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**Effectiveness of three manual toothbrushes with
different bristle designs in terms of plaque
removal and gingival inflammation:
A randomized controlled trial**

Authors...

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Background...

- Dental plaque can be defined as the soft deposits that form the biofilm adhering to the tooth surface or other hard surfaces in the oral cavity, including removable and fixed restoration.
- It is composed primarily of micro-organisms. One gram of plaque (wet weight) contains approximately 10^{11} bacteria which is typically the accumulation on a tooth in one day without brushing.

- It may be readily visualized on teeth after 1 to 2 days with no oral hygiene measures.
- Gingivitis and periodontitis are the main consequences of plaque accumulation in mouth with no oral hygiene measures.
- Plaque removal with a manual toothbrush is still the most popular and efficient oral hygiene technique when done correctly.

- The main factors which influence effective plaque removal can be categorized as the design of the toothbrush, the skill of the individual using the toothbrush, tooth brushing frequency and duration of use.

Rationale

- Today the market is flooded with various designs of toothbrush and each day more and more products are being added.
- Various other studies have also been conducted regarding the efficacy of manual toothbrushes.

- Needless to say, the results are conflicting, with some studies reporting some designs of toothbrushes to be superior but the general consensus in most of the studies have said that there is no superior design of toothbrush for plaque removal.

- To the best of authors' knowledge, there are no such studies in Nepal on the efficacy of manual toothbrushes in plaque removal and reduction of gingival inflammation.
- The results of this study guide dental professionals and general people to choose manual toothbrush for better oral hygiene measures.

Objective:

To compare the effectiveness of three different bristle designed manual toothbrushes in plaque control and reduction of gingival inflammation among undergraduate girl students

Methodology...

Study design: Randomized controlled concurrent parallel study

Study participants: undergraduate girl students

Setting: Girl's hostel of BPKIHS, Dharan

Study date: April 2021

Ethical approval: IRC of BPKIHS, Dharan and from Nepal Health Research Council (NHRC), Ram Shah Path, Kathmandu

Trial registration: The study was registered as a clinical trial by (npctr.nhrc.gov.np) Nepal clinical Trial Registry (Ref no. 2021/04/000069) and the Trial No. is NPCTR2021000616.

Inclusion criteria:

- Individual having Plaque and Gingival score at least 1
- Individual having at least 5 teeth (excluding third molar) in each quadrant with facial and lingual scorable surfaces were included in this study.

Exclusion criteria:

- Individual with systemic illness, orthodontic appliances, requiring any emergency dental treatment, not willing to participate in the study,
- advanced periodontal disease, a history of antibiotic usage or using antibiotic, oral prophylactic agents were excluded from the study.

Sample size :

Taking pooled standard deviation (0.07271), mean difference between gingival indices of both Crisscross and Flat toothbrush was 0.1717 were taken from study done by Narang et al. sample size was 31.

Considering 10% attrition rate, total sample size became **35 in each group.**

Randomization

The total of 105 students eligible for study were selected. Subjects were assigned in a ratio of 1:1:1 in three groups based on computer generated random numbers and each student was assigned to a group A, B and C for **Oral B Shiny Clean Toothbrush, Oral B Pro Health and Oral B Sensitive Care**, respectively.

Allocation concealment

An assistant, not participating in the study prepared sequentially numbered, opaque, sealed envelopes and participants picked the envelope according to the sequence. Based on assigned group, respective treatment was carried out.

Blinding:

It was a double blinded study where analyser and examiner were unaware about the treatment throughout the data collection procedure and till data analysis.

The toothbrushes were:

i) Oral B Pro Health- Crisscross bristle designed toothbrush

ii) Oral B Shiny Clean - Zigzag bristle designed toothbrush

iii) Oral-B-Sensitive Care - Flat bristle designed toothbrush



Oral B Pro Health



Oral B Shiny Clean



Oral B Sensitive Care



Side view of toothbrushes

With toothbrushes a fluoridated toothpaste was also distributed i.e., Close-up Triple formula anti-germ gel toothpaste red hot-80 gm at the baseline of the study.





Armamentarium



Demonstration of toothbrushing technique



Oral examination

Measurement parameters: The overall mean scores of **Plaque Index (Silness J and Loe H, 1964)** and **Gingival index (Loe and Silness J,1963)** were measured at baseline, 7, 14 and 21 days.

Coding:

- Plaque index(Silness J. and Loe H. in 1964) has scoring criteria:

Score	Criteria
0	No plaque
1	A film of plaque adhering to the free gingival margin and adjacent area of tooth. The plaque may be seen only by running a probe across the tooth surface.
2	Moderate accumulation of soft deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be seen by naked eye.
3	Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

Interpretation:

Excellent: 0

Good: 0.1-0.9

Fair: 1.0-1.9

Poor: 2.0-3.0



Recording of Plaque index

- Gingival index Loe H and Silness J (1963) has scoring criteria:

Score	Criteria
0	Absence of inflammation/normal gingiva
1	Mild inflammation, slight change in colour, slight edema, no bleeding on probing.
2	Moderate inflammation; moderate glazing, redness, edema and hypertrophy, bleeding on probing.
3	Severe inflammation; marked redness and hypertrophy, ulceration, tendency to spontaneous bleeding

Interpretation

Mild gingivitis: 0.1-1.0

Moderate gingivitis: 1.1-2.0

Severe gingivitis: 2.1- 3.0



Recording of Gingival Index

Result:

A total of 339 girl students were examined, out of which 105 participants meeting the inclusion criteria were included and randomized in three groups.

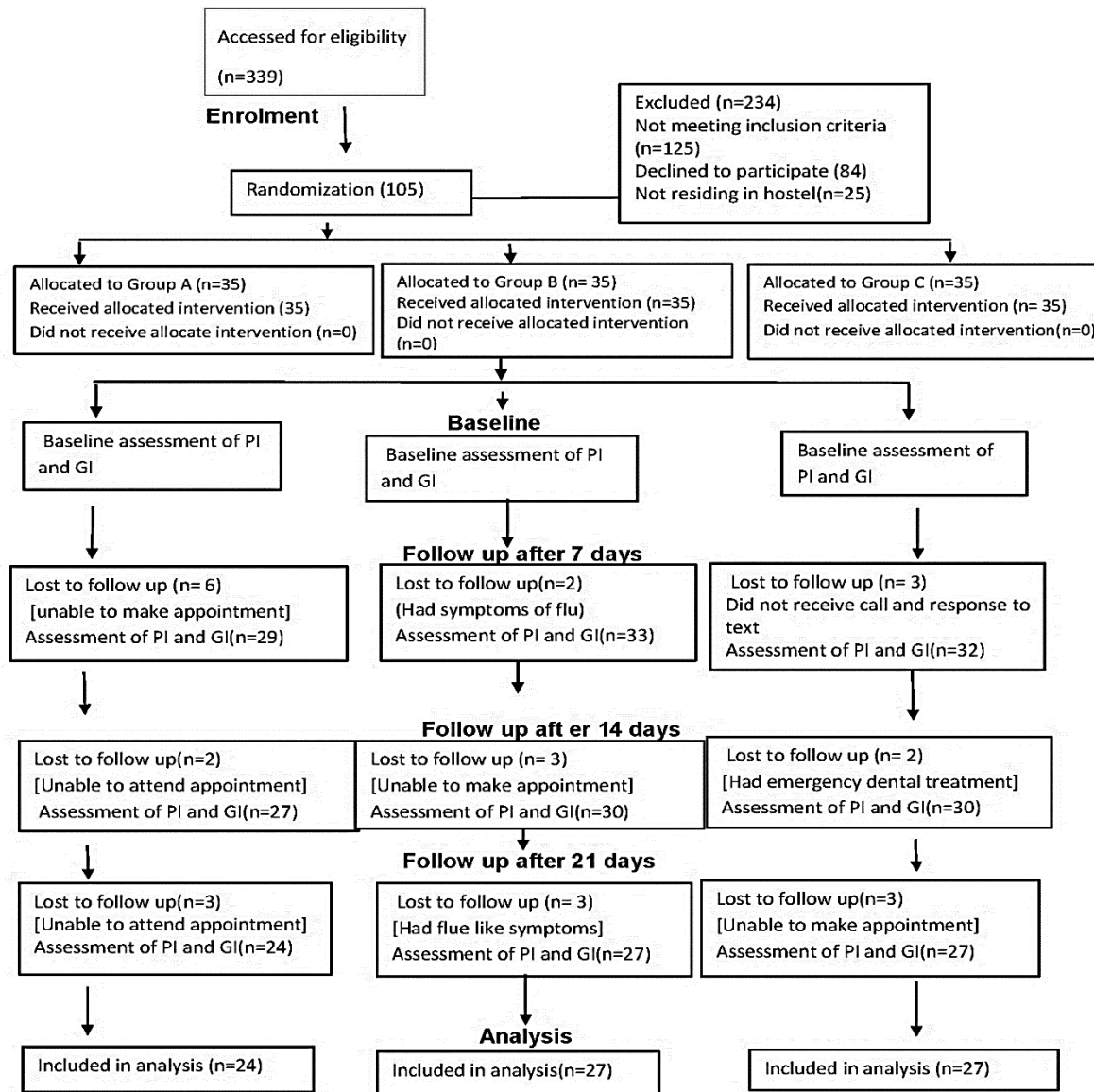


Figure 1: CONSORT flowchart of students screened for the study

- There were 35 participants allotted in each group.
- Majority of participants were MBBS and final year students (41.0% and 40.0%, respectively).
- The mean age (SD) of the participants was 22.61 (1.07)

Table 1: Plaque scores of toothbrushes at different follow up (n = 78)

Group	Mean rank score (Median)				<i>p</i> value*
	Baseline	Week 1	Week 2	Week 3	
Zigzag	3.81 (0.30)	2.83 (0.21)	2.21 (0.17)	1.15 (0.11)	< 0.001
Crisscross	3.78 (0.45)	2.70 (0.30)	2.30 (0.36)	1.22 (0.30)	< 0.001
Flat	3.76 (0.41)	2.83 (0.28)	2.28 (0.25)	1.13 (0.18)	< 0.001

*Friedman's test

Bold signifies statistical significance at $p < 0.05$

Table 2: Gingival scores of toothbrushes at different follow up (n = 78)

Group	Mean rank score (Median)				<i>p</i> value*
	Baseline	Week 1	Week 2	Week 3	
Zigzag	3.83 (0.71)	2.92 (0.53)	2.21 (0.43)	1.04 (0.34)	< 0.001
Crisscross	3.93 (0.78)	2.96 (0.60)	2.06 (0.52)	1.06 (0.38)	< 0.001
Flat	3.89 (0.72)	3.04 (0.71)	2.07 (0.51)	1.00 (0.38)	< 0.001

*Friedman's test

Bold signifies statistical significance at $p < 0.05$

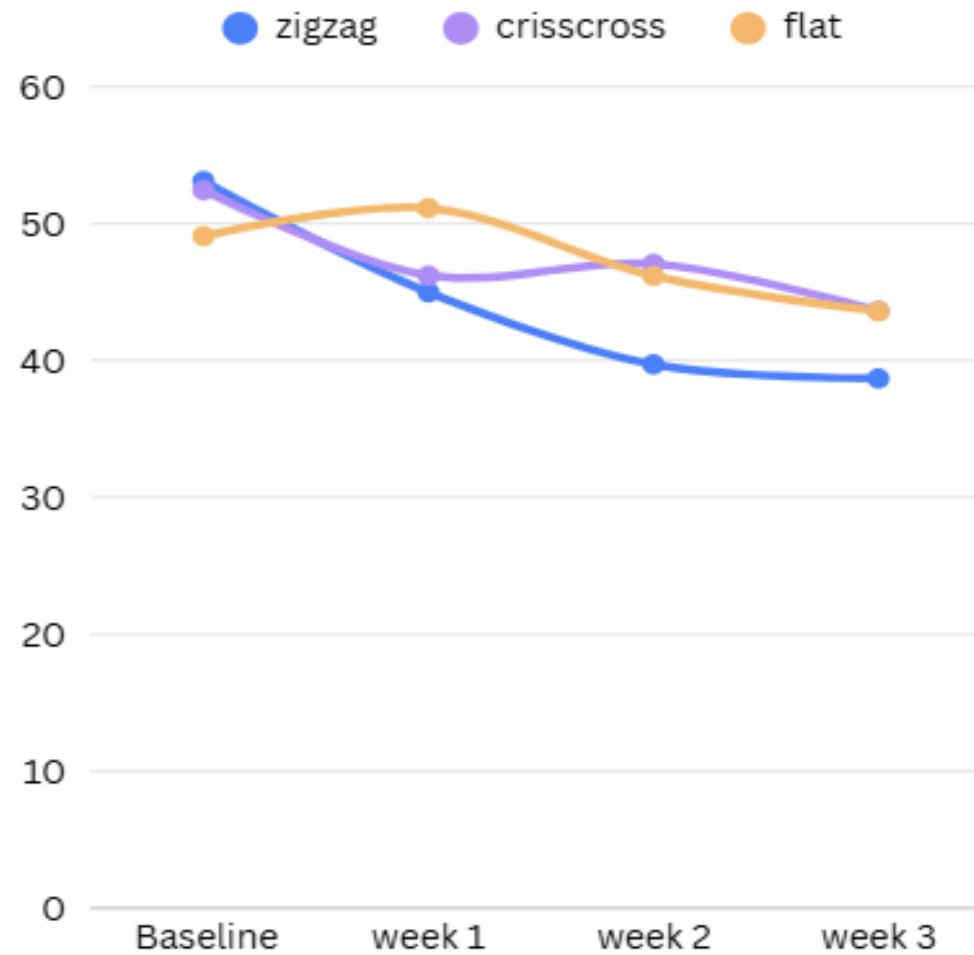


Figure 2: Intergroup comparison of PI scores at baseline and follow ups (n=78)



Figure 3 : Intergroup comparison of GI scores at baseline and follow ups (n=78)

Conclusion

- All three manual toothbrushes showed reduction in plaque and gingival scores over the period of time.
- Though, the zig-zag brush showed marked reduction in both scores, however the difference was not significant.
- The study strongly suggests that use of manual toothbrush must be practiced for oral hygiene maintenance.

- BDS, ***MDS in public health dentistry***, BPKIHS, Dharan
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Thank you....