drug classes, with calcium channel blockers being among the most often cited examples. Most often accompanied by a disruption in the oral biofilm, this form of gingival overgrowth, with histological signs of hyperplasia and hypertrophy, becomes a chronic inflammatory condition with the oral biofilm a primary cause. This periodontal disease is now classified as 'dental biofilm-induced gingivitis', and its preferred name is drug-influenced gingival expansion. The present study presented the case of a patient with gingival enlargement while being treated with nifedipine for cardiac disease. This patient had factors that contributed to the retention of bacteria, ranging from poor oral hygiene practices to poorly adapted prosthodontics. After reducing these factors, a multimodal treatment was conducted, including bacterial mechanical decontamination through guided biofilm therapy protocol, laser bacterial decontamination, and surgical laser gingivectomy. The patient was referred to their cardiologist for substituting the calcium channel blocker medication. Clinical evaluations followed each treatment step. At 12 months, the patient presented positive, stable results, with an improvement in gingival status (no gingival overgrowth in the area where all risk factors were eliminated and minimal overgrowth in the area where old poorly marginally adapted prosthodontics were kept in place and no/minimal signs of gingival inflammation).

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Introduction

It is well known and proven by a number of studies over the last 60 years, that the primary etiologic factor in periodontal disease is the oral bacterial plaque (1-4). Other factors such as smoking, diabetes, vicious habits (bruxism and occlusal trauma), dentoalveolar incongruity, including some drugs such as antiepileptic and some antihypertensive (as calcium channel blockers) medication are considered as additional risk factors, some with higher pathological influence than others.

The physio-pathological mechanism of calcium channel blockers-influenced gingival overgrowth involves an association between the decrease in the catabolic events (derived from decreasing of cation influx and folic acid transport within the fibroblasts in the gingiva) and the increase in the anabolic events in the gingiva (triggered by increased synthesis of keratinocyte growth factor by fibroblasts and decreased aldosterone), which end up in the accumulation of collagen and ground substance (4,5). However, no matter which one of these proposed mechanisms is considered, all studies show direct involvement of the dental plaque, as a *sine qua non* factor, in the process (4,5). The inflammatory and non-inflammatory mechanisms underlying this type of drug-influenced gingival growth impede different stages of the disease.

In these patients, there is also a vicious circle effect: The gingival overgrowth promotes dental plaque retention on increased gingival surfaces, and concurrently, the development of false periodontal pockets provide favorable conditions for the formation of the higher pathogenic anaerobic flora (6). Of course, the poorly marginally adapted prosthodontics play also an important role in excessive plaque retention and act as irritating spikes for the already inflamed gingiva.

In the great majority of these patients, other favoring factors coexist, thus creating the full picture of a true periodontal disease: Smoking, diabetes, and, most important and most often, the poor home management of dental hygiene.

Consequently, the treatment of these patients should begin with the thorough removal of the bacterial plaque and the favorable factors that can be removed (re-education of the patient about oral hygiene and removal of fixed prosthetic works or marginally unsuited restorations).

Figure 1. Day 0. Clinical aspect of the gingival overgrowth

Figure 4. Laser (450 nm) gingivectomy second quadrant.

Figure 2. First week: Laser decontamination and guided biofilm therapy protocol decontamination, ablation of old fixed prosthodontics with poor marginal adaptation.

Figure 5. Sixth week: 3 weeks after laser (980-nm continuous wave) gingivectomy second quadrant.

Figure 6. Sixth week: Laser gingivectomy first and fourth quadrants.

Figure 3. Three weeks after laser decontamination: Deep cleaning (air-flow supra and sub gingival, deep scaling and root planing) in accordance to guided biofilm therapy protocol.

At present, there are new generation methods, more efficient and less invasive, available both for bacterial decontamination and surgical excision part: For decontamination there is mechanical decontamination according to the guided biofilm therapy (GBT) protocol (7,8) (including patient re-education/motivation) and laser decontamination; laser-assisted nonsurgical periodontal pocket therapy at 980 nm (9-14). For the surgical excision of the overgrown gingiva, the use of a 450-nm laser is the most efficient and least invasive method (minimum tissue necrosis in depth) (15-17), with the fastest and most comfortable healing for the patient and with the lowest recurrence rate (18-25).

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
GBT	G											G												G												G												G	
LAPT	L	L	L									L	L											L	L											L	L											L	L
LS			S1			S2																																											

GBT: Guided Biofilm Therapy® protocol, which includes patient evaluation, motivational talk including re-education of at-home oral biofilm management and through mechanical biofilm decontamination, supra and sub-gingival thru Airflow®-ing and ultrasound scaling.

LAPT (Laser-Assisted Periodontal Therapy): Gingival sulcus and periodontal pocket decontamination using 980 nm laser, as described in manuscript.

LS (Laser Surgery): Gingivectomy using soft tissue surgical laser 450 nm, as described in manuscript.

S1: Gingivectomy, 2nd Quadrant

S2: Gingivectomy, 1st and 4th Quadrant

* Long term recommendation: every 3 months recall for GBT and two sessions of LAPT (seven days apart)

Figure 7. Treatment plan chart for 1 year.

Figure 8. At the 48th week: 12 months stabile results with moderate recurrence of inflamed, hyperplasic gingiva in the areas where the old prosthodontics were not removed/corrected, no recurrence in the area with no dental prosthodontic work/corrected prosthodontics.

Case report

Patient. Regarding the clinical case presented below, a patient was chosen with gingival hyperplasia influenced by calcium channel blockers, with no other risk factors except higher plaque retention caused by fixed prosthodontics with poor marginal adaptation and the inconsistent oral hygiene technique of the patient.

A 71-year-old male, non-smoking, non-alcoholic, with a medical history of atrial fibrillation, angina pectoralis and high blood pressure, under treatment with nifedipine 40 mg per day, for the last 6 months, attended the dental office complaining of pain, bleeding when touched and during mastication, and aesthetically disturbing overgrowth gingiva.

Prior to enrollment, the patient signed the written informed consent and the study was conducted in accordance with the principles of the Declaration of Helsinki. The ethical committee of the Titu Maiorescu University of Bucharest approved the research (approval no. 23/2023).

At the initial intraoral examination (Fig. 1), gingival overgrowth, inflammation, and bleeding lesions were present, surrounding all teeth, accentuated on the buccal side and in the gingiva in contact with old prosthodontics.

Prior to beginning of any treatment, anamnesis, clinical and para-clinical examinations (blood tests, radiological examination and histopathological examination) any tumoral etiology of the gingival growth, as well as other diseases in patient personal medical history that might lead to or represent other risk factors for the periodontal disease were excluded.

Following discussion with the attending cardiologist, the calcium channel blockers medication was substituted with another class of antihypertensive drugs. The treatment involved the thorough removal of the bacterial plaque, as described below, and the removal of risk factors that could be removed: Re-education of the patient concerning oral hygiene (also as a part of the GBT protocol) and removal of fixed prosthetic works and marginally unsuitable restorations.

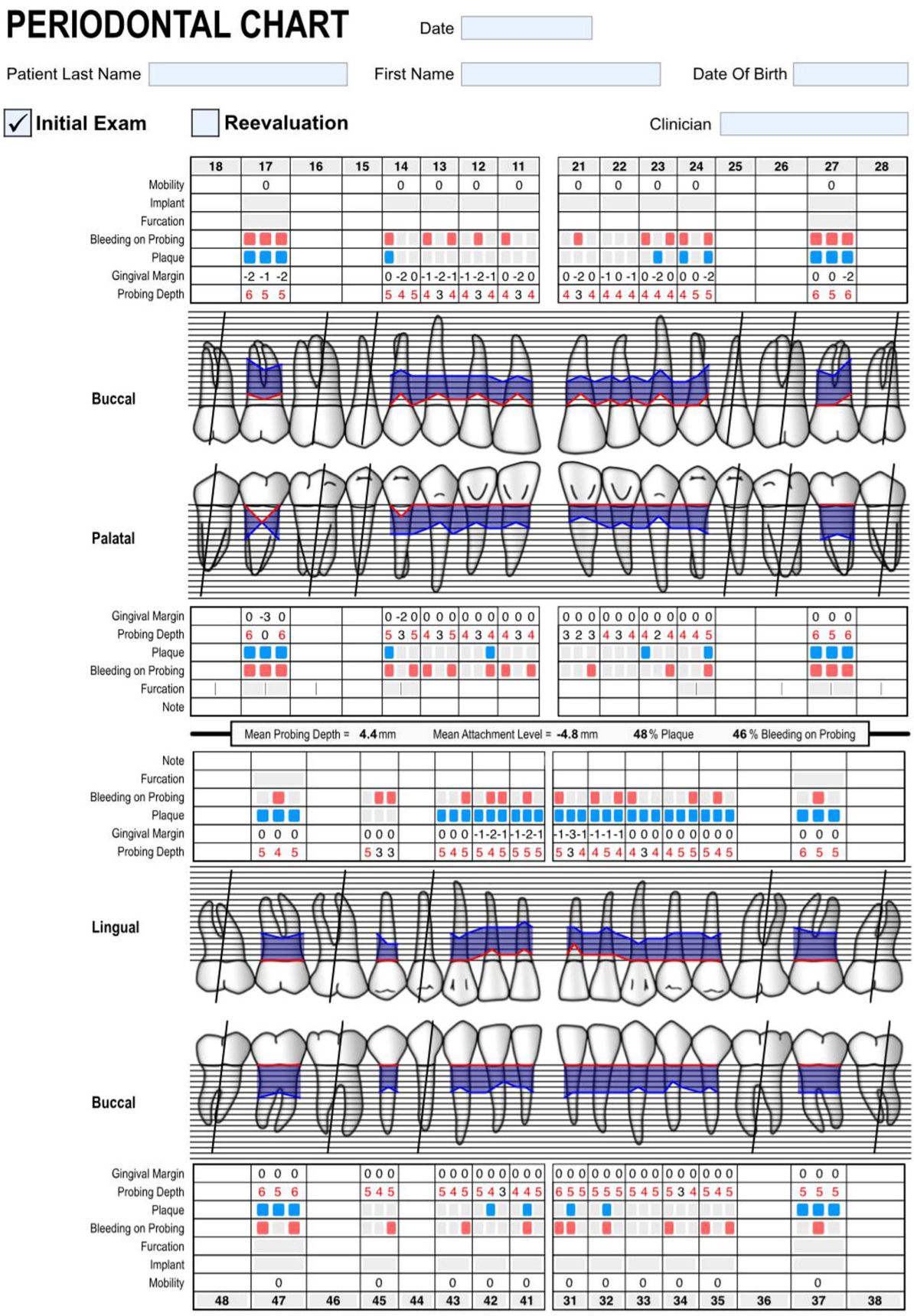

Figure 9. Periodontal chart: Initial examination.

Periodontal treatment. The treatment itself was multimodal and involved two stages.

First stage: The thorough mechanical removal of bacterial plaque using the GBT protocol (7,8). The procedure involved

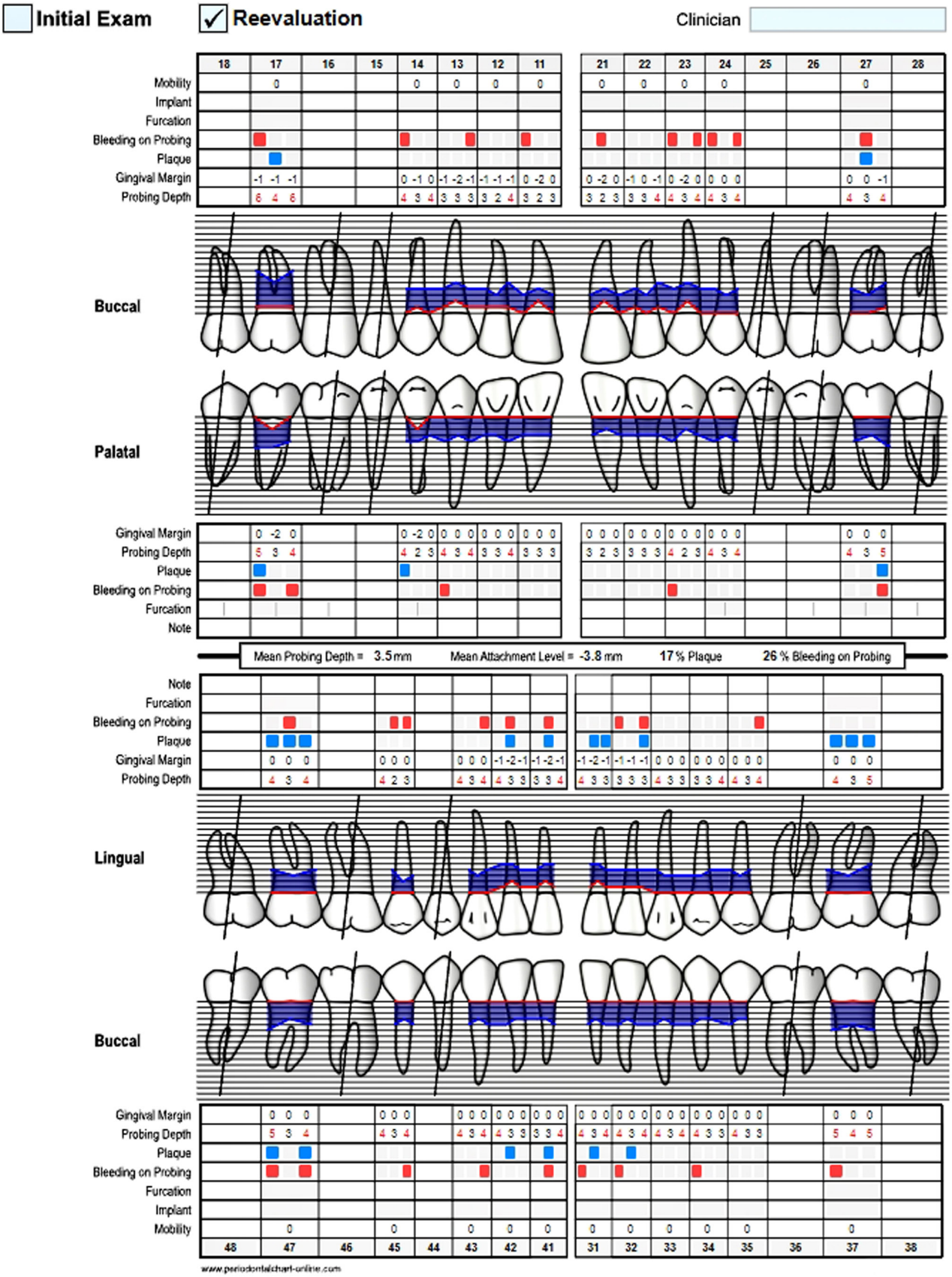

Figure 10. Periodontal chart: Reexamination at 6 months.

the following in-clinic procedures: Air-flow, deep scaling and root decontamination in four quadrants according to GBT, associated with 980-nm diode laser decontamination and laser-assisted nonsurgical periodontal pocket therapy, following the recommendations of several authors (11-14) (Figs. 2 and 3) followed by the at-home correction of oral

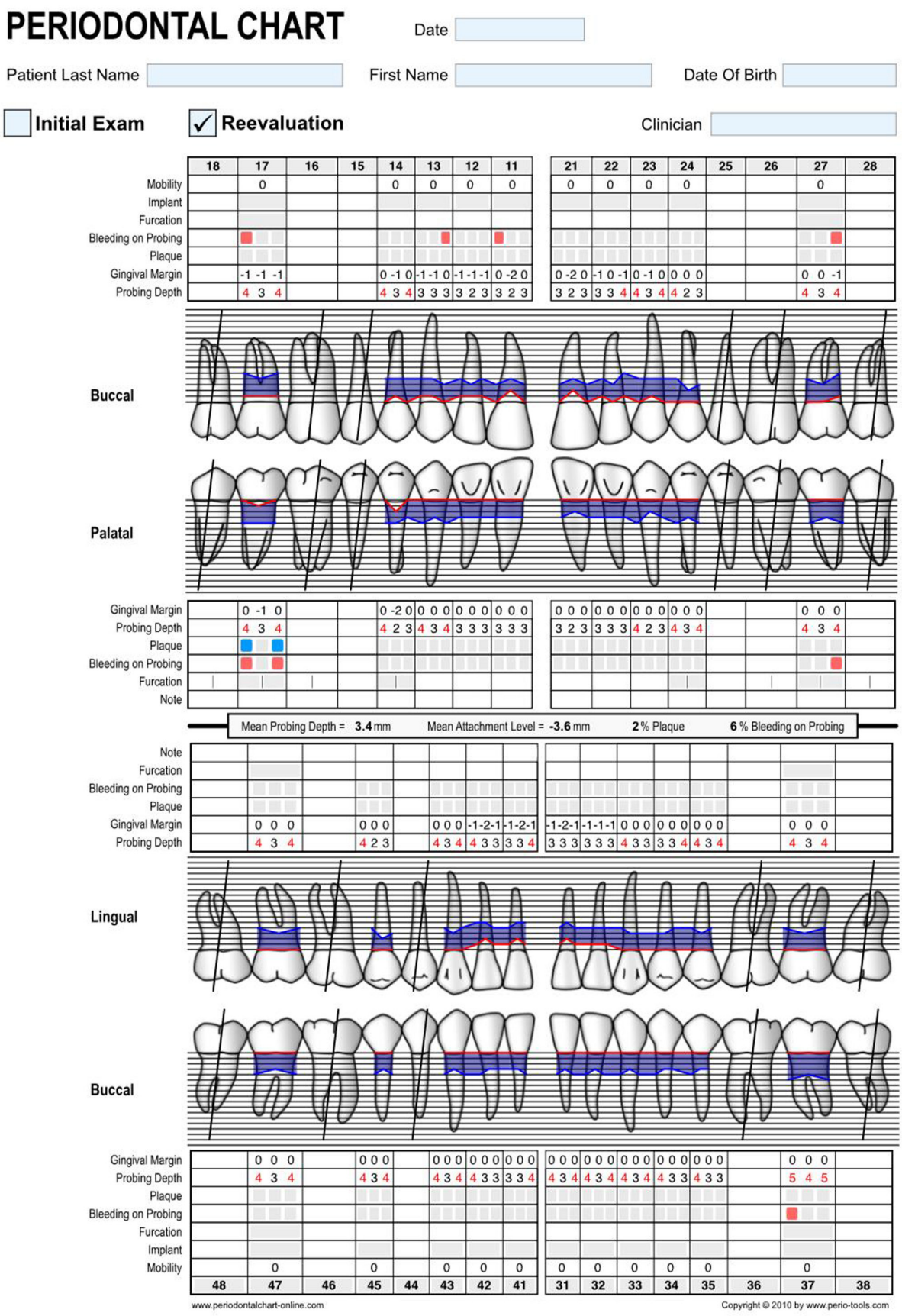

Figure 11. Periodontal chart: Reexamination at 12 months.

hygiene and a two weeks period of use of chlorhexidine gluconate (0.12%) mouthwash

In this case, the protocol for laser decontamination included the use of a 980-nm continuous wave (CW)

0.9 watts power laser. The device used was a medical diode laser (PIOON S3) manufactured by Wuhan Pioon Technology Co, Ltd. The procedure involved inserting a 300 um diameter fiber with a non-activated tip 1 mm coronary from the gingival insertion and performing sweeping, inward-outward movements parallel to the tooth axis in contact with the sulcular epithelium and the root for no longer than 20 sec per site (periodontal pocket). This protocol involved all gingival sulcus and periodontal pockets and was performed three times in one month (day 1, 1 week later and 3 weeks from day 1).

Second stage. The second stage was the surgical one to remove gingival hyperplasia. In the case of patients with gingival overgrowth influenced by calcium channel blockers, the hyperplasia is always associated with inflammation, vasculopathy and coagulation problems (some induced even by the associated medication) which leads to significant gingival bleeding, especially when an attempt is made to excise hyperplasia through a classic surgical technique with the bistoury (19,24). This is why an excision was needed that involved, at the same time, hemostasis. Between a classic excision technique with electrocautery hemostasis and the laser excision technique, the latter was chosen due to the effects of laser excision: A smaller area of intra-tissue necrosis, less pain and inflammation post-excision and lower risk of recurrence. Among the wavelengths generally used for surgery, the 450-nm laser was chosen, rather than the 980-nm laser, due to the smaller area of carbonization of the cut tissues, as well as the speed of the technique, as recommended by other authors (15-17,24).

For the working protocol, surgical excision of gingival hyperplasia was performed under local anesthesia, using the 450-nm diode laser, with 400 um fiber diameter with the following protocol: 1.5 W CW, activated fiber tip with contact or without contact, non-activated fiber tip at 1 mm distance from tissue; metronidazole 5 g/l solution wash, tetracycline-metronidazole gingival ointment application (Fig. 4).

The clinical aspect after performing laser decontamination and GBT decontamination protocol is presented in Fig. 5. The clinical outcomes after treatment in the 1st and 4th quadrants are presented in Fig. 6. The patient was instructed to use local mouthwash and application of gel containing 0.2% chlorhexidine.

The treatment plan included recall for bacterial decontamination using GBT protocol and laser decontamination and biostimulation (two sessions 1 week apart) every 3 months. The treatment plan chart is presented in Fig. 7.

The clinical aspect after 1 year (48 weeks) is presented in Fig. 8. The remission of gingival expansion was noted, with the gingiva displaying a pink color, firm consistency, uniform borders and a healthy-looking appearance.

The periodontal chart of the patient is presented in Fig. 9, initially and after 6-month and 1-year re-evaluations (Figs. 10 and 11). The model of periodontal chart used was provided by (26).

Discussion

The first literature mention on the gingival overgrowth induced by calcium channel blockers dates from 1984 when Ramon *et al* (27) reported a case series of five cases. The main risk factors for the extent and severity of this disease are the drug variable, such as plasma concentration of nifedipine, concomitant medication and the periodontal status (presence of gingival inflammation and/or plaque) (28). The mechanism of drug segregation in the gingiva remains to be elucidated (29). A review article analyzed 293 publications of case reports and case series and found no significant differences in the severity of lesions with different doses (27). The treatment modalities vary for each case and include changes of drug and improved oral hygiene (30). In addition, the diode laser at the wavelength of 445 nm blue light showed improvement in a case-report on gingival growth due to amlodipine intake (31).

The patient reported in the present article, diagnosed with gingival overgrowth induced by nifedipine, was referred to his cardiologist for analyzing the possibility of changing the antihypertensive treatment. The thorough removal of bacterial plaque in the dental clinic and a correct hygiene protocol at home are essential in the positive evolution of all periodontal diseases, including calcium channel blockers-influenced gingival enlargement.

The removal of factors favoring the retention of bacterial plaque (prosthetic works or marginally unfitted fillings) plays an essential role. Using the laser for bacterial decontamination is a valuable aid.

In the case of excision of gingival hyperplasia induced by calcium channel blockers, the use of the 450-nm laser is the least invasive method (minimum tissue necrosis in depth), with the fastest and most comfortable healing for the patient and the lowest recurrence rate.

The current report case limitations arise from the lack of ability to broadly apply the findings and the decision to publish a case with positive outcomes without balancing it with an unsuccessful one.

The dentist, the periodontologist and the patient all play important roles in gingival health. The clinical approach of the presented case included mechanical decontamination according to (GBT) protocol, laser decontamination (laser-assisted nonsurgical periodontal pocket therapy) and 980-nm and 450-nm laser surgical excision. At 12 months there were positive, stable results, with an improvement in gingival status (no gingival overgrowth in the area where all risk factors were eliminated and minimal overgrowth in the area where old poorly marginally adapted prosthodontics were kept in place and no/minimal signs of gingival inflammation).

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

Conceptualization was by LM and IP. Methodology was by AC and AB. Resources were the responsibility of AC and AB. Data curation was by IP. LM and AC confirm the authenticity of all the raw data. Writing of the original draft was by LM. Writing, review and editing were performed by LM, AB and AC. Visualization was performed by IP. Supervision and project administration were by LM. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The present study was approved by the Ethical Committee of the Titu Maiorescu University of Bucharest (approval no. 23/2023).

Patient consent for publication

Written informed consent was obtained from the patient.

Competing interests

The authors declare that they have no competing interests.

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