

Archiving the Natural Dentition to Serve as Pre-extraction Record: Evaluating Perceptions Among Indian Prosthodontists

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Abstract This survey is undertaken to: (1) assess the perceptions of prosthodontist towards the concept of natural dentition archival (NDA); and (2) to obtain any further suggestions/recommendations regarding it. 616 prosthodontist across India participated in the study. Data was collected using a self- designed, self-administered, pilot tested, structured 10 item questionnaire. Results indicate that 32.1 % prosthodontists make use of pre-extraction records; 54.4 % seemed to give consideration to natural findings of the patient while denture fabrication; 86.7 % recommended patient aged 25–34 years to archive his/her natural dentition to serve as pre-extraction record; 92.2 % were willing to promote the NDA concept for their patients and 33.7 % thought that it is an extra burden. It was noted that postgraduate students (61.5 %) significantly gave more consideration to natural findings of the patient as compared to practicing prosthodontist and faculty ($p < 0.001$). Using, pre-extraction records was preferred by the prosthodontists from urban and periurban area as compared to those from rural area ($p < 0.05$). 67.8 % prosthodontists' viewed NDA as ideal for denture construction which will result in greater patient satisfaction. However, 46 % prosthodontists have raised concerns like: storage and preservation of cast and records being tedious, extra time needed and patient

motivation an added burden. 54 % recommended that NDA concept can be introduced and emphasized in the prosthodontic curriculum, so that the dental students learn and promote it to their future patients. Overall, the perception towards NDA is favourable and the prosthodontist needs to be motivated to utilize this concept.

Keywords Archiving · Indian prosthodontist · Natural dentition · Esthetics · Edentulousness

Introduction

Esthetics is an important dimension in dental practice and is related to individuals' preferences, culture, socio-demographic factors and perceived dental treatments [1]. Denture construction for the edentulous patient is challenging for the dentist in terms of combining esthetics with function and comfort. The best guideline in this respect comes from Hardy, who said, "make the teeth look like natural teeth". As the complete denture replaces the entire dentition and associated oro-facial structures, patients often request to retain natural shape, size, shade, teeth-alignment, overlap, diastema, rotations, significant differences in incisal edges or any other unique dental feature in their dentition. Further, greater percentage of patient satisfaction has been observed when the patient is involved during the esthetic decisions of denture making, and greater the esthetics, more successful is the overall denture [2]. However, in most cases, the dentist are left with no clue to trace the natural findings in the patients once it has been lost. Hence, if pre-extraction records can be collected, preserved and utilized later for artificial prosthodontic reconstruction, it can help give natural appearance to dentition and greater patient satisfaction.

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Most common pre-extraction records used are pre-extraction diagnostic casts [3], instruments (Dakometer, profile template, Wills gauge, Sorenson profile scale and orofacial device) [4, 5], measurements (between tattoo points and of closest speaking space) [6] and physiological rest position [7], profile photographs [8], radiographs [8] and preserved extracted teeth [9]. The information access from pre-extraction archive records help to compensate for progressive changes and help to establish vertical dimensions, serving a guide as a starting point for teeth-rearrangement. Smith [5] emphasized the use of pre-extraction records and even stressed on its inclusion in the prosthodontic curriculum. Silverman [10] also stated, “greater the number of pre-extraction records available to dentist, greater is the chance of success”.

“Natural Dentition Archival (NDA)” is conceptualized on generating pre-extraction records by the age of 25–34 years which can be utilized later (when needed in future) to fabricate the denture better, by incorporating near natural dental characteristics in it and ensure greater patient acceptability. Preparing a diagnostic cast, facial profile photograph, photograph of anterior teeth in occlusion and recording tooth shade are steps, which can be recommended for NDA.

This survey is an attempt undertaken to: (1) assess the perceptions of cohort of prosthodontist towards the concept of NDA; and (2) to obtain any further suggestions/recommendations regarding it.

Materials and Methods

The present survey was conducted among the prosthodontist fraternity (in India) who are either doing their post-graduation, private practitioners, and/or faculty in dental institutions. The data was collected in 2 parts: part 1: about 800 forms were distributed at the 14th Indian Prosthodontic Society’s PG Convention held at Mangalore during June 2012, of which 416 filled forms were received. Part 2: to have representation from entire prosthodontist cohort across dental institutions in India, a questionnaire was posted to the department of prosthodontics of the 298 dental colleges in India, of which 200 filled forms were received in return. A reminder was sent to those who did not return the form within 15 days and response awaited for a month; all responses obtained within 1 month’s time period were included.

A self- designed, self-administered, structured 10 item questionnaire was developed, which was pilot tested in the Department of Prosthodontics, Rural Dental College, Loni. Questions 1–4 had 3 choices each, question 5–9 had two choices each and question 10 was open-ended. Based on pilot study, the questionnaire was modified to develop a final format which was used in the study. The study was

approved by the Institutional Ethics committee. Informed consent was obtained from all the participants.

The collected data was entered in the MS excel 2010. Descriptive analysis were calculated. Chi square test and F test were used for statistical analysis. Data was analyzed to compare the responses, category-wise (postgraduate students, private practitioner and staff at the college) and area-wise (urban, rural and periurban). The questions which showed statistical significance with Chi square test were further analyzed with F test. The level of significance was fixed at 5 %.

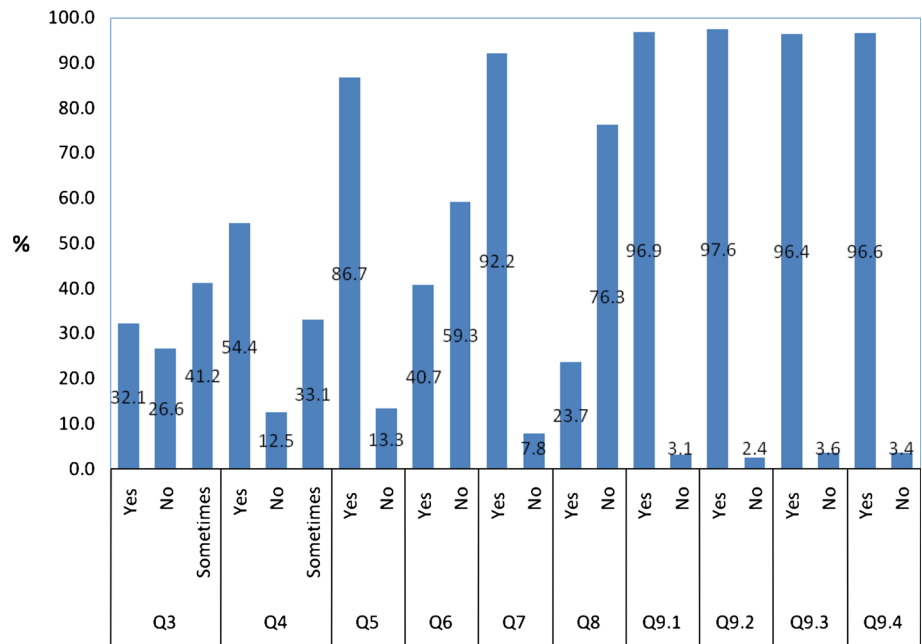
Results

A total of 1,098 self-administered questionnaires were distributed out of which 616 filled-up questionnaire were got yielding a response rate of 56.1 %. 338 were postgraduate students, 75 practicing prosthodontists’ and 203 were staff from various teaching institutions.

Figure 1 shows the distribution of the participants according to the responses to the questionnaire. Overall, only 32.1 % prosthodontists’ were shown to make use of pre-extraction records while fabricating dentures for their patients, and 54.4 % prosthodontists’ seemed to give consideration to natural findings of the patient while denture fabrication. Importantly, majority (86.7 %) recommended the patient (aged 25–34 years) to archive his/her natural dentition to serve as pre-extraction record so that the natural findings can be duplicated while making the denture. 59.3 % prosthodontists’ responded that so far, no patient enquired with them, whether his/her natural dentition can be archived to serve as a future reference for prosthetic construction. However, a majority of 92.2 % prosthodontists’ were willing to promote the concept of NDA for their patients. Interestingly, 76.3 % prosthodontists’ think that this process is not an extra burden, and majority (over 96 %) agreed that making impression and preparing a cast, taking facial profile photograph, or photograph of anterior teeth in occlusion and recording the tooth shade are steps that are recommendable for NDA.

Table 1 shows the responses and inter-category comparison of the participants, categorized as postgraduate student, practicing prosthodontist and faculty in the teaching institutions. Overall the responses of these three categories matched with one another, except for Q-4, 8, 9.2, 9.3 and 9.4 where statistically significant differences were noted. It was noted that postgraduate students (61.5 %) significantly gave more consideration to natural findings of the patient while denture fabrication (Q.4) as compared to the practicing prosthodontist (38.7 %) and the faculty (48.3 %). The responses for Q.8, indicate that as compared to the postgraduate students (15.1 %), greater percentage of the practicing prosthodontist (46.7 %) and the faculty (29.6 %) felt

Fig. 1 Percentage distribution of the prosthodontists' according to the responses to the questionnaire



that this process is an extra burden to them in their clinical practice. There was a good consensus among the post-graduate students and practicing prosthodontists as compared to the faculty regarding the facial profile photographs (Q9.2), photograph of anterior teeth in occlusion (Q9.3) and recording the tooth shade (Q9.4) as methods of NDA.

Table 2 shows the responses and inter-group comparison of the participants, categorized depending on the area of practice (urban, rural and periurban). Again not much difference in responses was noted except for Q 3, 5 and 9.4, where statistically significant results were obtained. Making use of pre-extraction records while fabricating dentures for patients (Q.3) was preferred by majority of the prosthodontists from urban (36.2 %) and periurban area (30 %) as compared to those from rural area (26.7 %). Similarly, recommending a patient (aged 25–34 years) to archive his/her natural dentition so as to serve as a pre-extraction record to help duplicate natural findings in the denture (Q.5) was opted by those in the urban (89 %) and periurban area (89.4 %) but significantly lesser by those in rural area (78.8 %). Recording the tooth shade as a step in NDA (Q.9.4) was opted by greater percentage of prosthodontists' in urban (98.6 %) and rural (96.6 %) area but was significantly lesser in those from periurban area (93.3 %).

Discussion

Successful complete dentures require a blend of science and art [11], in addition to the clinician's experience to achieve a pleasing appearance and function. Prosthodontist

who do not make use of pre-extraction records and give due consideration to the natural findings of the patient while denture fabrication are missing the scientific component in denture fabrication, translating into compromised patient's satisfaction. Srivastava et al. [12] has described that every denture should be characterized according to the particular patient rather than doing a pearl like arrangement of artificial teeth, as dental characterization make a denture appear life-like and more natural, which can only be achieved when a prosthodontist gives consideration to natural findings while denture fabrication.

The present study showed that overall 32.1 % prosthodontists' in India make use of pre-extraction record (Q.3) which is greater in comparison to dental practitioners in Riyadh, Saudi Arabia (12.2–24.7 %) who made use of the pre-extraction records in different aspects of teeth selection process for complete denture [13]. The present study also showed that 54.4 % prosthodontist gave due consideration to the natural findings of the patient (Q.4).

86.7 % prosthodontists' recommend that patient in the age range of 25–34 years should archive their natural dentition to serve as a pre-extraction record (Q.5). By the age of 25 years, all the third molars would have been erupted and the person will have a complete complement of natural teeth. By 35+ years there will be periodontal tissue involvement leading to tissue destruction, alteration in alignment of teeth and probably tooth loss. Even, WHO [14] recommends age 35–44 years as the monitoring age for health conditions among adults where the full effect of dental caries, level of severe periodontal involvement and general effects of care provided can be monitored. Hence,

Table 1 Inter-category comparison of the responses to the questionnaire

Options	Postgraduate students (n = 338) (%)	Practicing dentist (n = 75) (%)	Staff at college (n = 203) (%)	χ^2 value, p value
Q.3				
Yes	115 (34.0)	28 (37.3)	55 (27.1)	$\chi^2 = 8.75, p > 0.05$
No	94 (27.8)	22 (29.3)	48 (23.6)	
Sometimes	129 (38.2)	25 (33.3)	100 (49.3)	
Q.4				
Yes	208 (61.5)	29 (38.7) ^a	98 (48.3) ^b	$\chi^2 = 18.84, p < 0.001^*$
No	32 (9.5)	15 (20.0) ^a	30 (14.8)	
Sometimes	98 (29.0)	31 (41.3) ^a	75 (36.9)	
Q.5				
Yes	297 (87.9)	59 (78.7)	178 (87.7)	$\chi^2 = 4.77, p > 0.05$
No	41 (12.1)	16 (21.3)	25 (12.3)	
Q.6				
Yes	132 (39.1)	31 (41.3)	88 (43.3)	$\chi^2 = 0.98, p > 0.05$
No	206 (60.9)	44 (58.7)	115 (56.7)	
Q.7				
Yes	320 (94.7)	65 (86.7)	183 (90.1)	$\chi^2 = 4.75, p > 0.05$
No	18 (5.3)	10 (13.3)	20 (9.9)	
Q.8				
Yes	51 (15.1)	35 (46.7) ^a	60 (29.6) ^{b,c}	$\chi^2 = 39.58, p = 0.000^*$
No	287 (84.9)	40 (53.3) ^a	143 (70.4) ^{b,c}	
Q.9.1				
Yes	332 (98.2)	73 (97.3)	192 (94.6)	$\chi^2 = 5.68, p > 0.05$
No	6 (1.8)	2 (2.7)	11 (5.4)	
Q.9.2				
Yes	336 (99.4)	75 (100.0) ^c	190 (93.6) ^b	$\chi^2 = 20.16, p = 0.000^*$
No	2 (0.6)	0 (0.0)	13 (6.4) ^b	
Q.9.3				
Yes	332 (98.2)	75 (100.0) ^c	187 (92.1)	$\chi^2 = 16.89, p = 0.000^*$
No	6 (1.8)	0 (0.0)	16 (7.9) ^b	
Q.9.4				
Yes	333 (98.5)	73 (97.3)	189 (93.1) ^b	$\chi^2 = 11.44, p < 0.01^*$
No	5 (1.5)	2 (2.7)	14 (6.9) ^b	

* Statistically significant

^a Comparison between postgraduate students and practicing dentist (F test, statistically significant)^b Comparison between postgraduate students and staff at the college (F test, statistically significant)^c Comparison between practicing dentist and staff at college (F test, statistically significant)

25–34 years can be considered as an ideal age for archiving the natural dentition.

Patients are getting aware of denture esthetics and are demanding artificial dentition that mimics their natural dentition [15]. This can be due to wide exposure to information from different sources like internet, books, health magazines etc. Literary levels and socio-economic status also significantly relates to denture treatment in terms of awareness, satisfaction for esthetics and function, and increase in treatment motivation [16]. In the present study, it was reported by 40.7 % prosthodontist, that patients have enquired with them about archiving their natural dentition (Q.6).

Overall, 92.2 % dentist in the present study were in favour of the NDA concept and were willing to promote it (Q.7). However, 23.7 % prosthodontists' felt that it is an

extra burden for them (Q.8). One must understand that the NDA concept is a perspective of thinking ahead of the present time. A, dentist has to try and make a person (who is having good set of teeth today) understand the future scenario, when he would lose all teeth and opt for denture, then this NDA concept would come to his/her rescue by providing a pre-extraction record. The patient may not be willing or understand the preventive concept of saving the blueprint for the future (which could be probably 15–20 years ahead), and such an effort to motivate a patient is definitely time taking and would seem like an extra-burden for a dentist.

The four steps suggested for NDA (Q.9) were found suitable by almost all the prosthodontists' (over 96 %) in the study. Rehabilitating edentulous patients in the absence of pre-extraction records is problematic [17]. As compared

Table 2 Comparison of the dentist’s responses based on the area of practice

Options	Urban (n = 290) (%)	Rural (n = 146) (%)	Periurban (n = 180) (%)	χ^2 value, p value
Q.3				
Yes	105 (36.2)	39 (26.7) ^a	54 (30.0)	$\chi^2 = 11.19, p < 0.05^*$
No	78 (26.9)	48 (32.9)	38 (21.1) ^b	
Sometimes	107 (36.9)	59 (40.4)	88 (48.9) ^c	
Q.4				
Yes	159 (54.8)	84 (57.5)	92 (51.1)	$\chi^2 = 2.69, p > 0.05$
No	40 (13.8)	16 (11.0)	21 (11.7)	
Sometimes	91 (31.4)	46 (31.5)	67 (37.2)	
Q.5				
Yes	258 (89.0)	115 (78.8) ^a	161 (89.4) ^b	$\chi^2 = 10.42, p < 0.01^*$
No	32 (11.0)	31 (21.2) ^a	19 (10.6) ^b	
Q.6				
Yes	133 (45.9)	52 (35.6)	66 (36.7)	$\chi^2 = 5.97, p > 0.05$
No	157 (54.1)	94 (64.4)	114 (63.3)	
Q.7				
Yes	269 (92.8)	130 (89.0)	169 (93.9)	$\chi^2 = 2.86, p > 0.05$
No	21 (7.2)	16 (11.0)	11 (6.1)	
Q.8				
Yes	75 (25.9)	41 (28.1)	30 (16.7)	$\chi^2 = 1.22, p > 0.05$
No	215 (74.1)	105 (71.9)	150 (83.3)	
Q.9.1				
Yes	284 (97.9)	142 (97.3)	171 (95.0)	$\chi^2 = 3.26, p > 0.05$
No	6 (2.1)	4 (2.7)	9 (5.0)	
Q.9.2				
Yes	287 (99.0)	142 (97.3)	172 (95.6)	$\chi^2 = 5.51, p > 0.05$
No	3 (1.0)	4 (2.7)	8 (4.4)	
Q.9.3				
Yes	284 (97.9)	138 (94.5)	172 (95.6)	$\chi^2 = 3.84, p > 0.05$
No	6 (2.1)	8 (5.5)	8 (4.4)	
Q.9.4				
Yes	286 (98.6)	141 (96.6)	168 (93.3) ^c	$\chi^2 = 9.43, p < 0.05^*$
No	4 (1.4)	5 (3.4)	12 (6.7)	

* Statistically significant

^a Comparison between urban and rural (F test, statistically significant)

^b Comparison between rural and periurban (F test, statistically significant)

^c Comparison between urban and periurban (F test, statistically significant)

to the other methods [8, 17–19] which make use of facial measurements in selection of the anterior teeth, the four steps used in NDA can be considered more superior, because it is individualized, accurate measurements and undergoes little variations with age changes.

The intergroup comparison of the responses between postgraduate students, private prosthodontist and staff attached to teaching institutions showed a statistically significant difference with regards to Q-4, 8, 9.2, 9.3 and 9.4. The difference in responses can be attributed to the work settings. The manner in which dental treatment is provided in the private dental clinic is much different from the practice followed at the dental colleges. In private dental practice there is always a time constrain, single dental operator, big queues of patients in the waiting lobby, and the stipulated time to complete all the patient is quite a

task. However, in the college setting, the post-graduate students can spare a considerable amount of time with the patient, as it is a part of their curriculum and they have to take a detailed case history, discuss with their teachers and then execute the treatment. Hence, the adequate time availability probably did not allow the postgraduate students to think of this concept as an extra-burden, and they felt they could motivate the patient as well.

Though the dentists: population ratio of India is 1: 10,000 but in reality, in rural India one dentist is serving over a population of 2,50,000 [20]. Dentists are significantly under-represented in the rural areas, and even the specialized dentist (e.g. prosthodontist) would rarely practice their speciality and rather perform general dentistry. It is a known fact that as compared to the urban areas the people residing in the rural areas have low literacy

Fig. 2 .

Questionnaire: (Please tick whichever applicable)

1. You are : A. Postgraduate student B. Practising Dentist C. Staff at college.

2. Your College/Clinic is situated in: A. Urban B. Rural C. Periurban area.

3. Do you make use of pre-extraction records while fabricating dentures for your patients?
A. Yes B. No C. Sometimes

4. Do you give consideration to the natural findings of the patient while denture fabrication?
A. Yes B. No C. Sometimes

5. Would you recommend a patient (aged 25-35 years) to archive his/her natural dentition, to serve as a pre-extraction record so that the natural findings can be duplicated in the denture.
A. Yes B. No

6. Has any patient enquired with you, whether his/her natural dentition can be archived to serve as a future reference for prosthetic construction?
A. Yes B. No

7. Would you willingly promote this concept of natural dentition archival to your patient?
A. Yes B. No

8. Do you think this process is an extra burden to you ?
A. Yes B. No

9. Do you agree, that the following steps for “**Natural Dentition Archival**” should be recommended?

I.	Making impression and preparing a cast .	Yes	No
II.	Facial profile photographs.	Yes	No
III.	Photograph of anterior teeth in occlusion.	Yes	No
IV.	Recording the tooth shade.	Yes	No
V.	Any other-----		

10. Any suggestions / recommendation about the concept of “**Natural Dentition Archival**”--

level, poor socio-economic condition and could not ask for any sophisticated dental treatment. The urban and rural division was thus evident in the present study. Statistically significant difference was seen with Q-3, 5 and 9.4. Singh et al. [16] also support this difference when they reported that higher income people get the denture made for both esthetics and function while the lower income group get it made for function alone.

Question 10 was an open-ended question and several different responses were obtained. These responses were grouped under 3 headings: views, concerns and recommendations. Many prosthodontists' (67.8 %) viewed this concept as ideal and good for denture-making and resulting

in greater patient satisfaction. They also felt that this concept can serve as an aid for forensic evidence. However, 46 % prosthodontists' have raised concerns associated with natural dentition archival like: storage and preservation of cast and records being tedious, extra time needed and patient motivation an added burden (especially convincing them for NDA and to bear the extra cost in archiving the records). They also pointed towards an important key area that only those with pleasing teeth alignment would wish to replicate their natural dentition. Further, though esthetics plays an important role, it may not be recommendable for those patients with malocclusion. Also, the limitation that the teeth be placed in centric

position may not make it possible to duplicate certain natural dental characteristics. The prosthodontists' recommended that, the NDA concept can be introduced and emphasized in the prosthodontic curriculum, so that the dental students learn and promote it to their future patients and the; prosthodontists' must put in little more effort to practice this concept whenever feasible. These recommendations given by 54 % prosthodontists' can be initiated and practiced in the future (Fig. 2).

To many dentist it may appear that the storage and preservation of the records collected during NDA is an extra burden and tedious. But, in this digital era, there are systems referred as electronic patient record or automated patient record (initiated since 1980) which have been designed to create, manage and store information of the patient [21] can be utilized to create *e-bank* of NDA records. The dental cast can be easily converted and stored digitally using the 3D scanning system; this system creates highly accurate three-dimensional scans of your models, eliminating the headache and expense of physical storage [22]. For those who would not possess this system, alternate option is to store the photographs of the dental cast electronically. Also, for the photographs, it is very easy to store the soft copy. Additionally, the dental cast and the photographs can be preserved by the patient themselves and cart a card which contains the unique code for retrieval of his/her electronic data.

The great benefit of storing records electronically or on microfilm or microfiche is that they take up less space than paper records and have great quality and patient-safety benefits [23]. With access to more information in one place, digitally networked dental practitioners will continue to excel in managing their practices [24].

Conclusion

The survey results indicate that the perceptions of the prosthodontists' towards NDA is favourable. However, few limitations of NDA cannot be ignored. It definitely needs additional effort to utilize NDA in his/her regular clinical practice. Also, for those with no computerized system may find it demanding for storage of the records. For those practicing in the rural areas, NDA may not be readily acceptable. Prerequisite to making the concept popular is:

1. Firstly, to create awareness and motivation among the prosthodontist to use it in their practice.

2. Secondly, to educate and inform the patient community about this concept and how it can be helpful for them for future denture fabrication.

3. Thirdly, to introduce NDA in the dental curriculum so that the dental students from their early stage of learning can practice it.

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