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REVIEW ARTICLE

COMPARISON OF TUNNEL TECHNIQUE WITH CORONALLY ADVANCED FLAP IN THE TREATMENT OF MANDIBULAR GINGIVAL RECESSION – A SYSTEMATIC REVIEW

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ABSTRACT

This study will help the clinicians to differentiate between the clinical outcomes of tunnel technique and coronally advanced flap in mandibular gingival recessions.Methodology: Online search of the data and manual searching was done by using keywords. Inclusion and exclusion criteria were strictly followed to select the relevant articles and then screening of all the selected articles was done to finalize the studies to be included in this systematic review.Results: Only one randomized control trial was included in this study and rest 6 articles were case series. Only one study reported about the recession treatment in posterior teeth while rest all studies were done in anterior teeth of mandible. Clinical performance of both techniques were accessed based on the clinical parameters which were probing pocket depth PD, recession depth RD, clinical attachment level (gain or loss), keratinized tissue, complete root coverage CRC and Aesthetics.Conclusion: Both techniques showed very promising results with satisfaction of the clinician and patients as well. Aesthetically tunnel technique was more comfortable for patient but coronally advanced flap covered the root more than tunnel technique. Hence none of the treatment can be considered as the gold standard as a lot of research and direct comparison is required for tunnel and coronally advanced technique in mandible.

Keywords: *Gingival recession, root exposure, marginal recession in mandible, tunnel technique, modified tunnel technique, coronally advanced flap, connective tissue graft*

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INTRODUCTION

Apical migration of marginal gingiva resulting in exposure of root surface is called gingival recession.[1]The cement-enamel junction is exposed due to recession. Recession can be either localized or generalized. Responsible factors for recession are anatomical, physiological or pathological.[2]The affected individuals experience pain, root sensitivity, lack of aesthetics and root caries.[3] Some of the etiological causes of recession include:[4]

- Malocclusion and Tooth position
- Anatomy
- Mechanical trauma
- Orthodontic movements
- Plaque and calculus retention
- Chemical trauma
- Width and thickness of keratinized tissue
- Periodontal disease
- Smoking
- Systemic disease associated recession

Millers classification proposed in 1985 gained much attention as compared to rest of the classification systems. The point of differentiation in Millers classification was based on loss of soft and hard tissue in interproximal areas.[5] Another factor of Miller classification was that the percentage of root coverage can be anticipated. There were four types of Millers Classification:[6]

- Class I: Anticipates 100% of root coverage. Marginal tissue recession with no soft and hard tissue loss.
- Class II: Marginal recession is till mucogingival junction or further than mucogingival junction.

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No soft tissue or hard tissue loss in interproximal areas is seen. This recession type also anticipates 100% of root coverage.

- Class III: Marginal tissue loss to the mucogingival junction or further. Tooth malpositioning and bone loss in interproximal areas. Since there is association of soft tissue and bone, 100% coverage of root cannot be achieved.
- Class IV: Marginal tissue loss is beyond the mucogingival junction. There is loss of soft and hard tissue in interproximal area. No anticipation of root coverage.

RT Classification system which was introduced in 2011 is the latest classification system which is now widely used.[7] According to this classification system there are three types of recession.

- Recession Type 1 (RT1): Loss of marginal gingiva but no interproximal attachment loss is seen in this type of recession defect.
- Recession Type 2 (RT2): Gingival Recession accompanied by interproximal loss of attachment. Attachment loss in interproximal region is lower or up to buccal attachment loss.
- Recession Type 3 (RT3): There is obvious recession of gingiva and interproximal attachment loss. Interproximal attachment loss is higher than the buccal attachment loss.

The periodontal surgical procedures are done to cover the recessions. Use of graft to cover the mucogingival recession is dependent on the severity of recession present in that region. Coronally Advanced Flap and Tunnel techniques are two most common surgical procedures carried out in the treatment of gingival recessions which will be compared in this systematic review.

There have been many researches done so far which emphasize on the coronally advanced flap and tunnel technique to reduce the recession in maxilla, but there is still a room to have a detailed research on both the techniques in mandible. This review aims systematically assessing the literature in order to compare the clinical performance of Tunnel Techniques with Coronally Advanced Flap in the treatment of Mandibular Gingival Recession.

METHODS

A systematic review of literature encompassing clinical outcomes of tunnel technique vs coronally advanced flap in the treatment of gingival recessions in mandible.

The research topic in question was formulated according to the following PICO formula:

Population: Individuals with multiple gingival recessions in mandible

Intervention: Tunnel technique/modified tunnel technique

Comparison: Coronally advanced flap

Outcomes: The primary outcomes were measured in terms of Complete Root Coverage (CRC), Recession Reduction (RecRed) while secondary outcomes were measured in terms of Clinical Attachment Level (CAL) Gain, Keratinized tissue (KT) increase, Probing depth and Aesthetics.

Human studies including randomized clinical trials and case series that treated multiple mandibular gingival recession defects by CAF or tunnel technique. Clinical outcomes considered must have been reported with a mean follow-up period of not less than 6 months.

Studies in which tunnel technique was carried out in maxilla. Publications which did not include recession reduction and CAL gain in outcomes. Other systematic reviews or narrative were also not considered for this study or studies which were carried out on animals.

Types of outcome measures selected

- Complete root coverage (CRC)
- Recession reduction (distance from CEJ to gingival margin).
- Clinical attachment level (CAL gain/loss from CEJ to deepest point in gingival sulcus)
- Increase in the keratinized tissue (mucogingival junction to the free gingival margin measured in mm)
- Probing depth
- Aesthetics (based on visual analogue scale from 0-10 and patient satisfaction)

Literature Search

The entire search was carried out electronically via Pub Med, Science Direct, BioMed Central and Google Scholar. The following search terms were used in combination 'gingival recession' OR 'miller classI' or 'miller classII' OR 'miller classIII' OR 'root exposure' OR 'marginal recession in mandible' AND 'tunnel technique' OR 'modified tunnel technique' OR 'coronally advanced flap' OR 'CAF' AND 'probing depth' OR 'clinical Attachment level' OR 'keratinized tissue height' OR 'CAL gain' OR 'probing depth reduction'.

All the randomized control trials (RCT) selected for this research were assessed via Critical Appraisal Skills Program (CASP) tool and Jadad scale (Jadad,

Moore et al. 1996).The articles which had Jadad score 3-5 were selected and considered suitable for research. The search criteria were defined to incorporate human subjects of any gender or age.(Fig 1 shows the search strategy.)

Data extraction

The titles and abstracts of all extracted articles were reviewed and analysed by the two main authors (UA and SM). Each title was read individually, and a third reviewer (SH) was involved where there was disagreement amongst the authors. After the screening process, the studies were extracted based on the following data: author name, journal name, study design, CRC, reduction in recession, gain in clinical attachment level, increase in keratinized tissue, reduction in pocket depth and aesthetics.

RESULTS

This initial search yielded 23 articles. Initially after reading the tittles only 13 articles were selected. Analysis of those articles was then based on the abstract reading after which 8 articles were selected for complete reading and understanding. Combining the electronic search and manual search, 11 articles batch was formed. From those 11 articles only 7 were selected and finalized to be discussed in this study. There is very limited research on mandibular recession defects and most of them are case series. The criteria for exclusion and inclusion of the articles has already mentioned.

Total number of studies included in this study were 7 among which one of them was a randomized clinical control trial. All the rest were case series which had clinical results according to the clinical parameters such as complete root coverage (%), probing pocket depth, recession reduction, clinical attachment level (gain or loss) and keratinized tissue width. The summary of three screening levels is shown in the Figure 1, and search results can be seen in table-1.

DISCUSSION

In three studies of coronally advanced flap and in four studies of tunnel technique, the connective tissue graft was used. One study was done in posterior aspect of the mandible whereas the rest of the studies were focusing on the anterior mandible.[9] Muscles attachments in the vestibule, root prominences, frenum attachment, thin gingival biotype and crowding of teeth in anterior region; these are the important consideration which have been mentioned in past studies as well in this study which challenges the surgical procedure in front teeth of mandible.Moreover, mental nerve, lingual nerve and inferior alveolar nerves should be monitored while performing any surgical procedure in lower arch.

Graft placement has been the key point in all the case series and randomized control clinical trial brought under consideration in this research. In this systematic review the graft was used in both the techniques i.e. Coronally advanced flap and tunnel technique to cover the recession defect. Class II and III recession defects were mainly treated in this recession study and as a matter of fact both recessions lack keratinized tissue which ultimately needs grafting to cover the root surface. The thickness of graft was approximately between 1.5mm – 2.00mm and it was left 1 - 2mm exposed when placed at the site of recession so that the excessive tension in the flap specifically in coronally advanced flap can be avoided.[11] In one of the recent randomized clinical trials it also has been concluded that the thickness of the graft doesn't affect the clinical outcomes in terms of root coverage and gingival thickness.[16]

Details of comparison of CAF & Tunnel technique in Millar class II and III can be seen in table-2 & table 3. The most common and favorite characteristics of tunnel technique are less incisiras, esthetically superior, less sear and patient ease.

Millers Type II and III Recession Defects in Anterior Teeth: CAF vs Tunnel technique:

Class II Recession in Anterior Teeth versus Class II Recession in Posterior Teeth Treated by Coronally Advanced Flap and CTG

There are certain anatomical variations in anterior and posterior mandible which somehow affects the outcomes of the periodontal surgery but to a very minimum extent. In posterior teeth aesthetic concerns are not of the prime importance rather surgeon focuses on covering the root surface and increasing the periodontal health status of the teeth involved in defect. In this study a cross comparison is also done in which class II recession defects of anterior and posterior teeth are

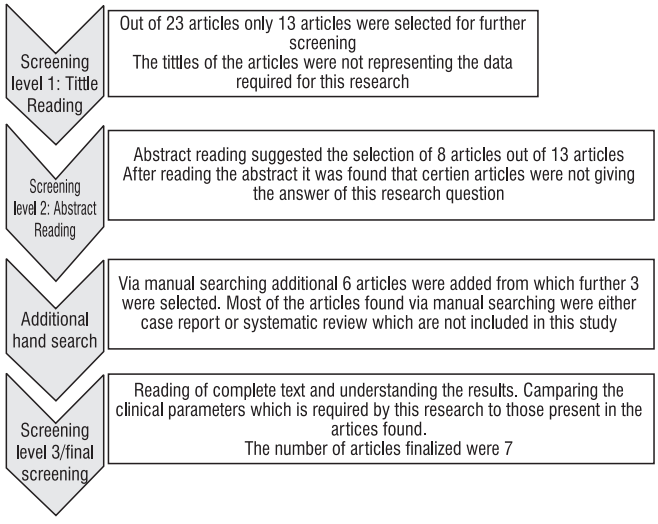

Fig 1: Summary of three screening levels

TABLE 1: SEARCH RESULTS

	(09)	(10)	(11)	(12)	(13)	(14)	(15)
Year	**2011**	**2012**	**2014**	**2016**	**2016**	**2011**	**2018**
Study design	Case series	Case series	Controlled randomized clinical trial	Case series	Case series	Case series	Case series
Population	Multiple recession in posterior mandible	Multiple recession in anterior mandible (class II and III)	Recession defect at lower incisors (anterior mandible)	Multiple Recession defects at anterior mandible	Recession defects Anterior mandible (class II & III)	Recession in anterior mandible	Anterior mandible with multiple recession defects (class I-III)
Follow up/ months	12	12	12	6	20	6	12
Surgical procedure performed	CAF + CTG	CAF + CTG	CAF + CTG	Tunnel + CTG	Tunnel + CTG	Tunnel + CTG	Tunnel + CTG
Complete root coverage CRC%	91.2% ± 4.1%	Class II: 71.42% Class III: 42.85%	Control group: 48% Test group: 88%	74.60%	Class II: 62.50% Class III: 14.30%	92.5%	50%
Recession Depth	0.28 ± 0.32 mm	Class II: 0.14 ± 0.24 class III: 0.85 ±1.06	C.G: 0.64 ± 0.76 T.G: 0.08 ± 0.28	0.18± 0.14mm	Class II: 0.38±0.52 Class III: 1.21±0.70	0.3mm	1.0±1.24
Probing depth	Not significant	Class II: 1.0mm Class III: 1.0mm	C.G: 1.0 ±0.01 T.G: 1.0 ± 0.02	1.70±0.06	Class II: 1.0mm Class III: 1.14±0.38	2.1mm	1.10±0.30
Keratinized tissue height KTH	3.05 ± 0.71 mm	Class II: 3.0 Class III: 3.0	C.G: 2.68 ± 1.14 T.G: 2.08 ± 0.87	3.41±0.14	Class II: 2.87 ± 0.35 Class III: 2.57±0.54	3.2mm	5.90±1.59
Clinical Attachment level CAL Gain	-	Class II: 1.14±0.24 Class III: 1.85±0.16	C.G: 1.64 ± 0.78 T.G: 1.08 ± 0.28	1.88±0.07	Class II: 1.38±0.52 Class III: 2.36±0.75	2.7mm	2.10±1.28
Aesthetics	Patient satisfied	VAS: 9/10	Acceptable by patients	Acceptable results	VAS: 9/10	Admirable maximum root coverage	Satisfactory

compared when both are treated with same periodontal surgery i.e. Coronally advanced flap with support of connective tissue graft.

Deep dissection of the flap was done in order to move the flap easily without any rupture and tension. Very high definition of precision is required in case of anterior teeth recession coverage because of the delicacy of the soft tissue. In posterior region there is already enough keratinized tissue which can be utilized in either way to gain the proper coverage of exposed root. Thus, the factor of tensed flap may somehow affect the root coverage procedure either by shrinkage or rupture. There is more root coverage observed in posterior class II recession type defect as compared to anterior class II

TABLE 2: COMPARISON OF CAF AND TUNNEL TECHNIQUE IN MILLER CLASS II AND III

	CAF in anterior mandible10 (Class II and III)	Tunneling technique in anterior mandible13 (Class II and III)
Complete root coverage CRC%	Class II: 71.42% Class III: 42.85%	Class II: 62.50% Class III: 14.30%
Recession Depth	Class II: 0.14 ± 0.24 class III: 0.85 ±1.06	Class II: 0.38±0.52 Class III: 1.21±0.70
Probing depth	Class II: 1.0mm Class III: 1.0mm	Class II: 1.0mm Class III: 1.14±0.38
Keratinized tissue width KTW	Class II: 3.0 Class III: 3.0	Class II: 2.87 ± 0.35 Class III: 2.57±0.54
Clinical Attachment level CAL Gain	Class II: 1.14±0.24 Class III: 1.85±0.16	Class II: 1.38±0.52 Class III: 2.36±0.75
Aesthetics	VAL: 9/10	VAL: 9/10

TABLE 3: CLASS II RECESSION IN ANTERIOR TEETH VERSUS CLASS II RECESSION IN POSTERIOR TEETH TREATED BY CORONALLY ADVANCED FLAP AND CTG

	Anterior Teeth Class II Recession Treated with CAF+CTG	Posterior Teeth Class II Recession Treated with CAF+CTG
	(10)	(09)
CRC %	71.42%	91.2% ± 4.1%
P.D	1.00±0.00	Not Significant
R.D	0.14±0.24	0.28±0.32
K.T.W	3.00±0.00	3.05±0.71
Aesthetics	VAS: 9/10	NA

defect but if recession reduction brought under consideration then there is more reduction in anterior class II then posterior class II defect. The aesthetic outcomes were more in anterior region with visual analogue scale of 9/10.

Healing Potential of CAF and Tunnel technique

Coronally advanced flap as discussed in this systematic review comprises more incisions which ultimately heals with more scarring. In aesthetic areas coronally advanced flap can be avoided and hence tunnel technique can be used if the recession defect is less then 4mm. Good management of interproximal papilla is an important factor which enhances the aesthetics of the region in which there is a defect. Tunnel technique helps in preserving the papilla and less incisive then coronally advanced flap. The main factor in the movement of coronally advanced flap is the flexibility of the flap pedicle which is done by dissecting deep in vestibule and the releasing incision, without these two incisions coronally advanced flap is incomplete and no adaptation occurs at the end. Tunnel technique is patient's friendly technique. Less incisions and papilla are totally preserved. The scaring is minimum because only intrasulcular incision is there and there are very less chances of the tunnel tissue to migrate apically. Aesthetic is a very crucial issue when periodontal plastic surgeries are done because the motive of maximum surgeries is to meet the aesthetic demands of patient. Visual analogue scales were used to access the level of patient satisfaction in few case series which draw our attention that the less incisive surgery the less scar it will show during healing and the more patient will be satisfied. Apart from two different approaches to cover the recession one thing common in both is the use of graft and the phenomenon of 'creeping attachment' best applies to grafts in both the techniques. It is basically the migration of gingival margin towards the coronal direction covering the root surface. In first phase there is bridging of the lesion with graft and in second phase of this phenomenon the creeping attachment occurs but this whole attachment procedure never takes place at constant rate, it variates, and follow-up period is the important factor in attachment procedure.[21]

Potential bias in the review and quality of literature involved

The authors have tried their best to reduce any bias with the involvement of third reviewer when article selection was being carried out. The results and the calibration of the results was done individually by both the authors to reduce any further risk of bias. One of the major limitations of this systematic review is lack of randomized control trials since very limited amount of work has been done. Most of the studies are case series which require randomized control trials to confirm the results.

IMPLICATIONS IN CLINICAL DENTISTRY

Clinically coronally advanced flap is more promising then tunnel advanced flap. It is of no doubt that CAF is more technique sensitive, more traumatic, not comfortable for patient and healing with scar can also take place, but the final outcomes are exactly what the periodontist demands. Root is completely covered, increase in keratinized tissue and gain in clinical attachment level.

CONCLUSION

Both Tunnel technique and Coronally advanced flap showed very promising results with satisfaction of the clinician and patients as well. Aesthetically tunnel technique was more comfortable for patient but coronally advanced flap showed better results in terms of CRC.Hence none of the treatment can be considered as the gold standard as a lot of research and direct comparison is required for tunnel and coronally advanced technique in mandible. There is very limited amount of data present regarding both the techniques specifically in mandible.

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