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Introduction of the ART approach in Egypt: Intentions, clinical effects and perceived barriers. A cohort study

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Abstract

Aim. To evaluate the effect of the introduction of ART in Upper-Egypt and assess the participating General Dental Practitioners' (GDPs) opinions, intentions, expectations and experiences regarding barriers related to using ART. ***Methods.*** Thirty-five GDPs were selected and trained on ART for 5 days. Knowledge assessments were done immediately before and after the training, using a questionnaire. Regular evaluation and assessment data were collected after 6 and 12 months, through questionnaires with closed and open-ended questions. Clinical data in government and private clinics were collected, using clinical record-forms. GDPs' opinions, intentions, expectations and experiences regarding barriers related to ART were assessed, through questionnaires, at the start and after 1 year. The control group comprised 35 other GPDs. ***Results.*** At the start, the most GDPs were intended to make ART restorations. After 1 year 65% and 97% actually made ART restorations in their government and private clinics, respectively. The barriers faced by the GDPs to making ART restorations in the government clinics were mainly unavailability of suitable restoration material and of hand instruments. After 1 year post-training, ART restorations constituted 41% of the total plastic restorations made. Finally, the majority of GDPs believe that ART is suitable for use in their government and private practices. ***Conclusion.*** All participating GDPs intended to introduce ART in their government and private clinics. They successfully introduced this technique in their private clinics but, owing to the unavailability of suitable instruments and restoration materials, failed to do so in the government clinics. They liked the simplicity of the technique.

Key Words: *ART, oral health, implementation, Egypt*

Introduction

Dental caries is the most widely spread oral disease in the world [1]. Untreated dental caries is a global public health problem, especially in low- and middle-income countries like Egypt. It is the main reason for tooth loss [2–4]. The population in rural and suburban areas of Egypt, in particular, is suffering from high caries prevalence with unmet needs [5]. Information about the Egyptian oral healthcare system is presented in Box 1. All general dental practitioners (GDPs) have to work in a government dental clinic and most of them also have their own private dental clinic(s).

In the late 1980s, restorative care constituted less than 1%, while tooth extractions constituted 53% of the total dental treatment provided in Egyptian government dental clinics in rural areas [6]. That pattern of care appears not to have changed over the years, as extraction rather than restorative treatment of cavitated carious teeth is currently the common treatment provided by general dental practitioners (GDPs). Moreover, the dentist–population ratio in rural areas of Upper Egypt, where 60% of the Egyptian population lives, is low [7].

The Atraumatic Restorative Treatment (ART) approach was suggested as an alternative or complementary treatment model for improving the presently poor level of preventive and restorative care [7]. Substantiating factors regarding the implementation of ART in Egypt were: the high survival rate of ART sealants and restorations [8,9]; the high survival rate of ART restorations after 5 years amongst secondary

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Box 1. General information about Egypt, the healthcare system and the study governorates.

Egypt's health care status is poor in comparison to the level of its national income. The healthcare system is complex and pluralistic. The Ministry of Health (MOH) is the major provider of care, which runs a nationwide system of health services. MOH services are provided largely free to all citizens. However, due to general long waiting times and insufficient equipment, most people will visit a private clinic. The second major provider is the Health Insurance organization (HIO), which provides universal coverage to the small urban formal sector.

Oral healthcare

A total of 28,000 general dental practitioners (GDPs) are working in the different health sectors. The majority of private dental clinics are located in the big cities in Lower Egypt. The dentist/population ratio in the rural areas, where almost 60% of the population lives, is consequently low. Due to the 'Upper Egypt phenomena of poorness', only a few dentists feel encouraged to work in this region. Oral care and dental hygiene is still not a major concern for many Egyptians, especially the uneducated middle- and low-income population. Recent national epidemiological oral health data are not available.

Information about Minya and Asyut Governorates.

	Minya governorate	Asyut governorate
Total area:	32,280 km^2	25,930 km^2
Population:	4.2 million	3.5 million
MOH dental clinics (*n*):	248	144
Private dental clinics (*n*):	164	195
GDPs (*n*):	243	175

scholars in Egypt and the high level of acceptance of ART by these scholars [10,11]; the reasonably successful introduction of ART into the public health services of South Africa [12] and Tanzania [13]. Furthermore, it was noted that the beneficial cost-effectiveness of the ART approach compared to the costs of conventional restorative care might make it suitable for applicability in Egypt [14,15].

Implementation of the ART approach in the oral healthcare services in conjunction with caries-preventive measures might lower the frequency of extractions and contribute to an increase in the number of restored teeth, slowly improving the oral health status of the Egyptian population. Introduction of the ART approach and caries-preventive measures into the healthcare system in Egypt requires, first, a well-structured training course and, secondly, a scheme for monitoring and evaluation of the clinical activities after completion of the training course. A better insight in GDPs' opinions and preferences on ART might be helpful during this process [12,16,17].

The aims of this study were: (1) to assess GDPs' opinions regarding the introduction and use of the ART approach and caries-preventive measures; (2) to assess the expected and experienced barriers factors relevant to this introduction; and (3) to evaluate GDPs' first clinical ART experiences.

Methods

The study protocol was approved by Minya University, Faculty of Dentistry, Egypt (ERC/2010/12) and was registered in the Netherlands Trial Register (NTR2719). Willingness and permission to allow GDPs to participate in this study were granted by the health authorities of the Ministry of Health (MOH), Cairo, and the Egyptian Health Insurance Organization (HIO). Questionnaires and clinical recording forms were evaluated for appropriateness by a panel of three experienced GDPs and modified according to their comments.

Sampling

A pre-test–post-test control group study was designed. The MOH presented a convenience sample of 70 Upper Egyptian GDPs, who were working in both private and governmental dental clinics. Eventually, the number of involved private clinics was 35 (out of a total of 164) in Minia governorate (test group) and 35 (out of a total of 195) in Asyut governorate (control group). For governmental clinics, the numbers were 29 (out of a total of 248) and 24 (out of a total of 195), respectively. Figure 1 shows the flow of the participants through the study.

Background questionnaire

The questionnaire comprised 42 items. Nine questions were on personal characteristics, eight on clinical and continuing professional development and 15 on practice-related information. The remaining 10 questions were on clinical decision-making and are presented elsewhere [18].

Intervention group

Composition. Inclusion criteria for participants were: willingness to attend the ART training course; knowledge of the English language; and future employment for at least another year in a government dental clinic.

ART training course. The selected GDPs were trained in ART [19]. In addition, topics on the caries process and prevention of enamel and dentine caries lesions were covered. The training was given in an 8-h per day

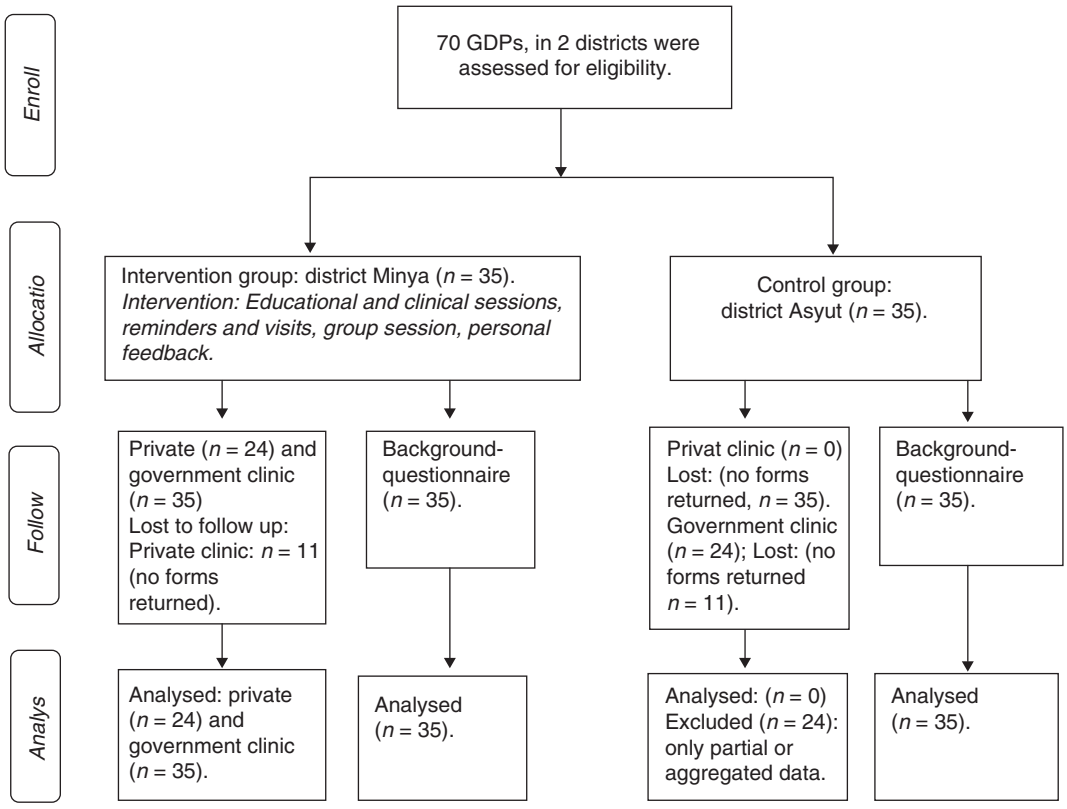

Figure 1. Flowchart of the number of participants taking part in each stage of this study on the introduction of ART in Upper Egypt.

5-day workshop. A pre- and post-training questionnaire was used to test the effect of the training on the participants' knowledge.

Evaluation and assessment. Post-intervention evaluation and assessments were done at 6 and 12 months, through use of questionnaires and clinical recording forms. Seven months after the training, a general reminder meeting for all course participants was organized. Twenty-four participants attended it.

Assessment of GDPs' opinions and intentions to apply ART. Another questionnaire was used for assessing the GDPs' views about the application of ART. Four questions were used to assess the GDP's opinion on acceptability and suitability of ART application in government and private clinics in Upper Egypt. Intentions to apply ART in government and private clinics were assessed using five questions. The general opinion regarding ART was assessed by checking answers to open questions about its advantages and disadvantages.

Assessment of expected and experienced barriers to introduction of ART. A questionnaire with open questions on barriers related to ART introduction in government and private clinics in Upper Egypt was distributed during the training and after 1 year. In addition, after 1 year, each GDP's experience concerning ART was assessed from 10 statements.

Control group

The control group comprised 35 GDPs working in government and private clinics in Asyut governorate, Upper Egypt. Background characteristics of the intervention group (gender, years of experience, weekly clinical working hours) were used in composing a comparable group. All participants were asked to answer the questionnaire and fill in the clinical record forms.

Clinical data collection in both groups

Clinical data from government and private clinics were collected on a monthly basis, using clinical record forms. All GDPs were asked to complete these forms on a daily basis. Data on gender, age, tooth number, toothache and type of treatment (prevention, restoration or extraction) of patients were collected. For restoration cases Black's class type of cavity, tooth surfaces, material used (i.e. amalgam, resin composite, glassionomer, others) and preparation method (ART or conventional) were recorded. Participants were asked to indicate the type of clinic (government or private) on each form. Non-respondents were reminded by telephone after 1 and 2 months.

Data analysis

The total number of clinical activities done during the study was calculated for each participant per clinic. The

Table I. Intentions and attitudes concerning ART, of intervention group GDPs who returned both questionnaires ($n = 31$), with p-values, at the start and after 1 year.

	Agree		Disagree		
Question statement at start (A) and after 1 year (B)	Start, *n* (%)	1 year, *n* (%)	Start, *n* (%)	1 year, *n* (%)	*p*-value
Intention					
(A) I already apply/ (B) I have applied ART in my dental clinical work[a]	9 (33%)	26 (96%)	18 (66%)	1 (4%)	0.0001*
(A) I intend to introduce/ (B) I have introduced ART in my government clinic	30 (97%)	22 (71%)	1 (3%)	9 (29%)	0.0047*
(A) I intent to make/ (B) I have made ART restorations in my government clinic[c]	30 (97%)	20*c* (65%)	1 (3%)	11 (35%)	0.0016*
(A) I intend to introduce/ (B) I have introduced ART approach in my private clinic	27 (87%)	30 (97%)	4 (13%)	1 (1%)	n.s.
(A) I intent to make/(B) I have made ART restorations in my private clinic	27 (87%)	30 (97%)	4 (4%)	1 (3%)	n.s.
Attitudes					
ART approach is suitable for my government clinic. A/ B	29 (94%)	28 (90%)	2 (6%)	3 (10%)	n.s.
Patients in my government clinic (A) may accept/ (B) have accepted ART restorations	27 (87%)	18*b* (90%)	4 (13%)	2*b* (10%)	n.s.
ART is suitable for my private clinic. A/ B	26 (84%)	27 (87%)	5 (16%)	4 (13%)	n.s.
Patients in my private clinic (A) may accept/ (B) have accepted ART restorations	26 (84%)	27 (97%)	5 (16%)	4 (13%)	n.s.

Statements: (A) at start; (B) after 1 year. * statistical significance at $p \leq 0.05$; n.s., no statistical significance.
[a] $n = 27$ (four non-respondents to this question); [b] $n = 20$, [c] only respondents from Intention.

answers to questions on opinion of the GDP on ART were dichotomized by combining 'strongly disagree' and 'disagree' into 'disagree' and 'strongly agree' and 'agree' into 'agree', while 'not applicable/not answered' remained unchanged. For each participant the answers to each question, pre- and post-training, were coupled in a 2×2 table and McNemar's tests were done to test the change in opinion. The statistical significance was set at $\alpha = 0.05$. The analyses were performed by a biostatistician using SAS version 9.2-software.

Results

Intervention group

Thirty-five GDPs (11 females) attended the ART training. Twenty-six of them were younger than 30 years, while the ages of the rest ranged between 31–50 years. The mean length of practice experience was 9 years (range 1–23 years). All 35 GDPs returned clinical data forms from their government clinic and 25 of them did it also from their private clinics. In government clinics, the mean ratio of tooth extractions/ restorations was 7:1 (range 1:1–40:1). A high workload, due to the number of patients needing urgent oral care, was reported by 58% of the participants.

ART training

At the end of the training, a statistically significant improvement ($p < 0.001$) was found in responses to 18 (of 40) questions. These questions focused on the caries process, caries prevention and practical steps of ART application. No changes in knowledge were found for questions dealing with glassionomer material properties, dental sealants and about the effects of patients' lifestyle (e.g. tooth brushing, use of toothpaste) on oral health. Significantly more GDPs practiced ART after taking the course (Table I).

Assessment of GDPs' opinions, intentions and actual practice of ART

Table I shows an overview of participants' intentions and thoughts about ART at the start and actual practice after 1 year. Thirty-one GDPs returned both questionnaires (response rate 89%). Most GDPs intended to introduce ART in their government and private clinics. After 1 year, significantly less GDPs actually introduced ART in their government clinic, compared to their intentions. Consequently, less GDPs actually made ART restorations in their governmental clinic.

Expected and experienced barriers

After 1 year of experience, significantly more GDPs realized the simplicity of ART, whereas the other items on GDPs opinions about the advantages and disadvantages of ART remained stable (Table II). There was a considerable increase in the number of the GDPs supporting the applicability of ART. The main barrier

Table II. Aspects mentioned mostly by GDPs (n=31) in the intervention group concerning advantages, disadvantages and barriers of introduction and using ART in government and private dental clinics, at the start of study and after 1 year.

Opinion	At start (*n*)	After 1-year (*n*)		*p*-value
Advantages				
Conservative/MID treatment	17	14		0.40
Simple technique	12	21		0.007
Applicable technique	3	9		0.06
Time-effective procedure	7	8		0.76
Child-friendly	6	8		0.56
No use of rotary instruments	5	8		0.26
No use of anaesthesia	5	8		0.26
Disadvantages				
Case selection	8	5		0.32
Material properties	6	8		0.42
Time-consuming	4	7		0.26
Barriers		Government practice (*n*)	Private practice (*n*)	
Unavailability of suitable GIC	12	16	0	
Unavailability of instruments	11	13	0	
Patient acceptance	13	3	4	
Financial costs	0	5	5	
No barriers present	4	4	21	

to application of ART in the government clinics was the unavailability of ART instruments and a suitable, high viscosity glassionomer restoration material. Twenty-one (68%) GDPs reported that there were no barriers to applying ART in their private clinics.

Table III covers the GDPs' general experiences related to ART. More than two-thirds of the participants had the opinion that the ART technique is, at least, equal to the conventional way of using mechanical devices to restoring teeth. Furthermore, more than half of the GDPs noted a positive attitude from government management and felt that it supported adoption of ART in government clinics.

Clinical data

On average, GDPs spend 16 h (range 4–50) in their private and 13 h (range 8–20) in their government clinic, respectively, on restorative dentistry per week. Table IV shows that almost 76% of the restorations were made in the private clinics and 24% in the government clinics. The number of ART restorations in government clinics halved during the second part of the study, compared to the first study part, whereas the numbers in private clinics remained stable. Black class 1 and class 2 restorations constituted both 35% of the total number of ART restorations made, while

Table III. Clinical experiences with and opinions about ART technique after 1 year of GDPs ($n = 24$) in the intervention group.

Statement	Agree (*n*)	Disagree (*n*)	N.A.
Having experience with drilling as well as ART, it is generally better to restore teeth using drill than ART	6	17	1
I still have some doubts on the effectiveness of ART restorations	8	16	
Overall, my patients like ART restorations	23	1	
Overall, I have adequate skills to make ART restorations	24	0	
Overall, the fee for ART restoration is a barrier for the majority of patients	6	18	
I have experienced some negative responses regarding ART from my superiors	5	15	4
Government management feels that glass ionomer is too expensive to afford	7	14	3
The government management is pleased that I make ART restorations	13	3	8
Overall, my government administration fully supports ART	14	3	7

N.A., not answered.

Table IV. Number and types of restorations made by GDPs ($n = 25$) in the intervention group in their private and government practices during 1 year post-test.

	Number of restorations		
	During March to November (%)	During November to March (%)	Total (%)
Private	1660 (40%)	1520 (36%)	3180 (76%)
Government	626 (15%)	369 (9%)	95 (24%)
Restorative technique			
Conventional	1437 (34%)	1032 (25%)	2469 (59%)
Private clinic	1008 (70%)	783 (76%)	1791 (73%)
Government clinic	429 (30%)	249 (24%)	678 (27%)
ART	849 (20%)	857 (21%)	1706 (41%)
Private clinic	612	737	1349 (79%)
Government clinic	237	120	357 (21%)
Type of restorative materials			
Amalgam	638	629	1267 (30%)
Composite	244	372	616 (15%)
Amalgam/composite	553	—	553 (13%)
GIC	788	857	1645 (40%)
Temporary filling material	61	33	94 (2%)
Class of restorations			
Class I	537	634	1171
ART technique	264	330	594
Class II	758	702	1460
ART technique	342	253	595
Class III	108	142	250
ART technique	51	51	102
Class IV	15	27	42
ART technique	3	2	5
Class V	127	132	259
ART technique	98	95	193
Sealants	84	96	180
ART technique	71	92	163
Not reported*	657	156	813
ART technique	20	34	54
Gender			
Male	1047	772	1819
Female	1099	919	2018
Not reported*	140	198	338

* The class of restoration or gender not reported.

11% were class 5 restorations. Another 10% concerned ART sealants.

Control group

All GDPs ($n = 35$) returned the background questionnaire. Twenty GDPs returned (part of) their government clinical data and four GDPs returned an overview with the total number of restorations and extractions, without any details. None of them returned the clinical record forms from their private clinic. Clinical data from this group could, therefore, not be analyzed without accepting the potential inclusion of biased outcomes.

Discussion

This study was planned as a pre-test–post-test controlled trial. However, the GDPs in the control group did not return any clinical record forms from their

private clinics and only partly returned those from their government clinics. This could be attributed to their cultural background, as these data are considered to be very private. In addition, they might not have seen any personal benefit. The bias in data from the control group prevented any reliable analysis, so this study should be seen as a cohort study, merely based on data from the intervention group. These aspects need more attention in future studies.

GDPs showed a positive attitude towards ART at the start and this contributed to a positive intention to apply a new procedure [20,21]. Almost all GDPs intended to introduce ART in their government clinic. However, because of the barriers that they met only a minority succeeded (Table I). The MOH send four managers to attend the training course. The fact that they were allowed to attend the training, to gain familiarity with ART, indicated preliminary acceptance at government management level. This could have a positive effect on the barriers mentioned mostly (Table II), as the management might now decide to provide their clinics with the essential ART materials and instruments. For those who want to introduce ART in comparable settings and countries, it can be recommended to start at management level and then introduce it in government and routine dental practice. Meanwhile, in the private clinics almost all GDPs applied ART and the majority did not feel any barriers (Table II). This indicates a high general acceptance and adoption of ART by GDPs. The clinical data showed that almost 41% of the restorations placed were ART restorations. The increase in the number of ART restorations observed from the first to the second half year during the 1-year post-training period further indicated the adoption of ART and the increased availability of materials in the private clinics. Further study is needed to determine whether this increase in ART restorations had indeed lowered the frequency of extractions. ART is an evidence-based treatment for use in single-surface cavities but cannot routinely be used in multiple-surface cavities [9,22]. In this study, we found almost 35% of class II ART restorations (Table IV). Insofar, more attention during the ART training should be paid to this topic, in order to prevent any possible disappointments regarding the survival of the ART restorations.

Because unavailability of pre-study data, we are uncertain if the ART restorations made during the first half of the follow-up period were due to the ART program. Nine participants mentioned being already familiar with the ART technique. On the other hand, during the course, participants gained insight in and got familiar with the required material, a high-viscosity glass-ionomer material, to make ART restorations, which was hardly obtainable before that time. Insofar, one may presume that the program directly has influenced the number of ART restorations.

Only a quarter of the restorations were made in government clinics (Table IV). This could be explained by the absence of suitable ART restorative materials and ART instruments and did not allow GDPs to actually introduce ART in the government setting. Some GDPs bought their own ART restoration material for use in their government clinic. However, this will not solve the problem at a national level. Moreover, that Egyptian patients seek dental help only when experiencing severe pain and that extraction is cheaper might influence their treatment options. This situation has existed for decades [6].

The GDPs liked the simplicity of ART (Table II) and thought that it would make treatment more comfortable to patients and lower their fear of restorative treatment, thus resulting in patients' seeking care in earlier stages of dental decay. In the near future, more teeth in Upper Egypt might be restored earlier, rather than removed in very late stages of caries progression. In addition, after GDPs had practiced ART for 1 year, they realized the simplicity of this approach even more. This finding might have an important bearing to those who want to pioneer the introduction of ART in routine dental service. They should not despair when they find that many GDPs are hesitating to introduce ART at the beginning of the implementation program, as, after GDPs have practiced ART, they are most likely to rejoice and like ART practice.

This study showed that GDPs in Upper Egypt have successfully introduced ART in their private clinics but not in their government dental clinics and that they liked the simplicity of the technique. GDPs faced barriers to implementation of ART in government clinics, despite of positive responses from the responsible management. This may indicate delays in governement machinery to translate their willingness to support health innovations financially.

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