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Knowledge, awareness and practice of digital study models and conventional study models among orthodontists and post-graduate students: A cross sectional pilot survey

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***Abstract*---**Introduction: Digital study models today, provide the state-of-art infrastructure for the diagnosis and treatment planning in orthodontic malocclusions. Its versatility and wide scope of application makes it a valuable alternative to conventional study models. However, affordability and lack of knowledge may be the reasons for its limited use, presently. Hence, it was aimed to assess the knowledge, awareness and practice of digital and conventional study models among orthodontists and post-graduate students. Methods: A close-ended self-constructed questionnaire comprising of fifteen questions was administered to 50 orthotists and 50 post-graduate students. Frequency distribution of the answers given by the participants in each domain (knowledge, awareness and practice) was presented graphically. Results: The orthodontists had a better understanding and also were more inclined to digital study model as compared to the post-graduates. Storage and sterilization are the main concerns addressed by the digital study model, whereas conventional study models still remain less expensive. Conclusion: Orthodontists as well as post-graduates possess sufficient knowledge about digital study models, with orthodontists having a slight edge over the post-graduate students.

***Keywords*---**digital, conventional, study models, orthodontic practitioners, students.

Introduction

Record maintenance in orthodontics is of paramount importance. Be it for orthodontic diagnosis or treatment planning, there are certain requirements that an orthodontist has to procure from the patient under study. These requirements come in the form of diagnostic aids, which can be broadly divided into essential and supplemental diagnostic aids [1]. These diagnostic aids guide the orthodontist towards a more precise diagnosis of the malocclusion and accordingly formulate a viable and effective treatment plan. Apart from case history, clinical examination, radiographs and photographs, study models are one of the important essential diagnostic aids [2]. Conventional orthodontic study models give a 3-Dimensional view of the patient's dentition that lets the orthodontist fully view and analyse the malocclusion in all three planes. This alleviates the need for the patient to be physically present for the treatment planning. Also, it facilitates the orthodontist in explaining the treatment plan to the patient, towards a better understanding of the underlying problem [2]. Furthermore, they can be used to fabricate various appliances, which can be checked for fit, prior to insertion in the mouth. This reduces the chair side adjustment time, improves accuracy and patient compliance.

However, the process involved in obtaining the study model is time consuming. Especially in today's generation where time is money, even the smallest amount of time employed in study model preparation is considered cumbersome. Storage of these study models is another drawback. Multiple study models are required per patient for every progress in their treatment stages. This only adds up to the issue as the number of patients increases. Storage of these study models and retrieval of older models makes the work more complicated, necessitates the need for manpower, loss of valuable time and reduces the quality of work [3]. With recent advances in digital dentistry, study models are slowly turning out to be a thing in the past. Digital models are the need of the hour. They are easy to use, patient friendly and do not require much work as compared to conventional study models. Digital models can be stored electronically and their retrieval is within seconds. Digital scanning is a more compliant alternative to the cumbersome impression making procedure, from the patient's point of view [4]. Apart from these benefits, digital models also enable the orthodontist to simulate the treatment digitally and view its outcome within minutes. Recent advances in technology and emergence of newer alternatives to fixed orthodontic therapy is slowly shifting the focus of many orthodontists towards digital dentistry [5]. However, the awareness and its usage is not widespread. The extent of application of digital models in private sectors and educational institutions could shed more light on its impact in the society, in terms of productivity and feasibility. Hence, the purpose of this survey was to evaluate the knowledge, awareness and practice of using conventional and digital study models among orthodontists and post-graduate students.

Materials and Methods

A pilot survey was conducted among 100 participants, to assess knowledge, awareness and practice of digital and conventional study models in orthodontic practice. A close-ended questionnaire comprising fifteen questions with five

questions in each domain (knowledge, awareness and practice) was developed. The ease of comprehension, content and validity of questionnaire construction were tested by circulating the questionnaire to 20 specialist orthodontists who were faculty members in dental schools and were associated in academics. The kappa value obtained was 0.83 which was a good agreement among them. After making few corrections as suggested by the orthodontists, the questionnaire was then administered to 50 orthodontic private practitioners and 50 orthodontic postgraduate students in printed form. Descriptive statistics in terms of frequency distribution was calculated for the data obtained. Non Parametric Chi – square test to test the significance of responses in the knowledge, awareness and practice domain among orthodontic practitioners and postgraduate students was done using SPSS software version 23.

Results

The frequency distribution of the choices that were made under the knowledge domain are depicted in (Table 1-3). Comparison of knowledge, awareness and practice among practitioners and post-graduate students assessed by Non-Parametric Chi square test shows that there is a statistically significant difference for most of the responses between the two groups ($P<0.05$) (Table 4).

Discussion

The responses of this cross-sectional survey report that the orthodontic practitioners had more knowledge and awareness about digital models than postgraduates. Practitioners prefer digital as well as conventional study models in daily practice, whereas postgraduates preferred digital study models more than conventional study models. Practitioners were well versed with digital model analysis and appliance fabrication than postgraduates. Most of the orthodontists were aware of the software used for digital model analysis, as opposed to 52% of orthodontic postgraduate students and the difference in awareness among them was significant ($P <0.05$). Brass wire was the standard method used for measuring arch perimeter in conventional study models by most of the postgraduate students as compared to orthodontists ($P < 0.05$).

Awareness about the armamentarium used to do measurements in manual study models, whether scanning of manual models was done or direct scans were taken and when asked about the available intraoral scanner, there was no significant difference between practitioners and postgraduates. ($P > 0.05$). Since Vernier calliper has an accuracy of 20µm, most of the study participants chose vernier calliper over divider and calibrated scale for doing measurements on conventional models [6]. As intra-oral scanner was the direct method of obtaining intra-oral records, it was chosen over alginate and model scanners. Most of the orthodontists and some post graduates were confident to do scanning on their own and the difference was not significant. Most of the Orthodontists (84%) were aware of the procedures involved in the preparation of the study model whereas not all of post graduates (64%) were aware of it and the difference was significant ($P < 0.05$). Orthodontists were more confident at performing digital model analysis and appliance fabrication compared to post-graduates and the difference was statistically significant ($P < 0.05$). Orthodontists had more awareness about

appliance fabrication and virtual bracket placements when compared to orthodontic post-graduates. These two responses however, were not statistically significant.

Most of the orthodontists (68%) chose digital scanning as their preferred impression making material. On the contrary, most postgraduates (44%) opted for hydrocolloids as their choice of impression material ($P < 0.05$). This could be attributed to the lack of accessibility to digital scanners in certain educational institutions, which lays more emphasis on conventional impression making for training purposes. Orthodontists preferred both digital as well as conventional study models whereas post graduates opted for digital study models ($P < 0.05$). Both orthodontists as well as post-graduates cited storage convenience as the main reason to opt for digital study models. 42% of orthodontists chose better visualization as the reason to opt for manual study models, whereas post graduates chose less expense as the reason to opt for manual study models. ($P > 0.05$)

Digital study models are faster to obtain and are a more accurate representation of intraoral structures. Although it involves a learning curve, it is better accepted by both orthodontists as well as patients.[6] Storage convenience and reduced armamentarium add on to its credentials. Digital models also facilitate the ability to accurately position brackets to the teeth and also to simulate and plan tooth movements [7]. This helps in better prediction of the treatment outcome. Furthermore, digital appliance fabrication is also made possible with the help of digital study models. This effectively cuts down laboratory time and manpower. Also, with an accuracy rate of 20µm when tested with Mitutoyo gauge, which has an accuracy of 10µm, digital models can be considered to be reliable [8].

Previous studies have not attempted to do a comparative survey on practicing orthodontists and post graduates on the use of digital and conventional study models. However, there are a few studies evaluating the accuracy and shortcomings of digital models. One such study shows that there is no significant difference between the measurements obtained from digital and conventional study model [9]. Asquith et al., in his study showed that there was no significant difference between digital and conventional study models in terms of treatment planning [10]. Study conducted by Zilberman et al., showed that measurements done on conventional study models using a digital calliper is more accurate than digital study model [11]. Burhardt et al., in his study showed that younger orthodontic patients preferred digital scanning over alginate impression. This was mainly due to the ease of impression making and patient compliance. However, the chairside time taken was lesser with alginate impression [4]. Yuzbasioglu et al., in his study also showed patients to be more receptive to digital scanning as compared to the conventional means [4,12].

Conclusion

Both, the orthodontists as well as post-graduate students seem to be well aware of the practice of digital study models. The orthodontic practitioners seem to be more inclined towards digital study models for its application as compared to post graduates.

Clinical Significance

- Digital study models will effectively reduce the requirements of storage space.
- It will reduce the need for additional manpower.
- 3-Dimensional simulation of treatment outcomes will be made possible with digital study models, which was previously not an option with conventional study models.

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References

1. Hatcher DC, Aboudara CL. Diagnosis goes digital. Am J Orthod Dentofacial Orthop. 2004. 125:512–5.
2. Rheude B, Sadowsky PL, Ferriera A, Jacobson A. An evaluation of the use of digital study models in orthodontic diagnosis and treatment planning. Angle Orthod. 2005 May;75(3):300–4.
3. Polido WD. Moldagens digitais e manuseio de modelos digitais: o futuro da Odontologia. Dental Press J Orthod. 2010;15(5):18–22.
4. Burhardt L, Livas C, Kerdijk W, van der Meer WJ, Ren Y. Treatment comfort, time perception, and preference for conventional and digital impression techniques: A comparative study in young patients. Am J Orthod Dentofacial Orthop. 2016 Aug;150(2):261–7.
5. Mangano F, Gandolfi A, Luongo G, Logozzo S. Intraoral scanners in dentistry: a review of the current literature. BMC Oral Health. 2017 Dec 12;17(1):149.
6. Lee SJ, MacArthur RX, Gallucci GO. An evaluation of student and clinician perception of digital and conventional implant impressions. The Journal of Prosthetic Dentistry. 2013 110:420–3.
7. Grauer D, Proffit WR. Accuracy in tooth positioning with a fully customized lingual orthodontic appliance. Am J Orthod Dentofacial Orthop. 2011.140:433–43.
8. Bukhari SAA, Reddy KA, Reddy MR, Shah SH. Evaluation of virtual models (3Shape Ortho System) in assessing accuracy and duration of model analyses based on the severity of crowding. The Saudi Journal for Dental Research. 2017.8:11–8.
9. Cho S-H, Schaefer O, Thompson GA, Guentsch A. Comparison of accuracy and reproducibility of casts made by digital and conventional methods. The Journal of Prosthetic Dentistry. 2015. 113:310–5.
10. Asquith JA, McIntyre GT. Dental Arch Relationships on Three-Dimensional Digital Study Models and Conventional Plaster Study Models for Patients with Unilateral Cleft Lip and Palate. The Cleft Palate-Craniofacial Journal. 2012. 49:530–4.

11. Zilberman O, Huggare JAV, Parikakis KA. Evaluation of the validity of tooth size and arch width measurements using conventional and three-dimensional virtual orthodontic models. Angle Orthod. 2003 Jun;73(3):301–6.
12. Yuzbasioglu E, Kurt H, Turunc R, Bilir H. Comparison of digital and conventional impression techniques: evaluation of patients' perception, treatment comfort, effectiveness and clinical outcomes. Vol. 14, BMC Oral Health. 2014.
13. Gede Budasi, I. & Wayan Suryasa, I. (2021). The cultural view of North Bali community towards Ngidih marriage reflected from its lexicons. Journal of Language and Linguistic Studies, 17(3), 1484–1497
14. Ghita, D. ., Ahmad, M. ., Budi, P., Liantanty, F. ., & Ahmar, H. . (2021). Effect of e-module stage iv childbirth care with blended learning model on skills improvement of midwifery students. International Journal of Health & Medical Sciences, 4(1), 110-116. https://doi.org/10.31295/ijhms.v4n1.1527

Legends of Illustration

Table 1: Frequency distribution of choices made in knowledge domain
Table 2: Frequency distribution of awareness among participants
Table 3: Distribution of practice on digital model analysis among participants
Table 4: Comparison of knowledge, awareness and practice among practitioners and post-graduate students

Results

Table 1
Frequency distribution of choices made in knowledge domain

Questions	Group	Options		
		Faced (n) (%)	3shape (n) (%)	Dolphin (n) (%)
Which software is used for digital model analysis?	Orthodontists	5 (10%)	42 (84%)	3 (6%)
	Post –graduate students	4 (8%)	26 (52%)	20 (40%)
		Calibrated scale (n) (%)	Vernier calliper (n) (%)	Divider (n) (%)
What you use to do measurements in manual study cast	Orthodontists	4 (8%)	33 (66%)	13 (26%)
	Post-graduate students	2 (4%)	30 (60%)	18 (36%)
		Alginate (n) (%)	Model scanner (n) (%)	Intra-oral scanner (n) (%)
What is the direct method of obtaining intra-oral records for a digital study model	Orthodontists	4 (8%)	6 (12%)	40 (80%)
	Post-graduate students	6 (12%)	1 (2%)	43 (86%)
		Autoscan 3D-EX (n) (%)	Medit i500	iTero
Which among the following is not an intra-oral scanner	Orthodontists	29 (58%)	13 (26%)	8 (16%)
	Post-graduate students	19 (38%)	17 (34%)	14 (28%)
		Calibrated scale (n) (%)	Vernier calliper (n) (%)	Brass wire (n) (%)

How do you measure arch perimeter in a conventional model	Orthodontists	4 (8%)	7 (14%)	39 (78%)
	Post-graduate students	2 (4%)	1 (2%)	47 (94%)

Table 2
Frequency distribution of awareness among participants

Questions	Group	Options	
		Yes	No
Are you aware of the intra-oral scanning procedure	Orthodontists	42 (84%)	8 (16%)
	Post–graduate students	41 (82%)	9 (18%)
Are you aware of the procedures involved in the preparation of digital study model	Orthodontists	42 (84%)	8 (16%)
	Post-graduate students	32 (64%)	18 (36%)
Are you aware of the procedures involved in performing digital model analysis	Orthodontists	42 (84%)	8 (16%)
	Post-graduate students	28 (56%)	22 (44%)
Are you aware of the procedures involved in appliance fabrication using digital study models	Orthodontists	30 (60%)	20 (40%)
	Post-graduate students	21 (42%)	29 (58%)
Are you aware of the fact that you can virtually place brackets on a digital model	Orthodontists	40 (80%)	10 (20%)
	Post-graduate students	36 (72%)	14 (28%)

Table 3
Distribution of practice on digital model analysis among participants

Questions	Group	Options		
		Hydrocolloid (n) (%)	Elastomer (n) (%)	Digital (n) (%)
Type of impression material you prefer in clinical practice	Orthodontists	9 (18%)	7 (14%)	34 (68%)
	Post –graduate students	22 (44%)	8 (16%)	20 (40%)
Type of study model you prefer in orthodontic treatment planning		Conventional model (n) (%)	Digital model (n) (%)	
	Orthodontists	25 (50%)	25 (50%)	
	Post-graduate students	15 (30%)	35 (70%)	
Reason to opt for digital study model		Accuracy of measurement (n) (%)	Storage convenience (n) (%)	Time saving (n) (%)
	Orthodontists	13 (26%)	25 (50%)	12 (24%)
	Post-graduate students	15 (30%)	23 (46%)	12 (24%)
Reason to opt for manual study model		Less expensive (n) (%)	Better visualization (n) (%)	Simple to use (n) (%)
	Orthodontists	19 (38%)	21 (42%)	10 (20%)
	Post-graduate students	23 (46%)	20 (40%)	7 (14%)
		Conventional study model (n) (%)	Digital study model (n) (%)	
	Orthodontists	13 (26%)	37 (74%)	

Type of study model you recommend your fellow orthodontists	Post-graduate students	22 (44%)	28 (59%)

Table 4
Comparison of knowledge, awareness and practice among Orthodontists and post-graduate students

Domain	Question	Chi-square value (x^2)	df	p value
Knowledge	Which is the software used for digital model analysis?	16.441	2	0.000
	What do you use to do measurements on a manual study cast?	1.616	2	0.446
	Direct method of obtaining intraoral records for digital study models	4.080	2	0.130
	Which is not an intraoral scanner?	4.253	2	0.119
	How do you measure arch perimeter in a conventional model?	5.911	2	0.052
Awareness	Are you aware of intraoral scanning procedure?	0.071	1	0.790
	Are you aware of the procedures involved in preparation of digital study model?	5.198	1	0.023
	Are you aware of the procedures involved in digital model analysis?	9.333	1	0.002
	Are you aware of the procedures involved in digital appliance fabrication?	3.241	1	0.072
	Are you aware of the fact that you can virtually place brackets on digital models?	0.877	1	0.349
Practice	Material of preference for impression making?	9.148	2	0.010
	Preference of study model	4.167	1	0.041
	Reason to opt for Digital Study Model?	0.226	2	0.893
	Reason to opt for Conventional Study Model?	0.935	2	0.627
	Which study model would you recommend?	3.560	1	0.059

df – degree of freedom