

Influence of Professional Teeth Whitening on Oral Hygiene: Long-term Results

Natalia Vlasova¹, Vadim Samusenkov², Irina Novikova¹, Denis Nikolenko², Nikita Nikolashvili², Marina Knyazeva¹

¹Department of Therapeutic Dentistry, ²Prosthetic Dentistry, I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russian Federation

Received : 03-03-21
Revised : 24-03-21
Accepted : 26-04-21
Published : 30-07-21

ABSTRACT

Aims: The aim of this article is to estimate the long-term influence of professional dental bleaching on quality of oral hygiene (year after procedure). **Materials and Methods:** A randomized controlled prospective clinical repeated study was carried out 6 months after the previous one, i.e., 1 year after the oral hygiene procedure, among 60 patients divided into two groups. In the first group, professional oral hygiene and bleaching using 25% hydrogen peroxide were performed. In the second group only, oral hygiene was performed. Dynamics of hygienic index of Quigley-Hein modified by S. Turesky was estimated. **Results:** In the first group, the average value of the hygienic index of Quigley-Hein modified by S. Turesky was significantly lower a year after procedure than before (1.33 ± 0.09 and 2.34 ± 0.14 , respectively). In the second group, this index exceeded 2.45 and nearly returned to the initiated level (2.45 ± 0.07 and 2.44 ± 0.08 , respectively). Patients underwent professional teeth whitening in the long-term period, and the level of oral hygiene was significantly higher than that in the control group. **Conclusion:** Professional dental bleaching has good long-term influence on the level of oral hygiene and serves as a significant motivation factor for maintaining health of oral cavity.

KEYWORDS: Oral hygiene index, professional bleaching, professional oral hygiene

INTRODUCTION

Oral hygiene is essential for health of oral cavity; also it is the most important condition of efficiency of treatment and prophylaxis of dental diseases. Level of individual oral hygiene first of all depends on motivation to maintain gained result and also on the level of knowledge of dental care and psycho-motor skills of every patient.^[1] Motivation level is sufficiently influenced by social state, psycho-emotional status, gender, and patient age.^[2] Wish of having beautiful smile is also one of the motivations for maintaining oral health.^[3]

Today, patients are giving much attention to teeth color, so dental bleaching is one of the popular dental procedures.^[4-6] According to several studies, correction of esthetic smile properties has good influence on psycho-emotional state and helps to improve life quality

of patients.^[7-9] Several scientific researches show good influence of dental bleaching on individual oral hygiene right after the procedure and in the period of use of individual home bleaching kits.^[10] But, estimation of long-term effects is quite rarely depicted.

Possible influence of dental bleaching on the level of individual oral hygiene is associated with changes of plaque formation due to enamel surface modification after the influence of bleaching agent. Also, it may be associated with direct influence of bleaching agent on microorganisms and stimulation of patients' motivation in maintaining high level of individual oral hygiene.^[10]

Address for correspondence: Dr Natalia Vlasova, I.M. Sechenov First Moscow State Medical University (Sechenov University), Trubetskaya Str., 8/2, Moscow 119991, Russian Federation.
E-mail: vlasovanata7@rambler.ru

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Vlasova N, Samusenkov V, Novikova I, Nikolenko D, Nikolashvili N, Knyazeva M. Influence of professional teeth whitening on oral hygiene: Long-term results. J Int Soc Prevent Communit Dent 2021;11:408-13.

Access this article online

Quick Response Code:



Website: www.jispcd.org

DOI: 10.4103/jispcd.JISPCD_71_21

In the previous study, we have already estimated the influence of dental bleaching on oral hygiene 2 weeks, 1 month, and 6 months after the procedure.^[11] This research serves as a continuation of the previous one and demonstrates long-term interaction between dental bleaching and oral hygiene 1 year after the procedure. The purpose of our study is to estimate the influence of dental bleaching on the level of individual oral hygiene the year after the procedure.

MATERIALS AND METHODS

At the base of Department of Therapeutic Dentistry of First Moscow State Medical University of I.M. Sechenov (Sechenov University), a randomized controlled prospective clinical study was reperformed. It was performed in the group of 60 patients with diagnosis “Change of color of dental crown” (code of MCB-10), who had already taken part in previous equal study.^[11]

Inclusion criteria were: age 21–40 and teeth discoloritis. Non-inclusion criteria were: severe general pathologies (diabetes, neuropsychiatric, and oncological diseases), partial secondary adentia, numerous caries lesions, acute periodontal pathology, prosthetic constructions, sufficient enamel loss resulted from pathological or physiological abrasion, enamel erosions, orthodontics treatment, smoking, pregnancy and lactation, and allergy on used medicines and materials.

Patients, who agreed to take part in the research, were divided into two groups of 30 members each using a simple randomization method, as shown in the previous study.^[11] In the second study, the groups were retained and all patients remained under the study.

All patients answered the questionnaire about methods and means of individual oral hygiene once more. In the first group (estimation group), professional oral hygiene and professional dental bleaching were performed 1 year ago using the clinical bleaching system Philips ZOOM! White Speed based on 25% hydrogen peroxide, LED lamp with cold diode origin with function of individual power control, which fully helps to avoid tooth and periodontal tissue overheating. Such lamp does not affect dentin. Another specific property of this system is alkaline gel pH (pH 7.5–8.5) and the presence of amorphous calcium phosphate, reducing post-bleaching teeth hypersensitivity. According to the producer recommendation, this system may be used in the group of patients with teeth hypersensitivity. Dental bleaching system Philips ZOOM! White Speed was used according to the Philips ZOOM! WhiteSpeed recommended company protocol.

The second group (control) contained patients who had undergone professional only oral hygiene at the same time.

All patients were performed professional hygiene and educated to use the Bass method of individual dental hygiene; also they were recommended to use soft toothbrushes and toothpaste with abrasion not more than 70 RDA.^[12,13] Estimation of level of oral hygiene was performed with the index of Quigley-Hein modified by S. Turesky.^[14] Vestibular and oral surfaces were colored with solution for indication of dental plaque CURAPROX PCA 260. Plaque value was estimated by the following criteria: 0—plaque absence; 1—a few plaque spots in the cervical region; 2—thin line of plaque in the cervical area (less than 1 mm); 3—line of plaque in the cervical region wider than 1 mm, covering less than 1/3 of the dental crown; 4—plaque covers more than 1/3, but less than 2/3 of the dental crown; 5—plaque covers 2/3 of the dental crown or more.

Estimation of oral hygiene was performed at the first visit, after professional oral hygiene, after 2 weeks, 1 month, 6 months, and 1 year after the procedure. In every case, hygienic index was calculated for all teeth (28 teeth, 56 surfaces), and separately for teeth that underwent professional bleaching (20 teeth, 40 surfaces), and molars (8 teeth, 16 surfaces).

All patients answered 12 questions of the questionnaire developed by the authors one more time on methods and means of individual oral hygiene. The questions in the questionnaire related to the frequency, time, and method of brushing teeth, oral hygiene products used, bleeding gums when brushing teeth, the frequency of consuming coloring food (tea, coffee, etc.), smoking, patient assessment of the state of the oral cavity, compliance with the dentist’s recommendations to improve hygiene oral cavity.

Statistical analysis of gained data was made using SPSS (USA). For data comparison, we used analysis of variance test and *t*-criteria. Result differences were declared to be statistically true on the level of statistical importance $p < 0.05$.

RESULTS

Results of estimation of hygienic index are given in Table 1 and Figure 1. As we may see from Table 1, hygienic index in both groups before the study may be characterized as satisfactory; also there are no statistically significant differences between groups. Besides, we should note that this index is significantly lower at the teeth in esthetically significant area than on molars.

Table 1: Dynamics of hygienic index Quigley-Hein in Turesky modification ($M \pm m$)

| | Before treatment | 2 weeks after treatment | 1 month after treatment | 6 months after treatment | 1 year after treatment |
|------------------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|
| Group No. 1 | | | | | |
| Incisors, canines, premolars | 2.05±0.16 | 0.59±0.11* | 0.84±0.18* | 0.89±0.201* | 0.97±0.17* |
| Molars | 3.044±0.25 | 1.426±0.17* | 1.746±0.28* | 2.08±0.17* | 2.24±0.21* |
| Average index | 2.34±0.143 | 0.84±0.11* | 1.088±0.212* | 1.244±0.11* | 1.33±0.09* |
| Group No. 2 | | | | | |
| Incisors, canines, premolars | 2.2±0.164 | 0.73±0.17* | 1.166±0.080* | 1.86±0.161 | 2.2±0.18 |
| Molars | 3.076±0.29 | 1.886±0.802* | 1.98±0.23* | 2.46±0.175 | 3.06±0.38 |
| Average index | 2.44±0.084 | 0.934±0.13* | 1.408±0.09* | 2.052±0.063 | 2.45±0.07 |

* $p < 0.05$

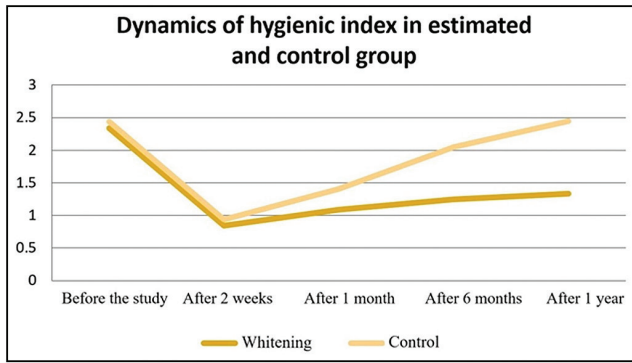


Figure 1: Dynamics of hygienic index in the estimated and control groups

After 2 weeks, hygienic index in the first group was characterized as good (it was not higher than 1). In the second group, the index level also improved to 0.934 ± 0.13 after professional oral hygiene and education in individual oral hygiene; therefore, good levels of oral hygiene were maintained, but the average index level was slightly higher than that in the first group. As in the beginning of our study, average index of esthetically significant area was significantly lower than that in the molar region. Six months after the procedure, average hygienic index in the first group stayed significantly lower than that before treatment (1.244 ± 0.11 and 2.34 ± 0.143 , $p < 0.05$). In the second group, the treatment index after 6 months became higher than 2.0 and nearly returned to the initial level (2.052 ± 0.063 and 2.44 ± 0.084 , respectively).

Year after the procedure, we noted a gradual increase of average hygienic index in both groups, and also we noted permanent significant difference between the first and second groups. According to the repeated study, average hygienic index in Group No. 1 is significantly lower than that at the beginning of the research (1.33 ± 0.09 and 2.34 ± 0.14 , $p < 0.05$). In Group No. 2, a year after the beginning of the study, it became higher

than 2.45 and returned to initial meanings (2.45 ± 0.07 and 2.44 ± 0.08). In addition, the hygienic index of the front teeth in both groups remained significantly lower than that of the molars.

Questionnaire results showed that before the start of the study, 83.3% of the patients in the first group used additional oral hygiene products, and after bleaching, all patients (100%) began to use mouth rinses, floss, or interdental brushes. Moreover, patients began to use more than one additional personal hygiene product for the oral cavity, but several at once, for example, mouthwash and floss.

In the second group, only 80% of the patients constantly used additional oral hygiene products even after the procedure and dental hygiene training, which slightly exceeded the indicators before the study (77.4%).

The majority of the patients in the first group (94.2%) after the procedure began to brush their teeth more often and longer (twice a day in the morning and in the evening for more than 3 min). Besides, 80% of the patients in the first group limited consumption of coloring products (strong tea, coffee, fuzzy drinks). Such tendencies persisted in patients of this group even 1 year after the bleaching procedure.

In the second group, this tendency was weaker, so only 72.2% brushed their teeth two times a day, in 28.6%, the brushing time did not exceed 3 min. Some patients sometimes forgot to brush their teeth altogether and made up for it with chewing gum, mouthwash, or dental floss. Patients in this group had practically no limited consumption of coloring products.

At the same time, this group showed a decrease in the use of additional oral hygiene products in combination with a decrease in the time for individual oral hygiene 1 year after the procedure.

Thus, the patients of the first group were interested in maintaining the achieved teeth whitening result, which led to a higher oral hygiene index than the initial one, even a year after the procedure.

DISCUSSION

As a result of repeated randomized, controlled clinical study, we noted that the hygienic index stays significantly lower after professional dental bleaching than that in the control group (1.33 ± 0.09 vs. 2.45 ± 0.07). Even during the year after procedure, we noted strong motivation for saving achieved bleaching results.

It is known that enamel superficial demineralization after bleaching may cause surface roughness and intense plaque formation, respectively.^[15] But this effect more likely depends on pH of the used system than on bleaching agent concentration.^[16,17] In this case, Xu *et al.*^[18] noted that pH neutral or alkaline systems do not affect enamel. Ittaturut *et al.*^[19] also think that bleaching systems based on 35% and 25% hydrogen peroxide, on the contrary, decrease enamel surface roughness. Besides, negative effect of bleaching easily decreases due to saliva remineralization activity and use of remineralization therapy in case of professional dental bleaching.^[16]

Antibacterial activity of bleaching systems is proved by various clinical studies. Napimoga *et al.*^[20] proved efficiency of the bleaching system against *Streptococcus mutans*, *S. sobrinus*, *S. sanguinis*, and *Staphylococcus aureus* in the microbiological study. Zheng *et al.*^[21] showed short-term decrease of plaque accumulation and quantity of cariogenic microorganisms after use of bleaching systems based on hydrogen peroxide. In 2014, the same authors proved during laboratory study that antibacterial effect of bleaching systems may be presented for 3 weeks after the procedure, but after this time significant growth of amount of plaque was noted.^[22] Gursoy *et al.*^[23] obtained the same results during clinical trials. Patients were offered to avoid individual dental hygiene for 5 days after dental bleaching. Speed of plaque formation during the first 3 days was significantly lower at surfaces, where bleaching agent had been used, than that at intact ones. Five days after the procedure, speed of plaque accumulation significantly increased and plaque index was higher in the estimation group than that in the control one.

As far as we can see from the literature mentioned effects may be seen only for a short-term period. The only mechanism of maintaining good level of individual dental hygiene in the long-term period is patients' motivation to save achieved result. During the last

few years, many research works dedicated to patients' motivation to maintain health and hygiene of oral cavity have been written. The majority of them agree that external motivation is not always effective especially in cases of prophylaxis of periodontal pathology.^[24] That is why it is necessary to give much intention to so-called inner motivation—to search for factor which may specifically affect concrete patient.^[2,25,26] In such cases, esthetic education of the surrounding society is quite important, because wish to have beautiful smile forms motivation of improvement of oral hygiene and dental treatment.^[3,27]

We have found just a few publications dedicated to long-term influence of professional bleaching on individual oral hygiene. For example, Skorinova *et al.*^[28] in 2020 estimated results of home dental bleaching and found no significant differences in hygienic index in the estimated and control groups 6 months after the procedure. Fernández *et al.*^[29] were estimating psycho-emotional status of patients for 9 months after professional bleaching and, on the contrary, noted that bleaching had good influence on esthetic self-estimation of smile and motivated patients in maintaining health of oral cavity.

Good influence of dental bleaching on psycho-emotional status and patients' life quality was proved in many researches. Bersezio *et al.*^[9,30-32] noted this influence on life quality not only during short-time period after procedure, but also 2 years after it. But Meireles *et al.*^[8] add that teeth hyperesthesia may have a negative effect on everyday life of patients right after the procedure. Besides patient's satisfaction level, after-bleaching effects, first of all, depend on his/her individual and specific features.^[33,34]

CONCLUSION

Therefore, professional dental bleaching has a positive influence on the level of individual oral hygiene in connection with psycho-emotional status and esthetic self-estimation for quite a long time after the procedure. Wish to save achieved result for long time may become important factor of inner patients' motivation to maintain high level of oral hygiene for stable and long-lasting bleaching result.

ACKNOWLEDGEMENT

This work was supported by the “Russian Academic Excellence Project 5–100.”

FINANCIAL SUPPORT AND SPONSORSHIP

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest to disclose.

AUTHORS CONTRIBUTIONS

Data gathering and idea owner of this study: Natalia Vlasova. Study design: Vadim Samusenkov and Irina Novikova. Data gathering: Denis Nikolenko and Marina Knyazeva. Writing and submitting manuscript: Nikita Nikolashvili. Editing and approval of final draft: all authors.

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

All the procedures have been performed as per the ethical guidelines laid down by Declaration of Helsinki (2019) to be mentioned.

PATIENT DECLARATION OF CONSENT

All patients agreed and signed a consent to participate in the experiment.

DATA AVAILABILITY STATEMENT

All data will be available on request.

REFERENCES

- Ramsay DS. Patient compliance with oral hygiene regimens: A behavioural self-regulation analysis with implications for technology. *Int Dent J* 2000;1:304-11. doi:10.1111/j.1875-595x.2000.tb00580.x
- Staunton L, Gellert P, Knittle K, Sniehotta FF. Perceived control and intrinsic vs. extrinsic motivation for oral self-care: A full factorial experimental test of theory-based persuasive messages. *Ann Behav Med* 2015;49:258-68.
- Walker K, Jackson R. The health belief model and determinants of oral hygiene practices and beliefs in preteen children: A pilot study. *Pediatr Dent* 2015;37:40-5.
- Carey CM. Tooth whitening: What we now know. *J Evid Based Dent Pract* 2014;14:70-6. doi:10.1016/j.jebdp.2014.02.006
- Martin J, Rivas V, Vildósola P, Moncada L, Oliveira Junior OB, Saad JR, *et al.* Personality style in patients looking for tooth bleaching and its correlation with treatment satisfaction. *Braz Dent J* 2016;27:60-5.
- Wilson NHF, Burke FJT, Brunton PA, Creanor S, Hosey MT, Mannocci F. Dental practice in the UK in 2015/2016. Part 2: Aspects of direct restorations, bleaching, endodontics and paediatric dentistry. *Br Dent J* 2019;226:110-4. doi:10.1038/sj.bdj.2019.50
- Klages U, Claus N, Wehrbein H, Zentner A. Development of a questionnaire for assessment of the psychosocial impact of dental aesthetics in young adults. *Eur J Orthod* 2006;28:103-11.
- Meireles SS, Goettens ML, Dantas RV, Bona AD, Santos IS, Demarco FF. Changes in oral health related quality of life after dental bleaching in a double-blind randomized clinical trial. *J Dent* 2014;42:114-21.
- Bersezio C, Martín J, Mayer C, Rivera O, Estay J, Vernal R, *et al.* Quality of life and stability of tooth color change at three months after dental bleaching. *Qual Life Res* 2018;27:3199-207.
- Sanz-Sánchez I, Oteo-Calatayud J, Serrano J, Martín C, Herrera D. Changes in plaque and gingivitis levels after tooth bleaching: A systematic review. *Int J Dent Hyg* 2019;17:117-29.
- Vlasova NN, Turkina AY, Prokhorov NI, Makeeva MK, Danilina AA, Nikolashvili NI. Effect of professional bleaching on the hygiene of the oral cavity: A randomized controlled study. *Hyg Sanitation* 2019;98:550-4. doi:10.18821/0016-9900-2019-98-5-550-554
- Babina KS. Index assessment of the effectiveness of various means and methods of individual oral hygiene A. Author's abstract of the dissertation, Moscow: PMGMU named after IM Sechenov; 2014.
- Borovskij EV, Makeeva IM, Babina KS. The choice of the method of index assessment of the hygienic state of the oral cavity. *Sechenovskiy Vestnik* 2013;11:10-14.
- Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of vitamin C. *J Periodontol* 1970;41:41-3. doi:10.1902/jop.1970.41.41.41
- Potocnik I, Kosec L, Gaspersic D. Effect of 10% carbamide peroxide bleaching gel on enamel microhardness, microstructure, and mineral content. *J Endod* 2000;26:203-6.
- Sun L, Liang S, Sa Y, Wang Z, Ma X, Jiang T, *et al.* Surface alteration of human tooth enamel subjected to acidic and neutral 30% hydrogen peroxide. *J Dent* 2011;39:686-92.
- Sa Y, Chen D, Liu Y, Wen W, Xu M, Jiang T, *et al.* Effects of two in-office bleaching agents with different pH values on enamel surface structure and color: An *in situ* vs. *in vitro* study. *J Dent* 2012;40(Suppl 1):e26-34.
- Xu B, Li Q, Wang Y. Effects of pH values of hydrogen peroxide bleaching agents on enamel surface properties. *Oper Dent* 2011;36:554-62.
- Ittatirut S, Matangkasombut O, Thanyasrisung P. In-office bleaching gel with 35% hydrogen peroxide enhanced biofilm formation of early colonizing streptococci on human enamel. *J Dent* 2014;42:1480-6.
- Napimoga MH, de Oliveira R, Reis AF, Gonçalves RB, Giannini M. *In vitro* antimicrobial activity of peroxide-based bleaching agents. *Quintessence Int* 2007;38:e329-33.
- Zheng CY, Pan J, Wang L, Zhang CF. Effects of hydrogen peroxide-containing bleaching on cariogenic bacteria and plaque accumulation. *Chin J Dent Res* 2011;14:47-52.
- Zheng CY, Pan J, Wang ZH, Wang Y. [Effects of hydrogen peroxide-containing bleaching on the growth of *Streptococcus mutans* biofilm on enamel disc surface]. *Beijing Da Xue Bao Yi Xue Ban* 2014;46:30-4.
- Gursoy UK, Eren DI, Bektas OO, Hurmuzlu F, Bostanci V, Ozdemir H. Effect of external tooth bleaching on dental plaque accumulation and tooth discoloration. *Med Oral Patol Oral Cir Bucal* 2008;13:E266-9.
- Gao X, Lo EC, Kot SC, Chan KC. Motivational interviewing in improving oral health: A systematic review of randomized controlled trials. *J Periodontol* 2014;85:426-37.
- Dikopova NZ, Volkov AG, Arakelyan MG, Makarenko NV, Soxova IA, Doroshina VJ, *et al.* The study of the electrochemical potentials of metal structures in the oral cavity in diseases of the oral mucosa. *New Armen Med J* 2020;14:54-8.
- Kumar PS, Doshi D, Kulkarni S, Reddy P, Reddy S, Srilatha A. Effect of motivation on oral hygiene and caries status among young adults in Hyderabad city. *Indian J Dent Res* 2019;30:15-20.

27. Lin F, Ren M, Yao L, He Y, Guo J, Ye Q. Psychosocial impact of dental esthetics regulates motivation to seek orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2016;150:476-82.
28. Skorinova KD, Kuzmenko VV, Vasilenko IA. The prospect of creating medicines based on selenium nanoparticles (review). *Drug Dev Regist* 2020;9:33-44. doi:10.33380/2305-2066-2020-9-2-33-44
29. Fernández E, Bersezio C, Bottner J, Avalos F, Godoy I, Inda D, *et al.* Longevity, esthetic perception, and psychosocial impact of teeth bleaching by low (6%) hydrogen peroxide concentration for in-office treatment: A randomized clinical trial. *Oper Dent* 2017;42:41-52.
30. Bersezio C, Martín J, Peña F, Rubio M, Estay J, Vernal R, *et al.* Effectiveness and impact of the walking bleach technique on esthetic self-perception and psychosocial factors: A randomized double-blind clinical trial. *Oper Dent* 2017;42: 596-605.
31. Bersezio C, Ledezma P, Estay J, Mayer C, Rivera O, Fernández E. Color regression and maintenance effect of intracoronal whitening on the quality of life: RCT—A one-year follow-up study. *Oper Dent* 2019;44:24-33.
32. Bersezio C, Martín J, Angel P, Bottner J, Godoy I, Avalos F, *et al.* Teeth whitening with 6% hydrogen peroxide and its impact on quality of life: 2 years of follow-up. *Odontology* 2019;107:118-25.
33. Kirichuk VF, Tsymbal AA, Antipova ON, Tupikin VD, Maïborodin AV, Krenitskiĭ AP, *et al.* Correction of acute stress-induced disorders of hemostasis using the KVCh-NO apparatus. *Meditssinskaia Tekhnika* 2006;1:29-33. doi:10.1007/s10527-006-0035-5
34. Kirichuk VF, Tsymbal AA, Antipova ON, Tupikin VD, Maïborodin AV, Krenitskiĭ AP, *et al.* Changes in quality of life induced by tooth whitening are moderated by perfectionism: A randomized, double-blind, placebo-controlled trial. *Int J Prosthodont* 2018;31:394-6. doi:10.11607/ijp.5499