OPEN ACCESS
https://doi.org/10.47811/bhj.159

Distribution and preferences of conventional fixed dental prostheses among patients at the National Referral Hospital, Bhutan

Kunga Penjor[1], Tshering Choeda[2], Tashi Norbu[3]

[1]*Department of Dentistry, Jigme Dorji Wangchuck National Referral Hospital, Thimphu, Bhutan*
[2]*Faculty of Postgraduate Medicine, Khesar Gyalpo University of Medical Sciences of Bhutan, Thimphu, Bhutan*
[3]*Medical Education Center for Research, Innovation and Training, Khesar Gyalpo University of Medical Sciences of Bhutan, Thimphu, Bhutan*

ABSTRACT

Introduction: Structural defects in teeth significantly impact oral health, leading to broader implications for an individual's overall well-being. Porcelain-fused-to-metal (PFM) crowns and bridges are the preferred forms of fixed dental prostheses (FDP) for restoring lost form, function, and aesthetics of the missing or damaged tooth/teeth. This study aimed to investigate the distribution pattern and proportions of FDP across genders, age groups, types of teeth, and jaw locations. **Methods:** This was a retrospective analysis of records of dental prostheses availed at the National Referral Hospital from July 2016 to June 2021. Specific data on FDP were extracted and utilized for the analysis. **Results:** The median age of patients was 33 (23 - 41) years for females and 37 (26 - 50) years for males. Female patients accounted for the majority of FDP recipients, consisting of 56.7% of the total cases. Posterior crowns (80.7%) and, anterior bridges (48.7%) are the most prevalent FDP types. In the upper jaw, a significant proportion of FDP consisted of posterior crowns (70.5%) and, anterior bridges (55.9%). In contrast, the lower jaw predominantly received more crowns (96.0%) and bridges (49.3%) in the posterior region. **Conclusions:** FDP are prevalent among female patients with a lower median age. Anterior bridges restoring aesthetics are more prevalent in the upper jaw, whereas the bridges and crowns for posterior teeth are more in the lower jaw. Dental practitioners can tailor treatment approaches to meet patient expectations, whether to focus on aesthetics or functionality.

Keywords: Bridges; Crowns; FDP distribution; Fixed dental prostheses; Jaw; Porcelain-fused-to-metal.

INTRODUCTION

Oral health cannot be considered as a separate entity from the general health of any individual[1,2]. When a tooth exhibits a structural defect or when some teeth are missing, oral health is threatened, because the form, function (i.e. mastication and speech), and esthetics are compromised. However, restoring the lost tooth part or replacing missing teeth with dental prostheses restores aesthetics, structural, and functional integrity. This improves oral health directly and contributes to enhancing one's general health[3].

In recent years, the rapid development of dental implants has revolutionized prosthodontic treatment[4,5] but Fixed Dental Prostheses (FDP), such as porcelain fused to metal (PFM) crowns and bridges continue to remain the preferred tooth/teeth replacement option[6–8], due to their affordability in comparison to implant-supported restorations. PFM crowns and bridges combine the aesthetics of porcelain with the durability of metal, making them suitable for both anterior (incisors and canines) and posterior (pre-molars and molars) restorations.

The national survey of Adult Dental Health of the United Kingdom reported a prevalence rate of 34% FDP among its population[9] and a survey on types of dental crowns in Melbourne, Australia, reported PFM (82.6%) as the most prescribed crowns[10]. Furthermore, a study from Virginia reported that dentists are mostly engaged in providing FDP services (49%)[11] and a similar study on dental laboratory production of prosthetic restorations from Bulgaria reported that FDP predominates over other types of dental prostheses[12]. In addition, a study from Karachi on the choice of treatment options mentioned that FDP (59.2%) are the most preferred choice for single tooth replacement[13] and a study on various type of prosthetic dental restorations in Europe reported high prevalence (45%) of fixed dental prostheses[8]. These pieces of information highlight the role of FDP in restoring tooth parts or missing teeth in many countries. Nevertheless, there is limited information available regarding the distribution, proportion, and

Corresponding author:
Kunga Penjor
kunjorbt@gmail.com

preferences for FDP in South-Asian countries.

In Bhutan, the FDP services started with the establishment of the prosthodontic laboratory at the National Referral Hospital (NRH) in 2002, which is the sole facility center providing the services. According to the hospital's Annual Reports[14,15], more than 580 FDP are delivered annually. However, there is a lack of information on the distribution pattern and proportion of FDP delivered by the hospital.

Therefore, this study was conducted to assess the distribution pattern and proportion of FDP provided to the patients seeking FDP services at the hospital.

METHODS

This is a retrospective data analysis of records of various dental prostheses maintained at the Department of Dentistry, Jigme Dorji Wangchuck National Referral Hospital (JDWNRH), which serves as the NRH of Bhutan. While prosthodontic services like complete dentures (CD) and acrylic removable partial dentures (RPD) are provided to patients in various hospitals across the nation, FDP services are exclusively provided by the NRH, because it is the only hospital with a fully equipped prosthodontic laboratory facility.

The data records of patients who availed of various prosthodontics services were reviewed and records of FDP (single crowns and PFM bridges) completed within the span of five years (July 2016 to June 2021) were retrieved for the study. The socio-demographic information, type of prostheses, location of the prostheses, and tooth combination for bridges were recorded. The extracted information was then anonymized and tabulated onto a spreadsheet. Out of the initial 1,835 FDP records, only 1,690 records were used for the study. The remaining 145 records were discarded due to incomplete information required for the study analysis.

Double entry of the data was done in EpiData 3.1 (EpiData Association. Odense, Denmark) and the analysis of the data was performed using STATA (Ver.14.1). A descriptive analysis was performed to determine the distribution pattern of FDP among gender, teeth type, age groups, and in upper or lower jaws. The association between the gender and age groups, prostheses type, and age groups were examined using chi-square test at 0.05 significance level.

The ethical clearance for this study was obtained via Ref. No. IRB/Approval/PN21-021/2021/519 from the Institutional Review Board (IRB), Khesar Gyalpo University of Medical Sciences of Bhutan (KGUMSB) and the study site approval was obtained from the administrative office of the NRH.

RESULTS

Distribution pattern of fixed dental prostheses

Females received more (56.75%) FDP compared to males. The median age of females requiring FDP was 33(23-41) years while it was 37(26-50) years for males. Accordingly, the distribution of FDP in different jaws was; 561 crowns and 539 bridges delivered in the upper jaw and 373 crowns and 217 bridges in the lower jaw (Table 1 & 2).

Crown distribution

The median age of patients who had crowns was 32(22-44) years. Amongst males, the age group of 21-30 years received the highest number of crowns (*n*= 402, 24.88%). For females, the age group 31-40 years received the highest number of crowns (*n*=532, 26.88%) (Table 1).

Table 1. Age and gender distribution of patients who received FDP* services from Dental Department of the National Referral Hospital from July 2016 to June 2021

Age groups	Crowns		Bridges	
	Male (*n*)(%)	Female (*n*)(%)	Male (*n*)(%)	Female (*n*)(%)
<=20	65(16.17)	132(24.81)	30(9.12)	52(12.18)
21-30	100(24.88)	137(25.75)	69(20.97)	104(24.36)
31-40	79(19.65)	143(26.88)	74(22.49)	145(33.96)
41-50	64(15.92)	69(12.97)	72(21.88)	76(17.8)
51-60	48(11.94)	38(7.14)	54(16.41)	41(9.6)
>60	46(11.44)	13(2.44)	30(9.12)	9(2.11)
Total	**402**	**532**	**329**	**427**

**Fixed dental prostheses*

Of the 561 crowns in the upper jaw, the highest percentage was in the 21-30 years age group (27.09%). However, the proportion of 373 crowns in the lower jaw has the highest percentage in the ≤ 20 years age group (24.4%) (Table 2).

Table 2. Age and jaw type of patients who received FDP* services from the Dental Department of the National Referral Hospital from July 2016 to June 2021

Age groups	Crowns		Bridges	
	Upper (*n*)(%)	Lower (*n*)(%)	Upper (*n*)(%)	Lower (*n*)(%)
<=20	106(18.89)	91(24.4)	67(12.43)	15(6.91)
21-30	152(27.09)	85(22.79)	131(24.3)	42(19.35)
31-40	140(24.96)	82(21.98)	160(29.68)	59(27.19)
41-50	84(14.97)	49(13.14)	96(17.81)	52(23.96)
51-60	43(7.66)	43(11.53)	60(11.13)	35(16.13)
>60	36(6.42)	23(6.17)	25(4.64)	14(6.45)
Total	**561**	**373**	**539**	**217**

**Fixed dental prostheses*

Amongst both males (*n*=402) and females (*n*=532), molar required most crowns (50.62% and 51.13% respectively) (Figure 1).

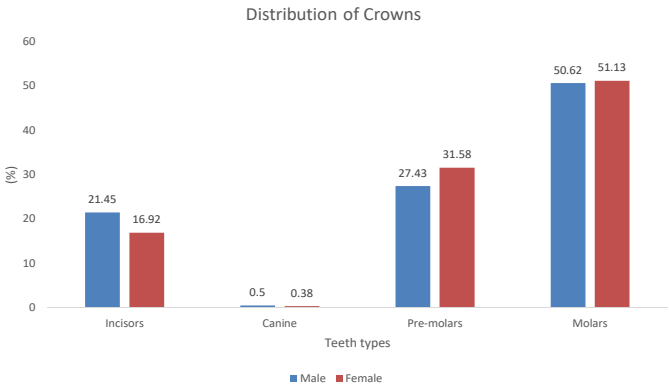

Figure 1. Crown distribution for different teeth types at the Dental Department of the National Referral Hospital from July 2016 to June 2021

In upper jaw, the distribution of crowns among tooth type revealed slightly higher percentage for pre-molars (35.89%). In contrast, the lower jaw exhibited a distinct proportion with a notably high percentage for molars (75.34%) (Figure 2).

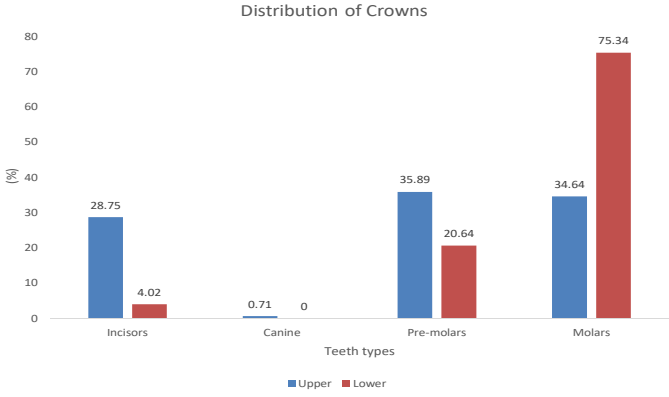

Figure 2. Upper and lower crown distribution for different teeth types at the Dental Department of the National Referral Hospital from July 2016 to June 2021

Bridge distribution

The median age of patients who had bridges was 36 (28-47) years. Both males (*n*= 329) and females (*n*=427) in the age group 31-40 years received the highest percentage of bridges (22.49% and 33.96% respectively) (Table 1). The distribution of 539 bridges in the upper jaw was found to be the highest for those in the 31-40 years (29.68%) age group. Likewise, the 217 bridges in the lower jaw were distributed with the highest percentage in the same age group (27.19%) (Table 2).

In both the gender groups, the distribution proportion of bridges showed a higher percentage for the anterior group; 52.73% in male and 44.73% in female group (Figure 3).

Anterior bridges were the most common (55.93%) in the upper jaw (*n*=539) while posterior bridges were most common (49.31%) in the lower jaw (*n*=217) (Figure 4).

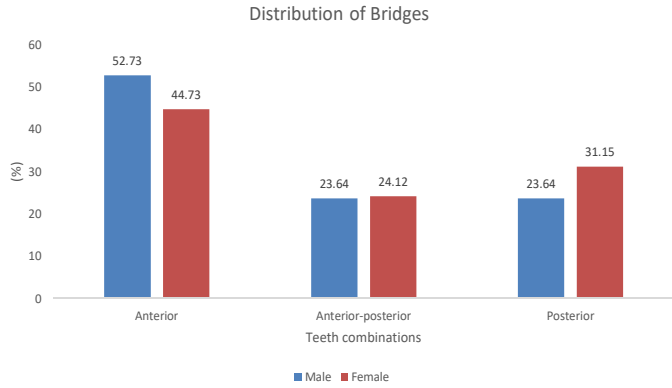

Figure 3. Bridge distribution in different teeth combinations at the Dental Department of the National Referral Hospital from July 2016 to June 2021

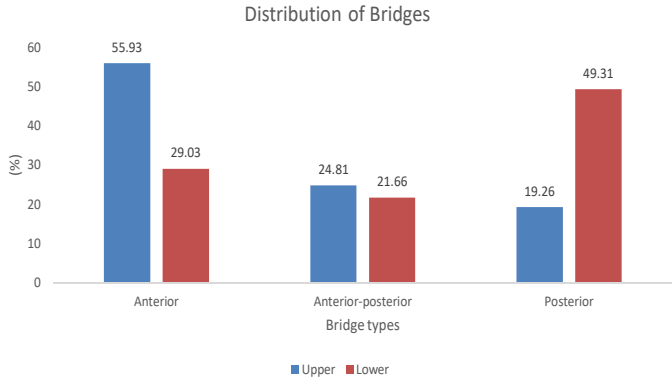

Figure 4. Upper and lower bridge distribution in different teeth combinations at the Dental Department of the National Referral Hospital from July 2016 to June 2021

DISCUSSION

Distribution pattern of fixed dental prostheses

The female group with 56.75% received more FDP with a lower median age of 33(23-41) years which is in agreement with previous studies from other countries on the socio-demographic distribution of patients with fixed prostheses in Nigeria[16], the United Kingdom[9], and distribution of artificial crowns and fixed partial dentures by Siliness and Odont[17]. However, this contradicts the results from an institutional study on patient-preferred treatment modalities for replacing one or two missing teeth from India[6,18], a study on factors influencing the treatment options for a single missing tooth from Pakistan[13], and a study on the prevalence of crowns and fixed partial dentures by Napankangas et al[19]. All these studies reported a higher proportion for male patients. The predominance of female patients may suggest that they are more concerned about their appearance and tend to seek FDP services at much younger ages than their male counterparts.

The chi-square test at 0.05 significance level indicates an association between gender and age groups with Pearson correlation coefficient = 86.14, df =5, and *p*-value=0.001. Similarly, an association between the prostheses type and age

groups with Pearson correlation coefficient = 44.49, df = 5, and *p*-value=0.001, was observed. These findings suggest that there are statistically significant relationships between the variables, highlighting the importance of considering gender, age, and prosthesis types when analyzing prosthetic dental data.

Crown Distribution

In the present study, a similar distribution pattern of crowns among the tooth types was noted in both gender groups with the molars, accounting for over 50%, followed by pre-molars, incisors, and canines. The distribution percentage was different from previous studies; a survey on the distribution and types of full crowns from Australia[10], a Nigerian hospital-based study on the distribution and types of artificial crowns and bridges[20], and a study from Norway[17], which all reported higher incisor crowns. Molars have complex occlusal anatomy with numerous pits and fissures, which makes them susceptible to dental caries development[21]. Extensively carious teeth often require root canal treatment (RCT) and FDP over them to restore their form and function. This could explain the main reason behind the higher crown percentage in molars.

The crowns distribution follows a similar pattern across gender and age groups, with a higher percentage observed in younger age groups; 24.88% (male) in 21-30 years, and 26.88% (female) in 31-40 years. Similarly, it was observed that the upper jaw had the highest percentage in 21-30 years age group, and in the lower jaw, the highest percentage was in ≤20 years. A similar result was reported from Nigeria 20, with the highest proportion in the 20-29 years age group. However, studies from European countries[9,17,22] reported a higher percentage in the more than 40 years age group. The larger distribution percentage in the younger age group may be due to the high prevalence of caries in developing nations[23] and within the Asian region[23–27]. This might have prompted them to avail earlier dental treatment and FDP services.

Research studies conducted in Norway regarding the distribution of artificial crowns and fixed partial dentures and pattern of FDP in dental schools and general dental practices found that incisors were the most frequently crowned teeth in the upper jaw and pre-molars in the lower jaw[17,22,28]. A Nigerian study reported incisors as the most crowned teeth in both jaws 20. An Australian survey in Melbourne which investigated the distribution and types of crowns, reported the most commonly crown teeth as incisors (27.2%) 10 in the upper jaw and molars (18.2%) in the lower jaw. In the study, a different distribution proportion in the upper jaw was observed with the highest proportion for pre-molars (35.89%), followed by molars, incisors, and canine. In the lower jaw; crowns were predominantly made for molars (75.34%).

The limited advocacy programs on the prevention of dental caries and oral hygiene practices in developing countries [24,25,27], and the posterior teeth with anatomically susceptible forms to dental caries could be the reasons for having a higher crown proportion of posterior teeth[21]. Upper incisor crowns (28.75%) have a substantially greater percentage than those of lower incisors. The conspicuous position and the inclination make the upper incisors more susceptible to injury from everyday activities and sports[29], which may need crown placement following root canal treatment.

Bridge Distribution

In gender and age categories, the distribution pattern of bridges shows a similar pattern to that of the crowns with the highest proportion found in the 31 - 40 years age group at 22.49% (male) and 33.96% (female). Likewise, in both the jaws, a similar distribution proportion with the highest percentage in the same age group; 29.68% (upper) and 27.19% (lower) was observed. Similar results were reported in Indian study18, (34.05%) in the same age group and by from Nigeria[16] in ≤ 30 years age group. But European studies[8,17,22], reported a higher percentage of fixed partial dentures in the 40 years and above age groups. Higher dental caries burden and the lack of awareness on preventive dental care and facilities in less developed countries[23,24,26,27,30] might be the reason for having a higher number of people in the younger age group who availed earlier dental treatment and FDP services to restore the lost dental form, function, and aesthetics.

The distribution proportion of bridges in gender groups reveals a higher percentage for the anterior group in both gender groups; 52.73% (male) and 44.73% (female). A similar trend was observed in the upper jaw, where the anterior group (55.93%) has the highest percentage. These findings are in agreement with the previous studies[16,17,20,22,28]. The relatively higher percentage of bridges for the upper anterior group may suggest that aesthetic and social factors play a significant role in patients seeking FDP services for maxillary teeth.

The distribution proportion in the lower jaw was observed with the highest percentage associated with the posterior group (49.31%). The study on dental laboratory production of prosthetic restoration from Bulgaria reported a similar result[12]. Given that the posterior teeth are primarily responsible for chewing, those patients with FDP in the lower jaw likely prioritized function over aesthetics.

The National Referral Hospital, being the sole facility offering FDP services in the country, is a crucial source of data. However, it is important to note that its location in the capital city may bias the data, potentially representing primarily the FDP cases of patients of the western region only.

To obtain a more comprehensive understanding of the prevalence, distribution, and proportion of FDP in different regions, genders, and age groups, there is a need to conduct a prospective study on FDP delivered to patients with a focus on the residential location of the patients coming to avail FDP services. This broader study would help provide a more representative and holistic picture of FDP utilization and needs in the country, ensuring that healthcare planning and resource allocation align with the dental care requirements of the entire population.

CONCLUSIONS

The findings from this study shed light on the distribution and preferences surrounding FDP. These insights are valuable for dental professionals and clinicians in understanding patient needs and guiding treatment planning.

The study revealed a consistent distribution pattern of FDP in both gender groups, with molar crowns and anterior bridges being the most prevalent. Notably, there were variations in treatment preferences between the upper and lower jaws, with the upper jaw requiring more aesthetic-focused restorations and the lower jaw emphasizing functionality.

In light of these findings, dental practitioners can tailor their treatment approaches to better meet patient expectations, whether focusing on aesthetics or functionality, depending on the specific dental restoration needs. Ultimately, these insights contribute to more personalized and patient-centered dental care, leading to improved oral health outcomes and patient satisfaction.

RECOMMENDATIONS

An essential requirement is establishing an appropriate preventive advocacy program for patients to minimize the demand for new FDP. Additionally, an adequate number of skilled dental professionals is required to increase coverage and enhance FDP services in all healthcare facilities to maintain the existing FDP in optimal condition and to address the issues of failing FDP.

ACKNOWLEDGEMENTS

Dr. Prakriti Rai, Prosthodontist , Eastern Regional Referral Hospital, Mongar for helping with manuscript editing and correction.

REFERENCES

1. Hakeem FF, Bernabe E, Sabbah W. Association between oral health and frailty: A systematic review of longitudinal studies. Gerodontology 2019;36(3):205–215. [PubMed | Full Text | DOI]
2. Tran TD, Krausch-Hofmann S, Duyck J, et al. Association between oral health and general health indicators in older adults. Scientific reports 2018;8(1):8871.[PubMed | Full Text | DOI]
3. Watanabe Y, Okada K, Kondo M, et al. Oral health for achieving longevity. Geriatrics & gerontology international 2020;20(6):526–538.[PubMed | Full Text | DOI]
4. Bartlett D. Implants for life? A critical review of implant-supported restorations. Journal of dentistry 2007;35(10):768–772. [PubMed | Full Text | DOI]
5. Frisch E, Wild V, Ratka-Krüger P, et al. Long-term results of implants and i mplant-supported prostheses under systematic supportive implant therapy: a retrospective 25-year study. Clinical Implant Dentistry and Related Research 2020;22(6):689–696. [PubMed | Full Text | DOI]
6. Pooja C, Ariga P, Nandan GJ. Patient Preferred Fixed Treatment Modalities For One Or Two Missing Teeth-An Institution Based Retrospective Study. Journal of Contemporary Issues in Business and Government 2020;26(2):71–76. [Full Text | DOI]
7. Reitemeier B, Hänsel K, Kastner C, et al. A prospective 10-year study of metal ceramic single crowns and fixed dental prosthesis retainers in private practice set tings. The Journal of prosthetic dentistry 2013;109(3):149–155. [PubMed | Full Text | DOI]
8. Zitzmann NU, Hagmann E, Weiger R. What is the prevalence of various types of prosthetic dental restorations in Europe? Clinical oral implants research 2007;18:20–33. [PubMed | Full Text | DOI]
9. Pine CM, Pitts NB, Steele JG, et al. Dental restorations in adults in the UK in 1998 and implications for the future. BRITISH DENTAL JOURNAL 2001;190(1). [PubMed | Full Text | DOI]
10. Stankiewicz NR, Wilson PR. A survey of the distribution and types of full crowns prescribed in Melbourne, Australia. Australian Dental Journal 2000;45(3):193–197. [PubMed | Full Text | DOI]
11. Janus CE, Hunt RJ, Unger JW. Survey of prosthodontic service provided by general dentists in Virginia. The Journal of Prosthetic Dentistry 2007;97(5):287–291. [PubMed | Full Text | DOI]
12. Damyanov ND, Witter DJ, Gerritsen AE, et al. Dental Laboratory Production of Prosthetic Restorations in a Population in Sofia, Bulgaria: A Descriptive Study. International Journal of Dentistry 2010;2010:1–6. [PubMed | Full Text | DOI]
13. Ahmed N, Abbasi MS, Alavi FB, et al. Factors influencing the treatment options for single missing tooth: A patient preference-based study. Isra Medical Journal 2021;13(1). [Full Text]
14. Annual Report_2017, Jigme Dorji Wangchuck National Referral Hospital, Thimphu, Bhutan. [Full Text]
15. Annual Report_2018, Jigme Dorji Wangchuck National Referral Hospital, Thimphu, Bhutan. [Full Text]
16. Enabulele JE, Omo J. Socio-demographic distribution of patients with fixed dental prosthesis in a developing economy. Periodon Prosthodon 2018;4(1):06. [Full Text | DOI]

17. Silness J. Distribution of artificial crowns and fixed partial dentures. The Journal of prosthetic dentistry 1970;23(6):641–647. [PubMed | DOI]
18. Ovia M, Duraisamy R, Sandeep AH. Distribution of age and gender for fixed dental prosthesis among patients in a university hospital setting- a retrospective study. Clinical Medicine 2020;07(01). [Full Text]
19. Näpänkangas, R., Haikola, B., Oikarinen, K., SÖDERHOLM, A. L., Remes-Lyly, T., & Sipilä, K. (2011). Prevalence of single crowns and fixed partial dentures in elderly citizens in the southern and northern parts of Finland. Journal of oral rehabilitation, 38(5), 328-332. [PubMed | DOI]
20. Oginni AO. Distribution and types of artificial crowns and bridges prescribed at a Nigerian teaching hospital. Nigerian Journal of Clinical practice;7(1)(24–27). [Full Text]
21. de Paiva MAA, Leite DFBM, Farias IAP, et al. Dental anatomical features and caries: A relationship to be investigated. Dental Anatomy 2018;61. [Full Text | DOI]
22. Valderhaug J, Karlsen K. Frequency and location of artificial crowns and fixed partial dentures constructed at a dental school. J Oral Rehabil 1976;3(1):75–81. [PubMed | DOI]
23. Schwendicke F, Dörfer CE, Schlattmann P, et al. Socioeconomic inequality and caries: a systematic review and meta-analysis. Journal of dental research 2015;94(1):10–18. [PubMed | DOI]
24. Jain, N., Dutt, U., Radenkov, I., & Jain, S. (2023). WHO's Global Oral Health Status Report 2022: Actions, Discussion and Implementation. Oral Diseases. [PubMed | Full Text | DOI]
25. Siddiqui AA, Alshammary F, Mulla M, et al. Prevalence of dental caries in Pakistan: a systematic review and meta-analysis. BMC Oral Health 2021;21(1):450. [PubMed | Full Text | DOI]
26. Ngedup S, Dorji Phurpa. National oral health survey in 6-and 12-old bhutanese school children. Bhutan health Journal 2016;2(1). [Full Text | DOI]
27. Pandey, P., Nandkeoliar, T., Tikku, A. P., Singh, D., & Singh, M. K. (2021). Prevalence of dental caries in the Indian population: A systematic review and meta-analysis. Journal of International Society of Preventive & Community Dentistry, 11(3), 256. [PubMed | Full Text | DOI]
28. Berge M, Silness J. Fixed restorations produced for recipients of dental prosthodontic treatment: A comparison between general dental practice and a dental school. Acta Odontologica Scandinavica 1990;48(4):233–244. [PubMed | DOI]
29. Soriano, E. P., Caldas Jr, A. D. F., Carvalho, M. V. D. D., & Amorim Filho, H. D. A. (2007). Prevalence and risk factors related to traumatic dental injuries in Brazilian schoolchildren. Dental traumatology, 23(4), 232-240. [PubMed | DOI]
30. World Health Organization. (2022). Action Plan for Oral Health in South-East Asia 2022–2030: Towards Universal Health Coverage for Oral Health. [Full Text]

AUTHORS CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

KP: Concept, design, data collection and analysis, manuscript writing and review.

TC: Data analysis, manuscript editing and review

TN: Data analysis, manuscript writing, editing and review

Author agree to be accountable for all respects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

None

GRANT SUPPORT AND FINANCIAL DISCLOSURE

None