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Current Practice of Internal and External Dental Whitening: Epidemiological Study Among Dentists in Morocco (Part I: Internal 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 ambulatory whitening product; 67% of dentists made casts with reservoirs; 66% of dentists used 35% hydrogen peroxide for chairside whitening; 81.2% of practitioners used the lamp as a means of activation, while 37% used the whitening product for 30 minutes with the lamp. **Conclusion:** Dentists in Khouribga and Marrakech frequently employ the oldest high concentration whitening procedures. It is imperative that dentists in these two cities receive ongoing training. It must be regular, demanding 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 complications encountered. The study was carried out by two dental students at Hassan II University in Casablanca, one 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

The response rate was 59.1%. The responses of 205 participants were collected from the 347 dentists surveyed. Practitioner profiles are shown in (Table 1).

- 93.7% of dentists performed whitening in Marrakech and 92.1% in Khouribga.
- 68.4% performed internal whitening in Marrakech and 60.3% in Khouribga.
- 98% of dentists performed whitening on patients aged over 18 in Khouribga and 99.2% performed it on patients aged over 18 in Marrakech (Table 2).

Table I Practitioner data

Variables	Number of employees (N)	Percentage (%)
Gender		
Female	99	48,3
Male	106	51,7
Age (years)		
< 30	55	26,8
Between 30 and 50	102	49,8
> 50	48	23,4
Origin of the diploma		
Casablanca	164	80,0
Rabat	13	6,3
Other	28	13,7
Duration of dental practice (years)		
< 5	54	26,3
Between 5 and 10	50	24,4
Between 11 and 20	46	22,4
> 20	55	26,8
Type of exercise		
General practitioner	200	97,6
Specialist	5	2,4

Table II Results of Internal Teeth Whitening Practice

Variables	Khouribga		Marrakech	
	N	%	N	%
Practice of whitening in-office	58	92,1	133	93,7
Type of whitening performed in-office				
- Internal	35	60,3	91	68,4
Practice of whitening in patients > 18 years	48	98	118	99,2
Practice of whitening in patients < 18 years	3	6,1	10	8,4

3.1. Indications and Contraindications for Internal Whitening

82.4% of dentists in Marrakech indicated internal whitening in cases of necrosis, and 72.5% of dentists contraindicated it in cases of root resorption. In Khouribga, 77.1% of dentists recommended internal whitening in cases of necrosis, and 82.9% of dentists advised against it in cases of root resorption. In Khouribga, 82.9% of dentists contraindicated internal whitening in cases of root resorption, and 77.1% in cases of cracks and/or fissures. The different percentages of internal whitening technique used by practitioners in the two towns are detailed in (Table 3).

Table III Practitioners' responses to the indications and contraindications of internal whitening

Variables	Khouribga (N=35)		Marrakech (N=91)	
	N	%	N	%
Indications				
- Discolouration due to intrapulpal bleeding	19	54,3	40	44
- Necrosis	27	77,1	75	82,4
- Defective endodontic treatment	12	34,3	21	23,1
- Asymptomatic root canal obliteration	8	22,9	13	14,3
- Presence of coronary restorative materials such as amalgam	11	31,4	34	37,4
- Discolouration due to eating habits and smoking	7	20	19	20,9
- Discolouration due marginal percolation	1	2,9	20	22
Contraindications				
- Dentinogenesis imperfecta	20	57,1	47	51,6
- Root resorption	29	82,9	66	72,5
- Severe coronary decay	22	62,9	53	58,2
- Bulky coronary restoration	12	34,3	35	38,5
- Crack and/or fissures	27	77,1	58	63,7
- Lack of patient motivation	19	54,3	42	46,2

3.2. Steps prior to internal whitening

Regarding the steps prior to internal whitening, 88.9% of dentists radiographically assessed the quality of endodontic treatment (density and length) and 82.5% took preoperative photographs. Regarding protection of the root canal filling, 84.1% of dentists protected the root canal filling before whitening, 84.3% used the glass ionomer cement to protect the root canal filling. Half of the dentists did not isolate the teeth with dental dam or modify the access cavity before whitening. 26% did not etch beforehand (Table 4).

Table IV Practitioners' responses to the stages prior to internal whitening

Variables	N	%
Preoperative Photography(N=126)	104	82,5
Radiographic evaluation of the quality of endodontic treatment	112	88,9
Isolation by rubber dam	62	49,2
Clinical evaluation of the quality of the root canal filling	86	68,3
Root canal retreatment before internal whitening	14	11,1
Removal of excess gutta-percha from the access cavity (N=124)		
- At the root canal entrance	31	26,7
- At the neck	8	6,9
- At 2 mm from cementoenamel junction	77	66,4
Rectification of the access cavity by removing pulp horns	66	52,4
Etching of the inner dentinal walls with orthophosphoric acid	33	26,2

3.3. Products Used for Internal Whitening

The most used product by Moroccan practitioners was hydrogen peroxide at 35 % in 35.7% of dentists. 22.2% of dentists used carbamide peroxide 15 to 16% (Table 5).

Table 5: Results of products used for internal whitening

Variables	N	%
Hydrogen Peroxide 6%	29	23
Hydrogen Peroxide 35%	45	35,7
Perborate de sodium	26	20,6
Carbamide peroxide 10%	14	11,1
Carbamide peroxide 15 to 16%	28	22,2
Carbamide peroxide 35%	17	13,5
Carbamide peroxide 40%	1	0,8
Heat-activated hydrogen peroxide	8	6,3
I don't know	4	3,2

3.4. Internal whitening product renewal

55.6% of dentists renewed the product once a week, while 20.5% renewed it once every 15 days. 74.6% determined the frequency of product renewal according to the intensity of dyschromia and 50% cited that it depended on the nature of the whitening product (Table 6).

Table 6: Product renewal Results

Variables	N	%
Frequency of product renewal (N=117)		
- 2 times / week	18	15,4
- 1 time / week	65	55,6
- 1 time / 15 days	24	20,5
- 1 time / 21 days	4	3,4
- 1 time /month	6	5,1
Determinant of frequency of product renewal (N=126)		
- Intensity of dyschromia	94	74,6
- Age of dyschromia	45	35,7
- Patient Habits	5	4
- Nature of the whitening product	63	50
- Patient cooperation	21	16,7

3.5. Temporary filling to seal access cavity

56.3% of dentists used glass ionomer cement and 23% used eugenol zinc oxide as a temporary restoration. Of the 120 dentists who responded to the question on permanent composite restoration after internal whitening:

- 39.2% performed restoration immediately after product disposal.
- 20% waited 1-3 days.
- 29.2% were waiting at least 1 week.
- 11.7% waited 2 to 3 weeks (Table 7).

Table 7: Results on the material used for the temporary filling to seal access cavity

Variables	N	%
Material used (N=119)		
- Zinc oxide eugenol	23	19,3
- Intermediate restorative material	4	3,4
- Glass ionomer cement	67	56,3
- Cavit	22	18,5
- Other	3	2,5

4. Discussion

Internal whitening consists of applying an oxidizing agent to the inside of the pulp cavity of a devitalized and discolored tooth, allowing the modification of its intrinsic color without altering its structure or resorting to prosthetic restorations (Clement et al., 2018).

Internal whitening requires essential preliminary steps, including pre-operative radiography to assess the endodontic filling, isolation of the tooth with a dental dam, rectification of the access cavity and removal of gutta percha up to 2 mm below the cemento-enamel junction (Poyser et al.2004; Greenwalle-Cohen et al.2019).

Indeed, grinding the access cavity is essential prior to internal whitening. This step effectively removes residual coronal restorative materials and necrotic pulp tissue (sometimes under the pulpal horns) to prevent tooth discoloration (Timmerman et al. 2018). To improve treatment efficiency, 37% orthophosphoric acid can be used for 15 seconds for etching. It removes dentin sludge and opens the tubules, facilitating penetration of the whitening agent (Fagogeni et al. 2022; Wood et al. 2022).

The gutta-percha should be removed 2 mm below the enamel-cement junction and protected with an isolation base. Various materials can be used, including glass ionomer cement, intermediate restorative material or zinc oxide eugenol. Injectable glass ionomer cement is the most effective, thanks to its rapid melting and its mechanical and adhesive properties. It preserves the root canal filling by preventing penetration of the whitening agent, which is then applied in the access cavity against the vestibular wall, followed by a provisional hermetic coronal filling (Greenwalle al.; Timmerman et al.; Zimmerli et al.; Aboudharam et al.). In the interim, the provisional filling must be watertight to prevent bacterial penetration and avoid any problems with bleaching products leaking out or spreading to the gingiva (Irusa et al. 2022; Guerreiro et al. 2021).

4.1. Internal whitening products

This survey showed that 35.7% of practitioners used 35% hydrogen peroxide as an internal brightener, and 20.6% used sodium perborate.

A similar study carried out in Brazil (Demarco et al. 2013), also showed that hydrogen peroxide over 30% was the most widely used by dentists.

Hydrogen peroxide between 5% and 35% can be used for internal whitening, but it can be caustic and release free radicals at high concentrations (Plotino et al.; Kwon et al.). A low concentration of hydrogen peroxide is also effective in achieving satisfactory results (Pontes et al. 2020).

Since 2011, the European Union has regulated the use of hydrogen peroxide, limiting concentrations to 6% or less and reserved for dentists (Traviglia et al.2019).

Sodium perborate has been banned in the EU since 2015 due to its carcinogenic, mutagenic, and toxic properties (Pallarés-Serrano et al., 2022). This product is still marketed in Morocco.

4.2. Carbamide peroxide or hydrogen peroxide

35% carbamide peroxide and 35% hydrogen peroxide provide equal effectiveness for intracoronal bleaching. Carbamide peroxide has several advantages over hydrogen peroxide, namely its decomposition to the equivalent of only 12% hydrogen peroxide; its slower diffusion through dentin, as the presence of urea stabilizes the mixture and increases the duration of its efficacy as a bleaching agent; and its effect of inducing an alkaline pH in the tooth (Lim et al. 2004). Indeed, whitening efficacy is directly proportional to the increase in pH of the whitening agent, with maximum efficacy at pH=9 (hydrogen peroxide has pH=5 and carbamide peroxide has pH>8). Alkaline pH also reduces damage to tooth enamel and periodontal tissue (Torres et al. 2014; Sharma et al. 2017).

Products with low hydrogen peroxide concentrations and neutral or alkaline pH are therefore preferred for internal tooth whitening (Lilaj et al., 2019).

This study showed that only 13.5% of dentists used 35% carbamide peroxide as an internal whitening product, compared with 35.7% for 35% hydrogen peroxide.

For 56.2% of dentists, hydrogen peroxide offered better aesthetic results, and for 48.5% it was faster acting.

Regarding the frequency of whitening product renewal, half of the practitioners renewed the whitening product once a week. Renewal is usually a function of the intensity of the coloration and its average duration is 6 to 8 weeks (Greenwall-Cohen et al. 2019; Aboudharam et al. 2008).

It is advisable to see patients at least every two weeks to assess the tooth's response, manage possible complications, reassure and remotivate the patient, and replenish the whitening agent if necessary (Greenwall-Cohen et al. 2019).

Finally, it is mandatory to wait at least two weeks after the removal of the whitening product to place a definitive restoration to the composite (Greenwall-Cohen et al. 2019; Aboudharam et al. 2008). This step is necessary to ensure that the enamel does not contain any oxygen residues that may inhibit the binding of the composite to air and decrease the adhesion strength to the composite by 25 to 50%. In this study, 39.2% of practitioners immediately performed the final restoration once the whitening product was removed, and 29.2% waited at least a week.

5. Conclusions and recommendations for practitioners

Continuous training on whitening techniques is needed for dentists in Marrakech and Khouribga. However, there are a few recommendations that are very useful for practitioners:

- Delaying whitening after recent trauma.
- Check the quality of the endodontic filling before whitening.
- Isolate with dental dam.
- Rectify the access cavity: cervical boundary cleared (2mm below the cemento-enamel junction)
- Protect the root canal filling with a cervical barrier (2mm glass ionomer cement)

- Recommend low concentrations without means of activation (heat, ultrasound or laser) to avoid cervical resorption.
- Preference should be given to whitening products based on carbamide peroxide rather than hydrogen peroxide.
- The final composite filling 2 weeks after the last whitening session.
- Follow-up

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