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The Availability of Modern Technologies in Dental Clinics Across Uzbekistan

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ABSTRACT

In the study of dental surgeons and implantologits , the purpose of the research was to determine which modern technologies in dental practices are adopted and what devices are used by a proportion of practitioners. The sample of respondents was asked to fill out the Google Form containing 9 specific questions about the availability of certain devices. Then, all the responses were collected and analyzed to understand the current position of the dental market in Uzbekistan. Specifically, what trends, problems, and shortages can be the reasons for the slow adaptation of modern technologies? As a result, it is found that although there are enough providers of dental equipment, financial problems of specialists and the prices of those modern devices being high are the reasons for slow development in the dental technology industry of Uzbekistan.

KEYWORDS: dentistry, dental devices, Uzbekistan, modern equipment.

INTRODUCTION

In dentistry, as in many other fields, technological alternatives to conventional practices are constantly emerging. New technologies are already utilized in many aspects of the dental workflow. Almost without fail, they are brought to dentists' attention in their career practices, conferences, correspondence, courses, and advertisements. As with high-tech objects in other areas of life, such as smartphones, social media platforms, and car technology, their presence is felt in many aspects of daily life, making treatment procedures easier for dentists and comfortable for patients. At the same time, they are not adopted by all specialists simultaneously; rather, the adoption process might be influenced by several factors, such as financial availability and the potential benefits of those technologies.

The research was conducted in Uzbekistan because the lack of academic research on the availability of dental devices in Uzbekistan's dental market was discovered. Although similar research might exist, it is not publicly available.

In Uzbekistan, particularly, the reasons for the slow adoption of modern instruments are related to the prices of dental services, which are not high enough to allow practitioners to purchase modern technologies. Moreover, there are more general dentists compared to specialists with narrow specialties, which is another reason not to delve deeply into a particular field – orthopedics or endodontics – that hinders the need for buying more technologies aimed at specific tasks. Still, there are some expensive modern devices in the dental market of Uzbekistan, and there are few specialists in regions like Tashkent and Samarkand who can afford those devices because the cost of service is relatively high there.

The objective of the conducted research is to understand the current conditions of dental practitioners from all over Uzbekistan, and which regions lack certain modern devices. The analysis of responses for this survey can lead us to unfold the answers for certain questions related to the dental field. Firstly, what is the current situation of the dental market? Specifically, what devices do dental specialists use these days? Secondly, which devices are not available for dentists to use, and in what ways can dentists benefit from adopting those devices? Thirdly, what kinds of modern treatment protocols are available throughout the world, but Uzbekistan? Finally, are those modern treatments not available because of poor adoption of modern technologies? If so, what can be done to overcome this scarcity?

1 Methodology

Firstly, to answer these questions, a survey was constructed by Abdulloh Ochilov in collaboration with the team of

Risus Dental Clinic, specifically with Dr. Umid Ochilov (Medical residency in Dentistry at TMA) and Dr. Abdulaziz Ochilov (M.A. in Dentistry at BSMI). The survey was conducted at Qarshi Pedagogical University (QPU) as part of the "Implantology" conference held for dental practitioners across the country. They were gathered for the lecture on implantology by Dr. Javlon Abzalov (Medical Residency in Dentistry at ANDC) and Dr. Ulug'bek Abdusattarov (Medical residency in Dentistry at SamMU)—practising dentists in the field of implantology and dental surgery. At the same time, my team has developed a form to inquire about the availability of dental instruments all over Uzbekistan. The survey consisted of 65 subjects, including at least two specialists from all regions of Uzbekistan, all of whom work as either implantologists or dental surgeons. They were asked to fill out a form consisting of 9 questions. The survey consisted of a mixture of drop-down and open-ended questions. The following is the list of questions as they appear in the survey:

1. Write your region:
2. Which of the given equipment do you have?

a. Apex Locator
b. Endomotor
c. Portable Dental X-ray
d. CBCT
e. Microscope
f. Binoculars
g. Intraoral camera
h. Dental Photocamera
i. Dental Chair

3. What brands of medical equipment do you use?

a. J Morita
b. Dentsply
c. Woodpecker
d. NSK
e. AppleDental
f. Zoomax
g. Examvision
h. Univet
i. VDW

j. COXO
k. Zeiss
l. Canon
m. Nikon
n. Vatech
o. Roson
4. How long do you use the given equipment?
a. Apex Locator:
b. Endomotor:
c. Portable Dental X-ray:
d. Dental Chair:
5. Which equipment is the most expensive?
6. Which equipment problems are difficult to repair? (Technicians are in short supply.)
7. Which piece of equipment do you find the most durable or long-lasting? (Name one.)
8. Write your top 3 most frequently used devices
9. Which device do you find the most difficult to adapt to and use?

These questions were asked with the intentions to understand market trends, barriers, shortages, and hardships associated with usage, as well as which devices were commonly used in practice. Specifically:
Question #1 was asked to determine the places where dentists work. So, we could attribute the rate of adoption of modern equipment. However, as the survey was conducted in Kashkadarya, more local dentists attended this survey. As a result, the sample revealed biased rates of regional distribution.
Question #2 was asked to determine the proportion of specialists who have the listed devices. With this in mind, we can identify the most and the least common devices in Uzbekistan.
Question #3 about the brands of equipment was asked to find the currently available companies in the Uzbek dental market and to understand which devices are preferred by specialists based on the devices' prices.
Question #5 was asked to understand which device is expensive. By this, we can determine which device is lacking due to its price.
Questions #4, #6, #7 were focused on technical aspects and durability. The technical issues that occur while utilizing those devices are important to include. By identifying which devices are most durable and which have inspection-related issues, further analysis of specific technologies can be beneficial for engineers responsible for repairing dental equipment in Uzbekistan.
Question #8 was asked to figure out what devices are the most commonly used ones, so we could figure out which procedures are widely conducted by dentists.
Question #9 was asked to identify the types of modern technologies that can be challenging to adopt, and therefore, serve as the theme for further dental lectures to help struggling specialists adapt certain modern technologies. [12pt]article [utf8]inputenc geometry a4paper, margin=1in

2 Results and Discussion

2.1 Most Common Dental Equipment

Three devices were found to be the most common among all devices: Apex Locator, Endomotor, and Dental X-ray.

2.2 Electronic Apex Locators (EALs)

It was determined that out of 65 dentists surveyed, 54 (83.1%) practitioners reported using an Electronic Apex Locator. Electronic Apex Locators are used in root canal treatment (RCT) procedures to determine the working length (WL) of the root (Shirazi et al. (1)). WL is the measurement from a reference at the coronal portion of the tooth to a specific location where the root canal procedures should end (Kaur et al. (2)). In fact, the precise determination of working length is considered a crucial step because it is the foundation for thorough debridement (cleaning and shaping), reliable obturation (filling with gutta-percha or other biomaterial), and durable coronal seal—all critical factors for successful root canal treatment (Tabassum et al. (3)). The prevalent availability of Electronic Apex Locator among many Uzbek dental practitioners can be explained by the fact that EALs have advantages of easy and fast application, reduction of radiation exposure, detection of perforations, safe use in pregnancy in patients with vomiting reflex, and mentally retarded patients (Yilmaz et al. (4)). Additionally, EALs are cost-effective, ranging from around $180 for inexpensive variations and around $700 for more expensive and higher-quality types.

2.3 Portable Dental X-rays

61 (93.8%) participants reported that they use Portable Dental X-Ray. Another finding from the survey was that Portable Dental X-rays were common, indicating that 61 participants out of 65, or 93.8%, use them in their practices. Portable Dental X-rays serve as a tool to take radiographic images of bones, teeth, jaws, and surrounding tissue (Vieyra et al. (5)). Additionally, Portable Dental X-rays are easy to carry, lightweight, and cost-effective. Moreover, dentists use it to analyze the current oral situation and to provide effective endodontic treatment protocols. To determine the position of the root tip and working length of the root, practitioners use X-rays analogous to EALs. This method of usage even predates the EALs' use. Radiographs are still the standard procedure for determining WL; however, the accuracy of canal length determination is challenging because the apical constriction (AC) cannot be recognized. Furthermore, numerous variables in this technique, such as angulations and exposure, can affect the final image, resulting in errors. Finally, the consensus on determining the WL of the root is that the most appropriate way to measure WL is to integrate the radiographic images of Portable Dental X-rays with EALs (Shirazi et al. (1)). Thus, we can attribute the preference for using Portable Dental X-ray among Uzbek specialists to its relative ease of use, cost-effectiveness, and high success rates in treatments while integrating with EALs.

2.4 Endodontic Motors

The same number of participants—61 out of 65—reported that they use endomotors in their practices. An endodontic motor is used in root-canal therapy to mechanically remove infections from the root canals (with a file) and to widen the working space during the procedure. By rotating endodontic files (NiTi rotary files), it removes pulp, bacteria, and debris from root canals, making canal walls smooth for obturation (filling the canal). Endomotor is more effective than other methods of canal preparation when used with the correct methodology. Due to its controlled torque and speed, it reduces the risk of canal transportation or perforation, making the procedure faster and less painful (Brkanic et al. (6)).´ Moreover, file breakage (using files for too long or applying too much force, which weakens the file so that it breaks while in the canal of the root)—a common problem among other methods like manual filling—is prevented for autoreverse and torque control functions. Other methods, such as manual filling and self-adjusting files (SAF system), are also used in canal preparation. Although these ways are cost-effective ($45 for file NIti compared to $250–$530 Endomotors with basic features and $700–$750 with advanced

features) and minimally invasive in some cases, machine-driven rotary instruments—endomotors—are effective, accurate, and faster (Brkanic et al. (6)). According to Sergo Dental, the price´ for endomotors ranges from $700–$750 for the model with advanced features (good torque/speed control, reciprocal + rotary) and more for more specialized models. In conclusion, dental specialists in Uzbekistan utilize Endodontic motors for their time-saving, low-risk, and less painful procedures, benefiting both themselves and patients.

2.5 Magnification Devices: Loupes vs Microscopes

Dental loupes were more prevalent than microscopes: 36% of respondents reported they used the former, while only 3.1% said they used the latter. The tenfold difference in usage between the two types of magnification devices can be explained by the fact that dental loupes have a relatively affordable price, being around $1300–$1400 according to Sergo Dental, and an easier usage protocol. Indeed, more participants reported microscopes as expensive relative to binoculars. However, some disadvantages limit the use of loupes among dentists: the lack of a fixed position (fine movements of the dentist's head disturb the image of the magnified operating field); the need to change the loupes to achieve different magnifications. On the contrary, the use of a dental microscope requires minimal adjustment and effort to reduce postural deviation while working. Microscopes offer adjustable magnification (magnification range 4x–25x), while most loupes provide fixed magnification (magnification range 2.5x–6x) (Bud et al. (7)). Magnification in the range 2x–8x is considered low-magnification, 8x–16x—mid-magnification, and 16x–25x—high-magnification. While loupes are limited to operate only within a low range of magnification, microscopes allow performing in all three types of magnification.

2.6 Dental Imaging Devices

The application of dental imaging devices in practice is found to be relatively low, as can be seen that only 8 participants responded that they use Intra Oral Cameras, and only 23 specialists are owners of dental photo cameras. IOCs and dental photocameras are considered dental imaging devices in teledentistry. They capture 2-dimensional images of the oral cavity and are regarded as tools to improve patients' awareness about their oral conditions, documentation of records and treatment, illustration of lectures, publication, and web connectivity of complicated cases (Pentapati et al. (8)). IOC systems consist of a video display, processing unit, and intra-oral camera with a light source while dental photo camera consists of camera body (the main, core part of a digital camera, whether it's a DSLR or a mirrorless model, that houses essential components like the shutter, image sensor, and viewfinder), macro lens, and a flash (ring-shaped or twin). Dentists prefer dental photo cameras over IOCs because although images by IOCs are accurate enough for teledentistry, their qualities are still below what dentists expect for esthetic cases, documentation, and marketing. However, the prices for dental photocameras are higher than those of IOC, being around $1700–$2200 (with all necessities) and around $200–$500 (fundamental variations) respectively.

2.7 Cone-Beam Computed Tomography (CBCT)

It is clear from the survey's results that Cone-Beam Computed Tomography (CBCT) is used as well, but by only around 10 respondents. Cone-beam computed tomography (CBCT) has revolutionized the field of dentistry with its ability to provide three-dimensional (3D), high-resolution images of the oral and maxillofacial structures. Unlike traditional 2D dental radiography, CBCT provides more comprehensive visualizations that are not adequately visualized by 2D radiography, aiding in precise diagnosis, treatment planning, and post-treatment assessment. In addition, CBCT is beneficial in various dental procedures such as Dental Implanting, Orthodontics, and Endodontics (Baccher et al. (9)). Firstly, by providing

images of bones, CBCT aids in determining the quantity and quality of available bone, identifying vital structures such as nerves and sinuses, and optimizing the implant position and angle (Venkatesh et al. (10)). Secondly, CBCT facilitates comprehensive assessment of dentofacial structures, enabling orthodontists to analyze skeletal relationships, temporomandibular joint (TMJ) morphology, and tooth angulation and inclination, and enables the specialists to provide a successful treatment protocol (Cattaneo et al. (11)). Thirdly, CBCT helps to visualize intricate root canal anatomy, detect the presence of additional canals, evaluate the extent of root resorption, and localize periapical lesions, making it easier for endodontists to form a treatment protocol accurately (Scarfe et al. (12)). However, the principal risks and limitations include ionizing radiation, the presence of artifacts, higher cost, limited accessibility, and the need for additional training (Abdelkarim (13)). CBCT equipment and imaging procedures are more expensive compared to 2D radiography, limiting their accessibility in certain dental practices and facilities (Baccher et al. (9)). Because of these reasons, the majority of Uzbek dentists cannot purchase CBCT. Indeed, 41 participants, or 63.1%, marked CBCT as the most expensive device among those surveyed.

3 Conclusion

In the dental market of Uzbekistan, costs for modern dental equipment have a significant influence on the adoption of modern technologies by dental specialists. Brands that are known for quality and have been present on the market for a long time are more expensive. Therefore, dentists look for alternatives with lower prices, such as devices provided by certain Chinese manufacturing companies. Moreover, even though the brands of equipment are not considered, some modern technologies are manufactured at high costs. Thus, their sale prices become even more, preventing dentists from purchasing them specifically in Uzbekistan.

The application of this research paper can be meaningful for newly opened dental equipment stores in order to investigate the market.

Still, there are many topics related to dental equipment adoption that are significant to research about. For example, the discussion of the ways in which modern equipment can be effectively adapted is a crucial factor for dental equipment industry development.

4 Limitations

The research project has some limitations related to data collection and the scarcity of available literature on equipmentrelated articles in Uzbekistan. For example, the sample size of respondents was 65, with 25 being from Kashkadarya. This disproportionated sample can lead to biased results in the regional distribution of available dental equipment. Another difficulty was the prices of equipment. On the websites of dental-equipment stores in Uzbekistan, there was no precise information given about the prices of equipment. However, prices were assessed by calling directly to the call centers of those stores.

References

1. Shirazi Z, Al-Jadaa A, Saleh A. Electronic Apex Locators and their Implications in Contemporary Clinical Practice: A Review. *Open Dent J*, 2023; 17: e187421062212270.
2. Kaur G, Thomas AR, Samson RS, Varghese E, Ponraj RR, Nagraj SK, Shrivastava D, Algarni HA, Siddiqui AY, Alothmani OS, Srivastava KC. Efficacy of electronic apex locators in comparison with intraoral radiographs in working length determination- a systematic review and meta-analysis. *BMC Oral Health*. 2024 May 4;24(1):532.

3. Tabassum S, Khan FR. Failure of endodontic treatment: The usual suspects. *Eur J Dent*. 2016 Jan-Mar;10(1):144147.
4. Ayca Yilmaz, Selc¸uk Gokyay, Bas¸ak Gokyay, ˙Ilda Sinem Birdal and Enver Sedat Kucukay (2015). "Clinical Efficacy of Three Different Electronic Apex Locators in Comparison with Radiographic Working Length Determination". *Journal of Research and Practice in Dentistry*, Vol. 2015 (2015), Article ID 260644.
5. Vieyra JP, Acosta J. Comparison of working length determination with radiographs and four electronic apex locators. *Int Endod J*. 2011 Jun;44(6):510-8.
6. Brkanic T, Zivkovi´ c S, Drobac M. [Root canal preparation techniques using nickel-titanium rotary instruments].´ *Med Pregl*. 2005 Mar-Apr;58(3-4):203-7.
7. Bud M, Jitaru S, Lucaciu O, Korkut B, Dumitrascu-Timis L, Ionescu C, Cimpean S, Delean A. The advantages of the dental operative microscope in restorative dentistry. *Med Pharm Rep*. 2021 Jan;94(1):22-27.
8. Pentapati, K. C., & Siddiq, H. (2019). Clinical applications of intraoral camera to increase patient compliance current perspectives. *Clinical, Cosmetic and Investigational Dentistry*, 11, 267–278.
9. Baccher S, Gowdar IM, Guruprasad Y, Solanki RN, Medhi R, Shah MJ, Mehta DN. CBCT: A Comprehensive Overview of its Applications and Clinical Significance in Dentistry. *J Pharm Bioallied Sci*. 2024 Jul;16(Suppl 3):S1923-S1925.
10. Venkatesh E, Elluru SV. Cone beam computed tomography: basics and applications in dentistry. *J Istanb Univ Fac Dent*. 2017 Dec 2;51(3 Suppl 1):S102-S121.
11. Cattaneo PM, Melsen B. The use of cone-beam computed tomography in an orthodontic department in between research and daily clinic. *World J Orthod*. 2008 Fall;9(3):269-82.
12. Scarfe WC, Levin MD, Gane D, Farman AG. Use of cone beam computed tomography in endodontics. *Int J Dent*. 2009;2009:634567.
13. Abdelkarim A. Cone-Beam Computed Tomography in Orthodontics. *Dent J (Basel)*. 2019 Sep 2;7(3):89.