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EVALUATION OF THE TYPE OF FLAP DESIGN USED FOR ENDODONTIC SURGERY- AN INSTITUTIONAL BASED STUDY

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ABSTRACT

Endodontic surgery can be used to locate small fractures or hidden canals previously undetected on X-rays during the initial treatment. It utilises both endodontic and surgical procedures to preserve the tooth and its supporting structures. During endodontic surgery various flap designs are used to attain adequate access and to minimise complications. Few examples of flap designs used include, Papilla preservation flap, trapezoidal flap, sulcular flap, triangular flap, semilunar flap etc.

To evaluate the type of flap design used during endodontic surgery by the dentists of Saveetha dental college.

All the cases reported for endodontic surgery between the month of June 2019 to March 2020 were considered for this study. Data of patients who underwent endodontic surgery were retrieved and reviewed. The type of flap design used were analyzed, tabulated and was subjected to statistical analysis using chi square test in SPSS by IBM.

From the statistical analysis, it can be observed that the most preferred flap design for endodontic surgery was Trapezoidal flap (63.2%), followed by Triangular flap (15.8%). Sulcular flap was preferred the least (5.3%). Trapezoidal flap was predominantly preferred among male patients of age 25 to 35 years and primarily in lower anteriors (66.6%).
Within the limitation of the present study, it can be concluded that the most preferred flap for endodontic surgery was trapezoidal flap, predominantly in male patients between the age group of 25 to 35 years, primarily reported in mandibular anteriors.

INTRODUCTION

Endodontic surgery is an alternative in case of endodontic failures which aren't treatable with a non surgical procedure.[1] The supreme goal in surgical endodontics is not only the eradication of periapical pathosis but also preservation of periodontal tissues using suitable endodontic surgical techniques. Treatment outcomes are not any longer acceptable without considering the esthetic consequences of all involved dentoalveolar structures. It is critical that incisions, tissue elevations and reflections are performed in a way that enables healing by primary intention.[2] In Surgical Endodontics we will counter complex situations that urge the employment of guidelines of endodontics (biomechanical preparation and obturation) in the root management [3, 4] and the principles of surgery (hemostasis and asepsis) in the phase of access to the root.[5, 6] According to Arens a few fundamental factors to be considered before beginning the surgical procedure includes the number of teeth involved, shape of the root, depth of periodontal pockets, position of muscle and frenulum insertions, depth of the vestibule, bone width etc.[7, 8]

The incision and flap design is one among the important steps in periapical surgery. Each type of incision is relatedto complications like wound dehiscence, gingival recession and scarring. These complications must be anticipated and incorporated into pre-surgical planning a decent flap design with less aesthetic consequences and adequate access will help in minimizing intra-operative complications and improve postoperative healing.[9] A Correct surgical plan is vital for the choice of flap design, adequate exposure of field, ease in surgery and eventually good closure leading to good healing.[10]

According to Gutmann and Harrison, the two major categories of periradicular surgical flaps are the complete mucoperiosteal flaps and the limited mucoperiosteal flaps.[11] The placement of the horizontal component of the incision is the peculiarity between the two categories of surgical flaps. All full mucoperiosteal flaps involve an intrasulcular horizontal incision with reflection of the marginal and interdental (papillary) gingival tissues as a part of the flap. Limited mucoperiosteal flaps have a submarginal (sub sulcular) horizontal or horizontally oriented incision, and therefore the flap doesn't include the marginal or interdental tissues.[12] The addition of plane geometric terms to explain flap designs, as suggested by Luebke and Ingle, provides for an easily identifiable classification of periradicular surgical flap designs. Surgical flaps on the idea of horizontal incision are often classified into two major types one is Full mucoperiosteal flap (Triangular, Rectangular,

Trapezoidal, Horizontal flaps) and Limited mucoperiosteal flaps (Submarginal curved,Submarginal scalloped flaps).[13]

Triangular flap is recommended for maxillary incisors and posterior teeth. It is the only recommended flap design for mandibular posterior teeth because of anatomic structures contraindicating other flap designs.[14] The desirability of trapezoidal flap design is predicated on the assumption that it will provide a better blood supply to the flapped tissues.[15] sulcular flap exposes the entire buccal cortical plate and eventually aids in the treatment of endo-periodontal defects.[16] The main advantages of papilla base flap are the absence of gingival recession, absence of papilla retraction, almost complete absence of scars. It also guarantees a large surgical area exposition without flap stretching, also permitting periapical surgery on long roots.[17,18]

All the above discussions prompted us to conduct a study at Saveetha dental college so as to chart the magnitude of different types of flap designs used by Endodontists during endodontic surgery. Thus the aim of the current study is to qualitatively and quantitatively evaluate the type of flap design used during endodontic surgery.

MATERIALS AND METHODS

Study setting

This was a retrospective study conducted under a university setting. Ethical approval for the current study was obtained from the institutional ethical board (Ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320). This study had advantages of easy access to the software, large data availability yet also had disadvantages of smaller sample size and geographic limitation. A researcher, a guide and a reviewer were involved in the current study.

Sampling

In the current study the data of patients who visited Saveetha dental college and hospitals from June 2019 to April 2020 were reviewed and analysed. The Sample size for the study was n =18. Also Cross-verification of data was done with photographs and direct communication with dentists. Randomised sampling was done and the available data on endodontic surgery were included. This study had internal validity and no external validity.

Data collection

Patients of all age groups (from 15 to 35 years) and genders (both male and females) who had undergone endodontic surgery were included in the current study.Other patients without endodontic surgery and those without follow up were excluded from the study. All the case sheets included in the study were approved and verified by an external reviewer to avoid errors while recording. Data for the study was retrieved and the collected data were tabulated in the excel sheet. Parameters such as age, gender, the tooth involved and the type of flap design were included, correlated and analysed. This data was then imported to SPSS by IBM after coding.

Data analysis

Data analysis was done in SPSS by IBM following the coding. Frequency of all the parameters considered were drafted. Parametric and non- parametric correlations were done. Following which graphs were made. Non parametric tests were generated by clicking onto legacy dialogue, chi square test was run and P value was determined to verify the significance of each of the variables considered and the results were interpreted and analysed statistically.

RESULTS

From the statistical analysis, it can be well documented that among different types of flap designs used trapezoidal flap was highly preferred (63.2%) followed by triangular flap (15.8%) (Figure 1). With regard to the preference of the type of flap design based on different age groups, trapezoidal flap was preferred the most among the age group of 20 to 25 years (66.6%) with significant p value ($p<0.05$) (Figure 2). Preference of trapezoidal flap and triangular flap was higher among male patients 83.3% and 67% respectively, with p value greater than 0.05 and shows statistical insignificance. This insignificance can be attributed to unbiased data and lesser sample size. (Figure 3). Triangular flap was preferred the most in maxillary anterior region (97%), while trapezoidal flap was preferred the most in mandibular anterior region (66.6%). Papilla preservation flap was equally preferred among maxillary and mandibular anteriors. Sulcular flap was preferred in the maxillary anterior region with p value greater than 0.05 showing statistical insignificance. This insignificance can be attributed to lesser sample size and unbiased data considered (Figure 4).

Table 1: Table showing the frequency of flap designs used during an endodontic surgery. It is evident from the table that trapezoidal flap was preferred the most in comparison to other types of flap designs.

FLAP DESIGNS	FREQUENCY	PERCENTAGE
trapezoidal	12	63.2
papilla preservation	2	10.5
sulcular	1	5.3
triangular	3	15.8
Total	18	100.0

Table 2: Table showing the frequency of age group of patients involved in the current study. It is evident from the **table** that higher percentage of patients were

were between 25 to 31 years of age.

AGE	FREQUENCY	PERCENTAGE
15	1	5.3
19	2	10.5
21	3	15.8
23	1	5.3
24	2	10.5
25	1	5.3

26	6	31.6
27	1	5.3
31	1	5.3
Total	18	100.0

Table 3: Table showing the frequency of gender of patients involved in the current study. It is evident from the table that the percentage of Male patients were higher than female patients in this study.

GENDER	FREQUENCY	PERCENTAGE
male	15	78.9
female	3	15.8
Total	18	100.0

Table 4: Table showing the frequency of teeth involved during an endodontic surgery. It is evident from the table that maxillary incisors had undergone higher endodontic surgeries than other teeth in the oral cavity.

TEETH	FREQUENCY	PERCENTAGE
11	4	21.1
12	1	5.3
21	3	15.8
22	1	5.3
31	2	10.5
32	2	10.5
33	1	5.3
41	1	5.3
42	1	5.3
43	1	5.3
47	1	5.3
Total	18	100.0

Table 5:Table showing statistical **analysis using the chi square test done in SPSS by IBM.**

ASSOCIATION BETWEEN AGE AND FLAP DESIGN			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	37.000[a]	24	.044
Likelihood Ratio	28.460	24	.241
Linear-by-Linear Association	.161	1	.688
N of Valid Cases	18		
ASSOCIATION BETWEEN GENDER AND FLAP DESIGN			
Pearson Chi-Square	1.200[a]	3	.753
Likelihood Ratio	1.588	3	.662

Linear-by-Linear Association	.200	1	.655
N of Valid Cases	18		
ASSOCIATION BETWEEN TEETH AND FLAP DESIGN			
Pearson Chi-Square	26.375[a]	30	.656
Likelihood Ratio	22.915	30	.819
Linear-by-Linear Association	6.277	1	.012
N of Valid Cases	18		

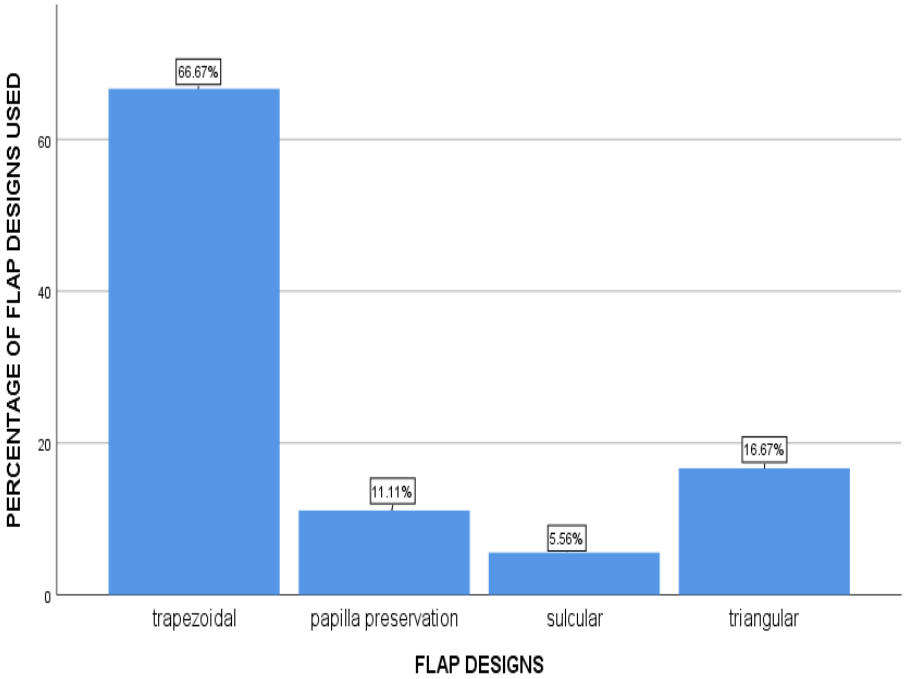

Figure 1: Bar graph showing the preference of different types of flap designs used in endodontic surgery. Flap designs are represented in blue. The Y axis scale shows the total percentage from 0 to 60%. It is evident from the graph that trapezoidal flap was preferred the most in comparison to other types of flap designs.

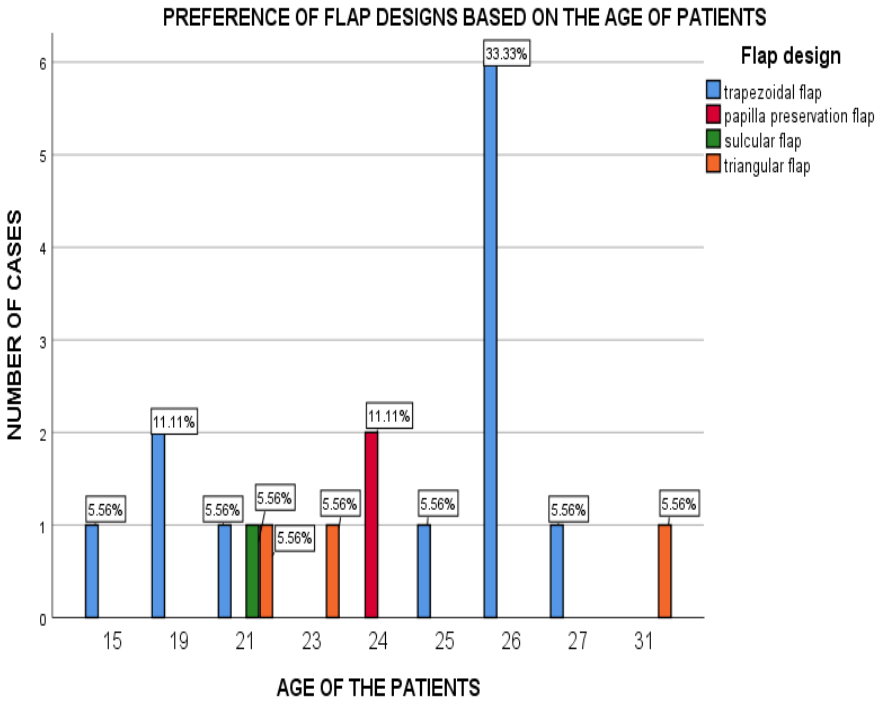

Figure 2: Bar graph showing the association between age of the patients and different types of flap designs used in endodontic surgery. Trapezoidal flap is represented in blue, papilla preservation flap by red, sulcular flap by green and triangular flap in orange. The Y axis scale shows the total count of cases from 0 to 6. It is evident from the graph that trapezoidal flap was preferred the most in patients among 25 to 27 years of age. Pearson Chi-Square Value:37 ; p=0.044, hence shows statistical significance.

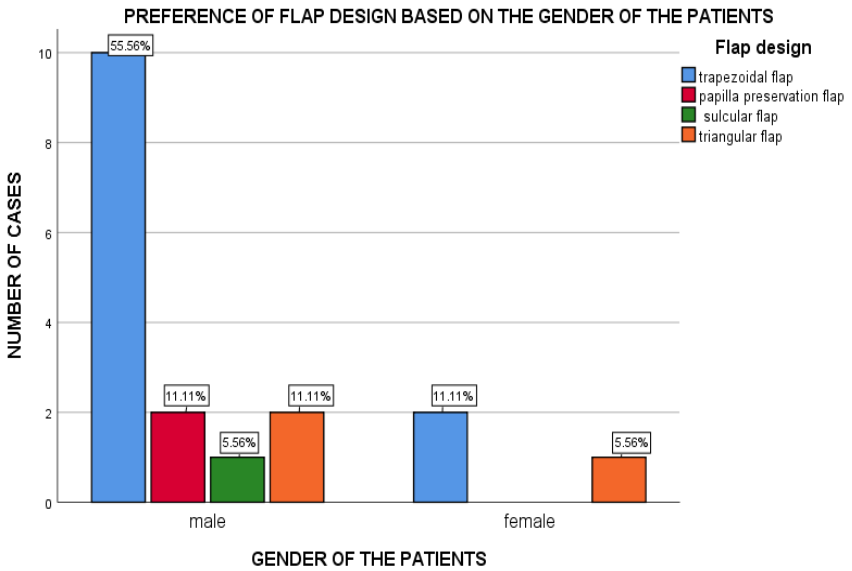

Figure 3: Bar graph showing the association between the gender of the patients and different types of flap designs used in endodontic surgery. Trapezoidal flap is represented in blue, papilla preservation flap by red, sulcular flap by green and triangular flap in orange. The Y axis scale shows the total counter cases from 0 to 10. It is evident from the graph that

trapezoidal flap was preferred the most among Male patients. However this finding has no statistical significance. (Pearson Chi-Square Value:1.2; p=0.753 (p>0.005), hence shows no statistical significance.

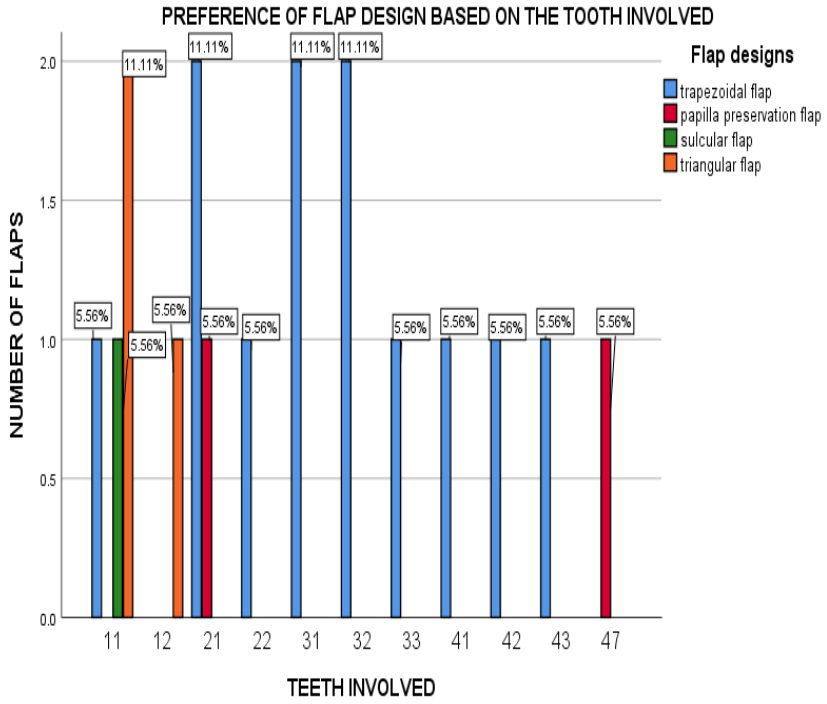

Figure 4: Bar graph showing the association between teeth involved and different types of flap designs used in endodontic surgery. Trapezoidal flap is represented in blue, papilla preservation flap by red, sulcular flap by green and triangular flap in orange. The X axis shows the number of teeth in the FDI system and the Y axis scale shows the total number of flaps used per tooth from 0 to 2. It is evident from the graph that trapezoidal flap was preferred the most in mandibular anteriors and triangular in the maxillary anteriors. However, this finding has no statistical significance. (Pearson Chi-Square Value:26.3 ; p= 0.656, (p>.0.005) hence it shows no statistical significance).

DISCUSSIONS

Dental caries progress further and cause pulpitis and peri apical lesions as sequelae that might demand endodontic therapies.[19] There are a diverse variety of flap designs available to gain access in Endodontics surgery. It is essential to determine a perfect flap design for the condition considering its advantages and disadvantages. A flap design has to be selected in a way that it will help in minimising Intraoperative and postoperative complications. Different types of flap designs used in the current study are trapezoidal flap (Broad base rectangle), triangular Flap (one vertical Releasing incision), sulcular Flat and papilla preservation flap. Also, Chlorhexidine is a cationic solution which can be used during endodontic treatment. It has a wide range of

antimicrobial activity.[20, 21] Calcium hydroxide and iodoform paste can be used to fill the debrided canal during endodontic surgery.[22, 23] Intracanal medications can be used in various endodontic conditions including multiple visit endodontics after trauma or in regenerative endodontics. These medications should be removed from the root canal before the placement of the filling or repair material.[24, 25] Teeth treated with calcium hydroxide root canal dressing displayed a minimum percentage of bacterial contamination, a lower MMP expression, and a more organized extracellular matrix, unlike those treated in a single visit. This suggests that calcium hydroxide might be beneficial in tissue repair processes.[26] And there are studies suggesting better sealing capacity of GIC and composite resins during endodontic therapy.[27]

In the current study, trapezoidal flaps were preferred the most by the dentists during endodontic surgery (63.2%) followed by triangular Flap (15.8%). This result is suggestive of better advantages of Trapezoidal Flap over other Flap designs. Gutman et al, in 1994 made similar arguments in his study. He stated that trapezoidal flap is more conservative and is extremely easy to perform, replace and suture, leading to low morbidity. This flap features a great mobility and permit to succeed in even longer roots. Likewise other full thickness flap, it exposes the whole buccal cortical plate and may eventually result in the treatment of endo- periodontal defects.[11] Study conducted by Mushtaq and Ivart also argued on better properties of Trapezoidal flap. [13, 14]

A variety of flaps have been employed in the past and in earlier days trapezoidal Flap was favoured owing to satisfactory visibility, easy suturing and tissue Handling.[12] Good access and visibility of the surgical field is one among the principle requisites of periapical surgery and therefore the manipulation of the soft tissues must be performed without compromising the optimal access to the peri apical region and excellent visibility of the involved apical Structures.[13, 14] Chindia et al, in 1995 conducted a study to compare between semilunar flap and trapezoidal flap on 20 patients aged between 16 to 44 years and found no loss of attachment in both flaps.[15] The desirability of trapezoidal Flap design is predicted on the assumption that it will provide better blood supply to the flapped tissues. Although this concept is valid in other tissues, such as the skin, its application is untouched in peri radicular surgery.[16] Yet, Vreeland and Tidwell in 1982 stated that proper alignment of flap is necessary for good aesthetics and is not easily achieved with trapezoidal flap.[17]

Triangular Flap is the second most commonly preferred flap in the current study. It is again due to its properties over horizontal and sulcular flaps. Frank and Avens in 1983 argued the advantages of Triangular Flap. The primary advantage of triangular flap is that it affords good wound healing, which may be as a result of minimal disruption of vascular supply to the flapped tissues and simple approximation with minimal sutures required. Yet, the major disadvantage of this flap is its limited surgical access it provided due to the only one vertical releasing incision.[28] As a Result of excellent wound healing potential of this flap design, its use is recommended whenever

possible.[29, 30] Only 10.5% of the dentists in this study had preferred papilla preservation flap. The reason can be attributed to its difficulty and requiring maximum technical ability. The careless manipulation of the papilla can cause aesthetic disasters to avoid which it has been conceived. This Flap is time consuming to be curved, to be raised and sutured. It completely exposes the Buccal plate only within the central zone of the teeth and may make Endo-periodontal treatment difficult.[31]

Preference of trapezoidal flap designs were higher among males patients (83.3%) than female patients (16.7%). Triangular flap is preferred the most in males (67%) than females (33%). With regard to the age group, Trapezoidal flap was commonly preferred in patients of age between 25 to 27 years, triangular flap between the age of 22 to 25 years (66.6%). Papilla preservation flap and sulcular flap is commonly preferred in the age group between 20 to 25 years. It can be dowmented from the above result that the prevalence of endo-periodontal defects was common among the age group of 20 to 35 years. This result is in accordance to the study conducted by Hansen in 1976 who stated that people of age 35 plus were highly susceptible to apical-periodontal defects.[32] Also Harald stated that 33% of patients in age group of 20 to 30 years were prone to endo-periodontal lesions requiring endodontic surgery.[33] In relation to the selection of teeth for respective flap design, triangular flaps are always preferred in maxillary anteriors. This result is in accordance with the study conducted by Ankita in 2017 who stated that triangular flap is recommended for maxillary incisors and posterior teeth.[33]

Limitations of this study include Geographic limitation as predominantly South Indian population were only considered, and was a Unicentric study with few Incomplete and unclear data. The Future scope of this study will yield a better and more accurate result when Different ethnic populations are considered.

With the current study as a platform, better flap design for endodontic surgery can be identified and will enable dentists to gain a thorough knowledge on pros and cons of different types of flap designs to be used during endodontic surgery.

CONCLUSIONS

Within the limitation of this study, it can be concluded that trapezoidal Flap was preferred the most, predominantly in young Male patients which was primarily reported in mandibular anteriors. Also, sulcular flap was preferred the least, among male patients and was primarily reported in maxillary anteriors and mandibular posteriors. Thus, as a clinician it is important to identify a better flap design bearing in mind the pros and cons of different types of flap designs for better visibility, access and to avoid post operative complications.

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AUTHOR CONTRIBUTIONS

Author 1 (Akshaya. K) carried out the retrospective study by collecting data and drafted the manuscript after performing the necessary statistical analysis. Author 2 (Dr. S. Delphine Priscilla Antony)aided in the conception of the topic, participated in the study design, statistical analysis and supervised in preparation of the manuscript. Author 3 (Dr.SenthilMurugan. P) has participated in the study design and has coordinated in developing the manuscript. All the authors have equally contributed in developing the manuscript.

CONFLICT OF INTEREST

Nil.

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