

Assessment of Awareness on Drug Delivery System among Oral Healthcare Professionals: A Cross-sectional Study

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ABSTRACT

Introduction: The technique or approach used to provide pharmaceutical drugs to achieve a therapeutic effect in people or animals is known as drug delivery. Local anaesthetics, Non Steroidal Anti-inflammatory Drugs (NSAIDs), and antibiotics are the most generally recommended medicines in dentistry. Dentists must be upto date on dosage formulations and various drug delivery methods.

Aim: To evaluate the knowledge about the Drug Delivery System (DDS) among oral healthcare professionals.

Materials and Methods: This was a cross-sectional questionnaire survey was conducted on 75 dental students and oral healthcare professionals of both genders, in population, Mysore, India. A questionnaire consisting of 12 dichotomous 'Yes' or 'No' questions were used in the study. The study population was obtained by convenient random sampling. The questionnaire was created and verified by healthcare professionals with extensive teaching and clinical experience. The responses received during the period from August 2022 to September 2022 were subjected to statistical analysis. The

study was analysed by descriptive statistics such as frequency and percentage.

Results: All the 75 participants responded to the questionnaire and the response rate was 100%. The mean age of the participants in the present study was 22±2.3 years. A 92.00% (n=69) participants knew about various drug interactions. The participants had less knowledge about recent nano-based drug delivery. Only 42.66% (n=32) were acquainted with microneedle based transdermal delivery system, 33.33% (n=25) about nanocrystals and 21.33% (n=16) about 3D printing technology in DDS. A 97.33% (n=73) of the participated subjects thought that selection of appropriate DDS plays a role in its therapeutic efficacy.

Conclusion: The recent advances in drug delivery methods are of little interest among the participants in the present study. Participants in the present survey demonstrated a lack of basic and fundamental understanding of nanotechnologies, highlighting the critical need for increased awareness. This article has highlighted the importance of knowing various drug delivery methods and the current trends in approaches.

Keywords: Drug interactions, Nanoparticles, Oral controlled release, Therapeutics

INTRODUCTION

Drug delivery systems (DDS) are used to transport pharmaceutical drugs in the body as needed to achieve the desired therapeutic effect. These systems are often made to: i) increase the solubility of active constituents in liquid and their chemical stability; ii) enhance pharmacological effectiveness; and iii) minimise adverse effects [1]. Since the introduction of the first sustained-release formulation of Dexedrine in the 1950s, modern drug delivery methods have experienced constant advancement [2]. Any DDS's objective is to deliver and maintain therapeutic drug concentrations at the targeted biological site. A drug formulation, such as a tablet, capsule, ointment, or solution, is referred to as a "DDS" [3].

When it comes to delivering drugs to specific bodily regions, traditional methods of drug administration face several obstacles. Since the development of medical application systems, numerous drugs are being provided through a variety of traditional drug delivery dosage forms to treat a variety of diseases [4,5]. These dosage forms include solutions, lotions, mixtures, creams, pastes, ointments, powders, suppositories, suspensions, injectables, pills, immediate-release capsules and tablets, and so on. Some of these traditional dose forms are still used today as the main medication delivery dosage products. These might not always support the best treatment outcomes, though. An innovative drug delivery method can significantly enhance the safety, effectiveness, and patient compliance with already available medicine in addition to the existing ones [6-9].

Additionally, the technique through which a medicine is administered can have a big impact on its effectiveness. To allow for the

successful and safe application of all pharmaceuticals to patients, appropriate DDS must be developed [10-12]. There have been no studies published in the literature that have evaluated knowledge on drug delivery methods among dentists. Thus, the current study was carried out to ascertain dental students' knowledge of various drug delivery methods. The present article intends to emphasise the importance of various drug delivery techniques and highlights the latest advancement in the field.

MATERIALS AND METHODS

This was a cross-sectional questionnaire study conducted on oral healthcare professionals and students in Mysore population. The present study's questions were developed and evaluated by two prominent specialists in the field of oral medicine. Ethical certificate was obtained from the Institutional Ethical Committee with approval number JSSDCH 30/2020. The present study was carried out during August 2022 and September of 2022.

Inclusion criteria: Postgraduate and undergraduate dental students, general dentists, specialist dentists, were included in the study.

Exclusion criteria: Participants who were not willing to be a part of the study were excluded from the study.

Sample size calculation: The study population was selected using convenient random sampling. Sample size assessed using G* power software was 75.

Study Procedure

A self-structured closed-ended questionnaire was designed based on the findings of a focus group discussion with experts in the

field. The experts and the 15 pilot study respondents checked the questionnaire's content validity, and the questionnaire was refined based on their comments and feedback. Based on Cronbach's alpha, the reliability of the questionnaire developed for the study indicated a good internal consistency with a value of 0.88. The practitioners' feedback was used to create the final questionnaire consisting of 12 questions. There was no scoring system, and the individual item response was tabulated and analysed accordingly. The questionnaire was created using Microsoft forms (forms.office.com), and the link was forwarded through digital media WhatsApp, to oral healthcare professionals. Identities of the participants were kept anonymous. After the deadline, the collected data was subjected to statistical analysis.

STATISTICAL ANALYSIS

The data was collected electronically, tabulated in a spreadsheet, and descriptive statistics were calculated using Microsoft excel 2019. Using International Business Management (IBM) Statistical Package for the Social Sciences (SPSS) software version 23.0, the interobserver reliability of the respondents was evaluated using kappa statistics and Cronbach's alpha (good=0.80). The study was analysed by descriptive statistics such as frequency and percentage.

RESULTS

A total of 75 respondents participated and responded in this study. The mean age of the participants was 22±2.3 years. All the participants (N=75) in the present study were aware of various methods in drug delivery methods. A 92% (n=69) of participants knew about various drug interactions. An 86.66% (n=65) knew about various forms in oral DDS. A 56% (n=42) prescribe sublingual mode of drug delivery. A 60% (n=45) had knowledge about buccal route of administration. A 42.66% (n=32) were familiar with transmucosal drug delivery patches. A 70.66% (n=53) knew information regarding parenteral route of drug administration. With regard to nano-based DDS (Q9, Q10, Q11), the participants had difference of knowledge. Only 42.66% (n=32) were acquainted with microneedle based transdermal delivery system, 33.33% (n=25) about nanocrystals and 21.33% (n=16) about 3D printing technology in DDS. A 97.33% (n=73) of the participated subjects thought that, selection of appropriate DDS plays a role in its therapeutic efficacy [Table/Fig-1].

S. No.	Question	Yes n (%)	No n (%)
Q1	Are you aware of various Drug Delivery Systems (DDS)?	75 (100%)	0
Q2	Do you know about drug interactions?	69 (92%)	6 (8%)
Q3	Do you know about various forms of oral drug delivery method?	65 (86.66%)	10 (13.33%)
Q4	Do you prescribe sublingual mode of administration?	42 (56%)	33 (44%)
Q5	Are you aware of various forms in sublingual method of drug administration?	36 (48%)	39 (52%)
Q6	Do you know about buccal route of drug administration?	45 (60%)	30 (40%)
Q7	Are you aware of transmucosal drug delivery patches?	32 (42.66%)	43 (57.33%)
Q8	Do you know about various route of parenteral mode of drug administration?	53 (70.66%)	22 (29.33%)
Q9	Do you know about micro-needle based transdermal drug delivery method?	32 (42.66%)	43 (57.33%)
Q10	Do you know about nanocrystals in drug delivery method?	25 (33.33%)	50 (66.66%)
Q11	Are you aware about 3D printing technology in drug formulations?	16 (21.33%)	59 (78.66%)
Q12	Do you think appropriate DDS plays a role in therapeutic efficacy?	73 (97.33%)	2 (2.66%)

[Table/Fig-1]: Sample distribution of responses.

DISCUSSION

Despite substantial progress in the design and development of new drugs, many of them still have undesirable side-effects because they interact with areas of the body other than the ones they are intended to address. To ensure that all medications are administered to patients safely and effectively, appropriate DDS must be developed for each medication [13]. DDSs regulate both the drug's adverse effects and its therapeutic effects, as well as its rate of release and rate of absorption. Ideal DDSs make sure the active medicine is accessible at the site of action by the patient's needs during the prescribed period [14].

Occasionally, adverse effects might happen based on the drug, the administration method, and our body's reaction. Unfavourable side-effects might result from the accumulation of high blood plasma drug concentration brought on by the frequent administration of traditional DDS. Therefore, efforts must be taken to ensure that the reduction in the number and frequency of doses required to maintain the desired therapeutic responses results in greater patient compliance [5]. The kind and intensity of these adverse effects might differ widely from person to person. The drug's effectiveness can be significantly impacted by the way it is administered.

In this assessment about awareness of various methods in DDS, the knowledge was assessed based on 12 'Yes' or 'No' questions. Most of the participants in the present study had sound knowledge about various drug interactions. This is in contrary to the online survey conducted by Yuan J et al., who demonstrated a lack of appreciation of the clinically relevant medication interactions [15]. In the assessment of level of knowledge about buccal and sublingual mode of drug administration, the participants had relevant knowledge but their knowledge regarding various forms in sublingual mode was less. Moreover, when asked about transmucosal drug delivery patches, 64% of the participants were aware of it.

Dental students know very little about nanodrug delivery methods. Nanotechnologies are clearly not a matter of public engagement, and even students enrolling in a professional degree are not exposed to them. In undergraduate degree, students have little opportunities to engage with nanodrugs. The results mirror similar tendencies to the study conducted by Al-Nemrawi NK et al., who evaluated the level of nanotechnology awareness among pharmacy students [16].

Hence, it is important to appropriately train the future graduates about the use of drug delivery methods and nanotechnology in drug delivery methods.

Limitation(s)

There are some limitations to the generalisability of the results in the present study, and it's possible that, they don't accurately represent the understanding of DDS among dentists in general. Also, the dental students, practising dentists, and specialist dentists, all have differing levels of education and practise excellence, and the research population is not evenly distributed among the participants.

CONCLUSION(S)

Participants in the present study had excellent knowledge about traditional drug delivery methods. However, there was inadequate knowledge among the study population regarding recent advances in nanotechnologies. It is essential for the oral healthcare professionals to have sound knowledge about various methods in DDS and its recent advances. In the last few years, a number of innovative drug delivery methods have significantly improved, and this trend is anticipated to continue in the near future. The need for research on DDS extends beyond sways to administer new pharmaceutical therapies.

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