

Journal of Health and Medical Sciences

Drouri, S., Benichou, A., Boujdila, O., Al jalil, Z. & Karami, M. (2024), Current Practice of Internal and External Dental Whitening: Epidemiological Study Among Dentists in Morocco (Part II: External Whitening). *Journal of Health and Medical Sciences*, 7(1), 49-58.

ISSN 2622-7258

DOI: 10.31014/aior.1994.07.01.305

The online version of this article can be found at: https://www.asianinstituteofresearch.org/

Published by: The Asian Institute of Research

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Current Practice of Internal and External Dental Whitening: Epidemiological Study Among Dentists in Morocco (Part II: External Whitening)

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Abstract

Aim: To find out which whitening techniques and products are currently used by dentists in two cities, Marrakech and Khouribga-Morocco. Methods: Study type: Descriptive cross-sectional survey; Study population: 347 dentists practicing in the private sector, including 276 dentists in Marrakech and 71 in Khouribga; Study design: a questionnaire was drawn up to collect the data required for the study; Statistical analysis: data were analyzed using SPSS software at the FMDC Community Health Laboratory of Epidemiology and Biostatistics. Results: 205 responses out of 347 questionnaires distributed. External whitening was most widely used in Khouribga, and internal whitening most widely used in Marrakech; 35.7% of dentists used hydrogen peroxide at 35% as an internal whitening product; 35.9% of dentists used carbamide peroxide at 15% as an at-home bleaching product; 67% of dentists made casts with reservoirs; 66% of dentists used 35% hydrogen peroxide in the dental office; 81.2% of practitioners used the light activation as a means of activation, while 37% used the whitening product for 30 minutes with the light activation. Conclusion: Dentists in Khouribga and Marrakech frequently employ the oldest high concentration whitening and of high quality, as the therapeutics of each dyschromia and the specificities of internal and external bleaching protocols call for up-to-date knowledge.

Keywords: Bleaching, Discoloration, Tooth Whitening, Hydrogen Peroxide, Carbamide Hydroxide, Internal Bleaching, External Bleaching, Walking Bleach Technique

1. Introduction

The methodical use of whitening techniques, improved and simplified in recent years, makes it possible to deal with a wide range of clinical situations, and to attenuate and very often eliminate dental dyschromia, whether

external or internal. The quality and longevity of the result depend on the precision of the diagnosis, and the knowledge and expertise of the clinician. Dental whitening is widely used by Moroccan dentists. The aim of this study is to identify the techniques and products currently used by dentists in Marrakech and Khouribga.

2. Materials and methods

This descriptive cross-sectional epidemiological survey was conducted in the cities of Khouribga and Marrakech, in private practice dental offices, from November 2022 to February 2023. The study population included private practice dentists registered in the south regional council of the national dentists' order in Khouribga or Marrakech who agreed to participate in the survey. Dentists specializing exclusively in orthodontics, pedodontics or periodontics were excluded. The total sample comprised 276 dentists in Marrakech and 71 in Khouribga. To collect the data, a four-part questionnaire was used, covering the identification of practitioners, the practice of internal and external whitening, and the postoperative complications. The study was carried out by two dental students at Hassan II University in Casablanca, one conducted the study in Khouribga and the other in Marrakech. Data processing was performed using SPSS (Statistical Package for the Social Sciences) software version 22.0 (SPSS, Chicago, Illinois), at the Laboratory of Epidemiology and Biostatistics of the Faculty of Dentistry of Casablanca, Morocco. Results for categorical variables were expressed as numbers and percentages.

3. Results

93.7% of dentists performed whitening in Marrakech, and 92.1% performed it in Khouribga. 94.8% employed external whitening in Khouribga, and 91% employed it in Marrakech. Combined whitening technique was the least used in both cities due to practitioners' lack of knowledge of this whitening technique (Table1).

Variables	Kho	uribga	Marrakech	
v ariables	N %		Ν	%
Practice of whitening in-office	58	92,1	133	93,7
Type of techniques in-office				
- External	55	94,8	121	91
- Combined	7	12,1	30	22,6

Table 1: Results of Internal Teeth Whitening Practice

3.1. Indications and Contraindications for External Whitening

Regarding the indications for external whitening, in Marrakech 92.6% of dentists indicated it in the case of coloration due to food and tobacco, while 57.9% indicated it in the case of coloration related to age. In Khouribga, 89.1% of dentists indicated it in the case of discoloration due to food and tobacco, while 61.8% indicated it in the case of coloration related to fluorosis.

Regarding the contraindications of external whitening, in Marrakech 93.5% of dentists contraindicated it in case of dentin hypersensitivity, while 86.8% contraindicated it in case of dental caries. In Khouribga, 90.9% of dentists contraindicated it in case of dentin hypersensitivity, while 85.5% contraindicated it in case of cervical resorption (Table 2).

Variables		uribga	Marrakech	
		=55)	(N=	(N=121)
	Ν	%	Ν	%
Indications				
- Age-related coloring	28	50,9	70	57,9
- Fluorosis-related staining	34	61,8	66	54,4
- Staining due to tetracyclines	17	30,9	30	24,8
- Coloring due to food and tobacco	49	89,1	112	92,6
Contraindications				
- Dentin hypersensitivity	50	90,9	113	93,5
- Large or leaky coronal filling	35	63,6	83	68,6
- Very saturated dyschromia	36	65,5	59	48,8
- Cervical resorption	47	85,5	87	71,9
- Lack of motivation on the part of the patient	43	78,2	86	71,1
- Dental caries	44	80	105	86,8
- Tooth crack	41	74,5	96	79,3
- Under 18 years old	42	76,5	86	71,1

Table 2: Results for the Indication and Contraindication of External whitening

3.2. Steps prior to external whitening

As for the steps prior to external whitening, 96.6% performed tooth scaling and 91.5% treated dental caries. The other pre-operative steps are detailed in (Table 3).

Variables	Ν	%
Tooth scaling	170	96,6
Tooth decay removal	161	91,5
Informing the patient about the possibility of the	135	76,7
appearance of transient white spots		
Diagnosis of tooth sensitivities, as well as their		
prevention with desensitizing toothpaste based on		
(N=116)		
- ACP(Amorphous calcium phosphate)	21	18,1
- Potassium nitrate	47	40,5
- Fluor	48	41,4
Preoperative Photography	136	77,3
Determination of hue with (N=144)		
- Shade guide	139	96,5
- Spectrophotometer	5	3,5
Repair or replacement of defective coronal restoration	113	64,2
Confection of dental gutters	120	68,2
Demonstration of the use and maintenance of dental	108	61,4
gutters		

Table 3: Results according to steps prior to external whitening

3.3. Products Used for External whitening

66.7% of dentists used hydrogen peroxide 35% for in-office whitening, and 30.3% of dentists employed hydrogen peroxide 20% for home whitening technique.

48.2% used 35% carbamide peroxide for in-office whitening, while 35.9% used 15% for at home whitening technique (Table 4).

Product Used	In-office			At home				
Concentration	Hydrogen peroxide (N=123)		Carb per (N:	oamide oxide =56)	Hyd per (N=	rogen oxide :199)	Carb per (N:	amide oxide =78)
	Ν	%	Ν	%	Ν	%	Ν	%
10%	5	4,1	5	8,9	18	18,2	18	23,1
15%	7	5,7	3	5,4	29	29,3	28	35,9
20%	9	7,3	4	7,1	30	30,3	21	26,9
25%	20	16,3	17	30,4	14	14,1	7	9
35%	82	66,7	27	48,2	8	8,1	4	5,1
70%	0	0	0	0	0	0	0	0

Table 4: Products Used for External whitening

3.4. Techniques Used for External Whitening

For the techniques used for external whitening, 52.3% of practitioners associated both methods, at-home technique and in office technique. Regarding the means of activating the whitening product used in the dental office, 81.2% of practitioners used the light activation (Table 5).

Table 5: Positive results according to the techniques used for external whitening

Variables	Ν	%
Technique used: (N=174)		
- At-home technique	41	23,6
- In office technique	42	24,1
- Combined technique (In-office+ at home)	91	52,3
Means of product activation (N=133)		
- Light activation	108	81,2
- Laser	21	15,8

3.5. Confection of teeth gutters and duration of wear during at-home bleaching technique

64.7% of practitioners made casts with gutter tanks.

- 53.7% of practitioners recommended wearing the aligner for 4 hours a day.
- 62.8% of practitioners recommended wearing the aligner for 1 to 2 weeks (Table 6).

Table 6: Moulding and	duration of wear	of aligners	during at-home	bleaching te	chnique
- 8		0	0	0	1

Variables	Ν	%
Confection of gutters with tanks (N=119)		
- Yes	77	64,7
- Not	11	9,2
- Not necessarily.	31	26,1
Duration of gutters wear per day (N=121)		
- 4 hours/day	65	53,7
- 6 hours/day	11	9,1
- 8 hours/day	7	5,8
- Nocturnal wear to sleep	38	31,4
Period of wear of the gutters N=113)		
- 1 to 2 weeks	71	62,8
- 2 to 4 weeks	30	26,5
- 4 to 6 weeks	9	8
- 6 to 8 weeks	3	2,7

3.6. Time to apply the whitening product in the dental office

36.8% of dentists used a 30-minute duration with a light activation, while 30.8% opted for a duration of 15 minutes (Table 7).

Table 7: Results of time	e to apply the	whitening p	product in	the office
		01		

Variables	Ν	%
15 minutes without light activation	25	18,8
30 minutes without light activation	31	23,3
60 minutes without light activation	2	1,5
15 minutes with light activation	41	30,8
30 minutes with light activation	49	36,8
60 minutes with light activation	11	8,3

3.7. Desensitizing products during external whitening

75.6% of dentists did not apply fluoride.

61.9% applied desensitizing gel or toothpaste postoperatively (Table 8).

Table 8: Positive results according to desensitizing products during external whitening

Variables	Ν	%
Application of fluoride is essential after whitening	43	24,4
Use of a desensitizing gel or toothpaste		
- Intraoperatively: alternating desensitizer with	40	22,7
whitening product		
- Intraoperatively: after temporary discontinuation of	37	21
the product		
- Post-operative	109	61,9

4. Discussion

External whitening is a technique that modifies the external dyschromia of the teeth using oxidizing agents, such as hydrogen peroxide or carbamide peroxide. These agents penetrate the enamel and dentin and break down the pigments responsible for tooth discoloration. The effectiveness of external tooth whitening depends on many factors, such as the concentration and pH of the whitening agent, the duration of application, the chemical additives, and the demineralizing agents used (Alkahtani et al.2020).

The indications for external whitening concern many pathological and natural discolorations. Age-related whitening of stains gives good results, but results can also be obtained in cases of pathological stains such as tetracycline poisoning (early stages 1 and 2), certain imperfect amelogenesis, fluorosis, white spots, hypo mineralization of the incisors and molars, and traumatic hypo mineralization (attenuation of the contrast between the lesion and the shade of the rest of the tooth). These pathological discolorations sometimes require a slightly longer treatment (Clement et al.2018).

Absolute contraindications are relatively rare. These include (Clement 2018):

- Teeth with significant wear or deep cracks;
- Teeth with cavities (polycarous patients);
- Restorations with major leaks;

- Mucous membranes with oral lesions, such as canker sores;
- Patients with untreated, unstabilized gingivitis/periodontitis;
- Lack of oral hygiene;
- Pregnant or breastfeeding women;
- Patients who are allergic to any of the different components of the products;
- Patients with dental sensitivities.

There are two main techniques for external whitening: at home and in-office techniques. At home technique involves the use of teeth gutters, into which the patient injects the product and then usually wears them at night for a few weeks. In contrast, in the dental office technique is performed directly by a practitioner, with high concentration whitening products, which can be combined with a light, thermal, or laser activation source (Alkahtani et al.2020, Buchalla et al 2007).

The results of our study showed that 52.3% used both external whitening techniques, 24.1% used only external in the dental office. In Brazil (Demarco et al. 2013) showed that at-home bleaching is the most commonly performed by 78.1% of dentists.

4.1. At-home bleaching technique

Regarding at-home bleaching products, the results of this study showed that 35.9% of practitioners used 15% carbamide peroxide, and 30.3% of practitioners used 20% hydrogen peroxide. These hydrogen peroxide concentrations are higher in comparison to the study conducted in Brazil (Demarco et al. 2013) which showed that 40.9% of practitioners used 10% carbamide peroxide while 11.7% used 30% hydrogen peroxide.

Furthermore, (Suntil et al.2022) In their randomized controlled clinical trial showed that the use of 37% carbamide peroxide or 10% carbamide peroxide for 3 weeks gave equivalent results. Also, (de Geus et al. 2018) demonstrated that the efficacy of whitening with 10% carbamide peroxide compared to 15% and 28% was similar with a lower risk and intensity of tooth sensitivity for the 10%. The effectiveness of whitening depends on the time the product is in contact with tooth surfaces and not on the concentration of the whitening product.

67% of practitioners reported using casts with gutter tanks. These do not have a significant effect on the effectiveness of whitening, regardless of the type of whitening agent used (Greenwall-Cohen 2019, Geisinger 2015). In addition, gutter tanks do not increase the longevity of tooth whitening (Martini et al. 2021). (Haywood et al. 2021) recommend the use of 10% carbamide peroxide 10% gutter (without tanks) as the first option considered for the treatment of various external dyschromia.

A low concentration of hydrogen peroxide between 7.5 and 15%, when worn at night for a period ranging from 3 days to 6 weeks, could be recommended for at home whitening (Geisinger 2015, Haywood et al. 2021- de Fátima Carvalho Vasconcelos et al. 2017).

4.2. In-office bleaching technique

Concentrations and Efficacy of Whitening Products

The results of our study showed that dentists employed hydrogen peroxide in high concentrations. 66% of practitioners used 35% hydrogen peroxide and 48% used 35% carbamide peroxide. In contrast to the study by (Demarco et al. 2013), where 40.9% of practitioners used 10% carbamide peroxide.

Although higher concentrations of hydrogen peroxide significantly improved tooth tint, there was no significant difference in efficacy compared to lower concentrations (Lilaj et al. 2019, Martin et al. 2015). Also, 6% hydrogen peroxide is just as effective as 25%, 30%, and 40% (Lilaj et al. 2019, Martin et al. 2015). In addition, dental whitening products used in-office and containing hydrogen peroxide at low concentrations (6% to 20%) or medium concentrations (between 20 and 30%) have a lower risk of sensitivity than those containing a high concentration

of hydrogen peroxide, with no difference in terms of effectiveness in changing the color of teeth (Maran et al. 2020).

4.3. Means of activation and time of application of the product in office

In our study, it was found that 81.2% of practitioners used the light activation as a means for in-office whitening technique. 37% used it for 30 minutes.

Activation by the light activation does not appear to improve tint change or sensitivity, regardless of the concentration of the whitening agent used. The diode laser gives better clinical results and better long-term tint stability (Tekce et al.2022). However, the same side effects, namely postoperative tenderness, and gingival irritation, are noted for both light activation and laser activation (Alshammery 2019- Yusof et al.2020).

(Ozdemir et al. 2021) showed similar results of 40% carbamide peroxide whitening without a light activation for 20, 40, and 60 minutes in continuous mode. According to this study, 40 minutes was the ideal application time. On the other hand, (Reis et al. 2011) propose the application of 35% hydrogen peroxide without a light activation in three 15-minute sessions instead of one 45-minute session. A prolonged session reduces the speed of whitening and slightly increases the intensity of tooth sensitivity.

Comparison of in office bleaching technique with 35% hydrogen peroxide with light activation for 15, 30 and 45 minutes in continuous mode, does not affect the effectiveness of the whitening (Ribeiro et al. 2022). Increasing the application time of hydrogen peroxide to 35% with light activation does not affect the whitening efficiency. The results of studies vary, with some suggesting that shorter, repeated sessions produce better results, while others advocate a longer session.

Nevertheless, the duration of application does not always affect the changes in the shade. Practitioners must therefore consider several factors to determine the best approach for each patient (Ozdemir et al. 2021, Ribeiro et al. 2022).

4.4. Comparison between in office dental technique and at-home bleaching

The efficacy and safety of both methods have been evaluated in several studies, but the results are inconclusive. Some studies (Buchalla 2007, Browning et al. 2011) have shown that both techniques are effective in achieving teeth whitening, with shade regression for both methods during the 3- and 6-month follow-up periods. However, color regression and tooth sensitivity after treatment were significantly higher for in-office bleaching (Mounika et al. 2018).

(Dourado Pinto et al. 2019) also demonstrated that both methods can treat dental dyschromia and offer stability over time. On the other hand, the at-home bleaching technique can cause more tooth sensitivity and gum irritation than in the dental office technique.

The application in dental office followed by at-home whitening, with the aim of improving and maintaining the whitening effect. This combination demonstrated the highest indices of tooth sensitivity, while producing a shade change effect similar to only at-home bleaching.

In conclusion, the choice of the best whitening technique depends on several factors, such as the patient's preferences, cooperation, expectations, compliance, oral health status.

4.5. Combined Whitening

This inside/outside whitening technique was first described by (Settembrini et al.1997) in the original American literature, and (Liebenberg et al. 1997) made a modification to this technique later. It consists of applying 10% carbamide peroxide to the inner and outer surfaces of the tooth. During treatment, the access cavity remains open

to allow for easy and regular change of the whitening product. The window tray at the adjacent teeth of the tooth to be treated is used to keep the whitening agent in and around the tooth (inside/outside open).

The whitening product should be changed inside the tooth and tray every two hours during the day, and the tray containing the product should be worn overnight (Poyser et al.2004). After the whitening session, the patient should clean the access cavities with a toothbrush. Injecting the viscous whitening product will naturally remove any remaining food residue.

Unlike the whitening of vital teeth, there is no limit to the number of times the material can be changed, as it is very unlikely that the patient will experience sensitivity. The more often the agent is changed, the faster the whitening will occur.

It is essential that the patient be cooperative. If the patient does not follow the instructions, it will result in a prolongation of the duration of the treatment and the discoloration may persist. Prolonged treatment means that the access cavity remains open longer (Poyser et al.2004).

The inside/outside closed technique has several advantages over other whitening techniques (internal, external, and inside/outside open), including reduced risk of infiltration, alteration of the coronal surface, and accumulation of food in the access cavity in the case of the inside/outside open technique (Greenwall-Cohen 2019).

4.6. Comparison between the effectiveness of Combined Whitening (Inside/Outside) and Internal Whitening

According to the results of our study, it was found that 60.3% of practitioners in Khouribga opted for internal whitening, while 12.1% practiced combined whitening. In Marrakech, these figures were 68.4% for internal whitening and 22.6% for combined whitening, respectively.

(Pedrollo et al. 2018) demonstrated that both techniques, internal whitening and combined whitening, were effective in producing a large and stable hue gain after two weeks, with no significant difference in brightness.

Zimmerli B et al. in 2010 suggest that combined whitening might be preferable to internal whitening because it avoids the use of sodium perborate, a product banned in the European Union due to its carcinogenic, mutagenic, and toxic effects. They also found that combined whitening could reduce the risk of external cervical resorption by using lower concentrations of whitening agents (Zimmerli et al. 2010).

We note a lack of knowledge of this technique by the practitioners included in our study.

5. Conclusions and recommendations for practitioners

- Use a protective barrier to protect gums and soft tissue.
- Make castings without gutter tanks.
- Wear dental gutter at night.
- Opt for at-homr rather than in the office technique.
- Prefer low-concentration products such as 6% hydrogen peroxide to avoid sensitivities.
- Avoid the use of activators such as LED lamps, heat, or lasers, and invest funds in other devices instead of the lamp itself.
- Prescribe a desensitizing toothpaste or gel.
- Regularly monitor patients to assess results and detect side effects.

Author Contributions: All authors contributed to this research.

Funding: Not applicable.

Conflict of Interest: The authors declare no conflict of interest.

Informed Consent Statement/Ethics Approval: Not applicable.

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