

## Decision-making in classifying gingival recession defects – A systematic review

### ABSTRACT

**Background:** Various classification systems have been devised to classify gingival recession defects (GRDs). Recent evidence has raised many questions on the use of currently popular classification systems. The purpose of this systematic review is to assess various classification systems in the light of the current scientific literature.

**Methods:** A comprehensive and systematic search was done to identify literature related to classification systems for GRD. Sources included books, journals, and online database. The search was done using the predefined criteria; 337 articles were initially identified through online database PubMed (Medline) and 12 from handsearch, of which a total of 10 full text articles were finally selected.

**Results:** The classification systems which were included in the review included the classifications given by Sullivan and Atkins, Miller, Smith, Nordland and Tarnow, Kumar and Masamatti, and Mahajan. The systematic review revealed that the Sullivan and Atkins classification system for gingival recession was the most useful classification system for clinicians till the year 1985 in which P. D. Miller introduced the classification system for marginal tissue recession. From 1985 to till date, the Miller's classification system is the most frequently used and popular classification system.

**Conclusion:** None of the classification systems for GRD fulfilled the ideal criteria; however, some of the recently introduced classification systems have evolved as a more comprehensive and viable alternative to already established classification systems.

**Keywords:** Classification, evidence-based dentistry, gingival recession, systematic review

### INTRODUCTION

#### Rationale

Gingival recession is a common consequence of periodontal disease in most populations;<sup>[1]</sup> the condition is associated with functional and esthetic problems for the patients. Typical causes of recession are trauma, periodontitis, tooth malposition, or local inflammation.<sup>[2]</sup> Gingival recessions may be asymptomatic but may result in root caries, dentinal hypersensitivity, and unesthetic appearance.

Management of gingival recession defect (GRD) can be done either surgically or nonsurgically. Surgical management techniques include free gingival graft,<sup>[3]</sup> free connective tissue graft,<sup>[4]</sup> laterally (horizontally) positioned flap,<sup>[5]</sup> coronally positioned flap like semilunar pedicle,<sup>[6]</sup> subepithelial connective tissue graft,<sup>[7]</sup> pouch and tunnel

technique,<sup>[8]</sup> guided tissue regeneration technique for root coverage,<sup>[9]</sup> periosteal pedicle grafts,<sup>[10]</sup> and combined techniques.


Correcting faulty tooth brushing technique, orthodontic realignment, veneering using composites, and gingival prosthesis result in the management of GRD nonsurgically.

**AJAY MAHAJAN, KANWARJIT SINGH ASI, DEEPA RAYAST, MAYUM NEGI**

Department of Periodontology, Himachal Pradesh Government Dental College and Hospital, Shimla, Himachal Pradesh, India

**Address for correspondence:** Dr. Deepa Rayast, Department of Periodontology, Himachal Pradesh Government Dental College and Hospital, Shimla - 171 001, Himachal Pradesh, India. E-mail: deeparayast@gmail.com

**Received:** 07-09-2018, **Revised:** 27-12-2018, **Accepted:** 25-03-2019, **Published:** 12-11-2019

Access this article online	
<b>Website:</b> www.njms.in	<b>Quick Response Code</b> 
<b>DOI:</b> 10.4103/njms.NJMS_71_18	

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** reprints@medknow.com

**How to cite this article:** Mahajan A, Asi KS, Rayast D, Negi M. Decision-making in classifying gingival recession defects – A systematic review. Natl J Maxillofac Surg 2019;10:206-11.

Classification systems are vital in providing a framework to scientifically study the etiopathogenesis and treatment of diseases in a methodical manner. In addition, classification systems help clinicians immensely to categorize their patients according to their individual needs. Although most of the clinicians are aware about the clinical implications of GRD, till date, there is no consensus on the various classifications used to classify GRD.

Many research articles are being published on limitations, and drawbacks of various established classification systems and new systems to classify GRD are now being introduced frequently, making it further difficult for the clinicians to decide on a single effective means to classify and hence treat GRD accordingly.

### Focused questions

Is Miller's classification still relevant in the light of the current evidence?

What are the other alternatives to Miller's classification system which may be used to classify GRD?

## METHODS

### PIOS

P: Population – patient with GRD

I: Intervention – to classify GRD.

O: Objective – classify and determine the treatment plan for GRD.

S: Studies included – observational to clinical studies.

### Search process

A comprehensive and systematic search was undertaken for the literature related to GRD classification systems as per the Preferred PRISMA guidelines.<sup>[11]</sup>

Sources included books, journals, related sites, and online database (Medline, PubMed). The search was not language restricted and combined the following terms: gingival recession classification, recession defects classification, and classification system for gingival recession. The flowchart depicting selection process of the studies included in the systematic review is shown in Figure 1.

### Inclusion criteria

Only original articles published related to classification of GRD in indexed journals and authentic books from the year 1968 to 2013 were selected for the systematic review as no

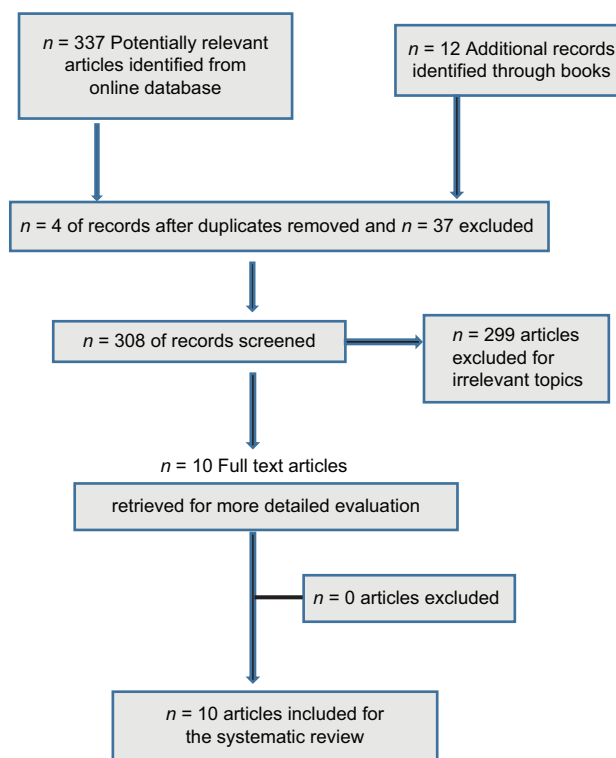


Figure 1: Flow chart showing selection process of the studies included in the systematic review

relevant original research publication was found beyond 2013.

### Exclusion criteria

Nonindexed journals/local magazines and articles on topic other than classification of GRD.

## RESULTS

The search was done using the predefined criteria, 337 articles were initially identified through online database PubMed (Medline) and 12 from handsearch, of which a total of 10 full text articles were finally selected for systematic review [Table 1], considering the theoretical and subjective nature of the review; no statistical data was available, and hence, no biostatistical calculations were performed.

## DISCUSSION

The aim of the present systematic review was to assess and critically analyze the various classification systems available in the literature to classify GRD, thereby arriving at a consensus on the best available classification system based on the current evidence. Murphy had given criteria of an ideal classification systems which included the following:<sup>[12]</sup>

1. Usefulness: an ideal classification system should be practical and easy to use

**Table 1: The list of Selected studies included in the systematic review**

List of Articles included for systematic review
1. Sullivan HC, Atkins JH. Free autogenous gingival grafts 3. Utilization of grafts in the treatment of gingival recession. <i>Periodontics</i> 1968;6:152-60.
2. Mlinek A, Smukler H, Buchner A. The use of free gingival grafts for the coverage of denuded roots. <i>J Periodontol</i> 1973;44:248-54.
3. Liu WJ, Solt CW. A surgical procedure for the treatment of localized gingival recession in conjunction with root surface citric acid conditioning. <i>J Periodontol</i> 1980;51:505-9.
4. Miller PD Jr. A classification of marginal tissue recession. <i>Int J Periodontics Restorative Dent</i> 1985;5:8-13.
5. Smith RG. Gingival recession. Reappraisal of an enigmatic condition and a new index for monitoring. <i>J Clin Periodontol</i> 1997;24:201-5.
6. Nordland WP, Tarnow DP. A classification system for loss of papillary height. <i>J Periodontol</i> 1998;69:1124-6.
7. Mahajan A. Mahajan's modification of Miller's classification for gingival recession. <i>Dent Hypotheses</i> 2010;1:45-50.
8. Cairo F, Nieri M, Cincinelli S, Mervelt J, Pagliaro U. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: An explorative and reliability study. <i>J Clin Periodontol</i> 2011;38:661-6.
9. Pini-Prato G. The miller classification of gingival recession: Limits and drawbacks. <i>J Clin Periodontol</i> 2011;38:243-5.
10. Kumar A, Masamatti SS. A new classification system for gingival and palatal recession. <i>J Indian Soc Periodontol</i> 2013;17:175-81.

2. Exhaustiveness: an ideal classification should accommodate majority of the variations in the condition being classified
3. Disjointness: there should be no overlapping between two classes of classifications
4. Simplicity: large number of subclasses and too many variables should be avoided in the classification.

During our search, the first classification which was identified was given by Sullivan and Atkins in 1968.<sup>[13]</sup> They initially classified gingival recession into four morphological categories: the shallow–narrow, the shallow–wide, the deep–narrow, and the deep–wide. Although very popular and simple to use, it lacks scientific evidence, exhaustiveness, and objectivity.

Mlinek *et al.*<sup>[14]</sup> based their classification system on the Sullivan and Atkins classification system and gave it objectivity by “shallow-narrow” defects as recession <3 mm, while “deep-wide” defects were recessions >3 mm; this classification system also inherited the limitation of their predecessors.<sup>[14]</sup>

Liu and Solt had also classified marginal tissue recession.<sup>[15]</sup> According to their classification, there are two types of gingival recessions:

1. Visible recession is the clinically observable root measured from the cemento-enamel junction (CEJ) to the crest of the soft tissue margin
2. Hidden recession is the depth of the sulcus or pocket as

measured from the soft tissue margin to the epithelial attachment. The total amount of recession is the sum of the two types.

This system for classifying gingival recessions was theoretically valid but clinically was not very effective as it did not discuss the prognosis with visible and hidden recessions. The classification also failed to provide information about the condition in which CEJ was absent. Benque *et al.*<sup>[16]</sup> gave a classification system based on the prognosis and the shape of the GRD; they described the following three forms:

1. U: Poor prognosis for covering recession defect
2. V: Favorable prognosis
3. I: Good prognosis for covering recession defect.

The classification system was simple but lacked scientific support to support its use.

After thoroughly studying the various classification systems, it was found that all of the above classification systems had the following limitations:

- Observation is only on facial surface neglecting lingual/palatal recessions which is important as denuded root surfaces on the lingual/palatal side may cause discomfort like pain and sensitivity; they should also be classified
- No criteria for interdental soft and hard tissue loss were given in these systems for classifying GRD which was a major drawback as these factors may affect the prognosis
- Measurement of gingival thickness in patients with GRD is a recent concept which might affect the outcome and long-term prognosis of the treated GRD; this was not taken into account in any of these classifications
- Severity of malaligned teeth which is an important factor in determining the extent and severity of GRD was not included.

Until 1985, Sullivan and Atkins classification was the most clinically acceptable and popular when P. D. Miller Jr. classified marginal tissue recession into four classes.<sup>[17]</sup>

Miller's classification is still the most popular among all the classification systems. Four classes of GRD were made based on the evaluation of soft and hard periodontal tissues [Table 1]. It was found that Miller's classification, which claimed to anticipate the prognosis of root coverage, has revealed its inadequacies, which were recently pointed out by various researchers.<sup>[18]</sup> In addition, Miller's classification system lacks both reliability and validity which are central to determining the utility of any clinical examination.<sup>[19]</sup>

The limitations and drawbacks of Miller’s classification system prompted various researchers to invent newer and more holistic classification systems. One such classification system identified in our study was Smith who proposed an index of recession (IR). The system had an observational and descriptive value, was capable of denoting severity of the recession defects, and also provided a basis for evaluating treatment modalities and experimental studies. The IR had two components: horizontal and vertical.<sup>[20]</sup>

The horizontal component: the first digit is expressed as a whole number value from the range 0–5 depending on what proportion of the CEJ is exposed, on either the facial or lingual aspects of the tooth, between the mesial and distal midpoints (MM-MD distance) approximately.<sup>[20]</sup>

The second digit of the IR gives the vertical extent of recession measured in whole mm on a range of 0–9.<sup>[20]</sup>

Although this index is exhaustive, it lacks simplicity and is difficult to use.

In 1998, Nordland and Tarnow had given a classification system for loss of papillary height.<sup>[21]</sup> The system utilizes 3 identifiable anatomical landmarks: the interdental contact point, the facial apical extent of the CEJ, and the interproximal coronal extent of the CEJ [Table 2].<sup>[17]</sup> This classification system although is simple to use, it lacks exhaustiveness.

After Nordland and Tarnow from 1998 to 2009, no recognized and popular classification system was identified through our online database and handsearch till the year 2010 when a modification of Miller’s classification was given by Mahajan.<sup>[22]</sup> He pointed out some of the inherent drawbacks associated with Miller’s classification system:

- Miller’s classification lacks exhaustiveness and disjointness, for example, it would be difficult to

**Table 2: The Miller’s classification of gingival recession defects**

Class I	Marginal tissue recession, which does not extend to the MGJ There is no periodontal loss (bone or soft tissue) in the interdental area, and 100% root coverage can be anticipated
Class II	Marginal tissue recession, which extends to or beyond the MGJ There is no periodontal loss (bone or soft tissue) in the interdental area, and 100% root coverage can be anticipated
Class III	Marginal tissue recession, which extends to or beyond the MGJ Bone or soft tissue loss in the interdental area is present or there is a malpositioning of the teeth, which prevents the attempting of 100% of root coverage. Partial root coverage can be anticipated
Class IV	Marginal tissue recession, which extends to or beyond the MGJ The bone or soft tissue loss in the interdental area and/or malpositioning of teeth is so severe that root coverage cannot be anticipated

MGJ: Mucogingival junction

classify the GRD that does not extend to mucogingival junction (MGJ); but, there is associated hard and soft tissue loss in the interdental areas adjacent the defects

- The difference between Class III and IV lies only in the extent of the severity of the GRD
- The classification system does not mention any objective criteria to assess the severity of bone/soft tissue loss.

Based on the above facts, the following modifications were suggested by Mahajan:

- The emphasis on the extent of GRD in relation to MGJ should be separated from the criteria of bone/soft tissue loss in interdental areas
- Objective criteria should be included to differentiate between the severity of bone/soft tissue loss in Class III and Class IV, as used in some of the other classifications
- Prognosis assessment must include the profile of the gingiva as recent studies have shown that gingival thickness is an important criteria affecting long-term prognosis of treated GRD (>0.8 mm improves the prognosis); in other words, thick gingival profile favors treatment outcome and vice versa.

An outline of Mahajan’s modification of Miller’s classification including the above-mentioned changes is presented:<sup>[22]</sup>

- Mahajan’s Class I (M I): GRD not extending to the MGJ
- Mahajan’s Class II (M II): GRD extending to the MGJ/beyond it
- Mahajan’s Class I (M III): GRD with bone or soft-tissue loss in the interdental area up to cervical one-third of the root surface and/or malpositioning of the teeth
- Mahajan’s Class IV (M IV): GRD with severe bone or soft tissue loss in the interdental area greater than cervical one-third of the root surface and/or severe malpositioning of the teeth.

### Prognosis

- BEST: Class I and Class II with thick gingival profile
- GOOD: Class I and Class II with thin gingival profile
- FAIR: Class III with thick gingival profile
- POOR: Class III and Class IV with thin gingival profile.

Thus, an individual with similar Miller’s classification may have different prognosis depending on the gingival profile. In addition, the Mahajan’s modification removed the confusion between GRD with no interdental hard/soft tissue loss (Mahajan’s Class I and II) and GRD with interdental hard/soft tissue loss (Mahajan’s Class III and IV).

The positive aspect of this classification system was that it was based on the most popular Miller’s classification system and hence making it convenient for the clinicians to shift

over to it who are already accustomed to the more than two decades old time-tested Miller’s classification system; also, the fact that by including the recent clinical evidence-based criteria, it offers a “gradual up-gradation” and improvement rather than a “sudden drastic shift” to more comprehensive but complex classification systems, thus avoiding the initial resistance by the users which is among the most common cause for unacceptability and lack of popularity of the recently given classifications for GRD. This classification system exhibited exhaustiveness, disjointness, and simplicity and was found to be reliable<sup>[23]</sup> but required radiographic evidence in every patient and is limited to facial surface defects only.

Another classification system identified was given by Cairo *et al.*<sup>[24]</sup> who used the interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes. It took into account the desirable characteristics of a classification system suggested by Murphy<sup>[12,24]</sup> but needs further studies to test its validity and reliability [Table 3].<sup>[21]</sup>

Recently, Kumar and Masamatti<sup>[25]</sup> gave their classification which classified buccal and lingual gingival recessions into 3 classes with further subclasses in each type; the palatal gingival recessions were classified separately into different classes. Although the classification system tried to incorporate the lingual recessions which makes it relatively more exhaustive than Miller’s classification system, it lacked simplicity. The authors of this classification system also compared their classification with the Miller’s classification

system in terms of clinical applicability,<sup>[26]</sup> but the fact that the Miller’s classification system does not include palatal and lingual GRD while the Kumar and Massamati’s classification system is based on inclusion of these defects for classifying GRD; therefore, comparison on these grounds abates the outcomes of the study results as the possibility of bias in favor of the latter cannot be ruled out. In addition, the Kumar and Massamati’s classification system lacks any evidence in its support about the inter- and intra-rater reliability, which is an inherent quality of a system to be clinically applicable.

**Summary of evidence**

At the end of the systematic review, the classification systems which may be labeled as theoretically and clinically relevant, till date, included the classifications given by Sullivan and Atkins, Miller, Smith, Norland and Tarnow, Cairo *et al.* [Table 4], and Mahajan. The review also revealed that only three classification systems, namely the classifications given by Mahajan, Cairo *et al.*, and Kumar and Masamatti have tried to objectify their findings when used to classify GRD.<sup>[23,24,26]</sup> It is also pertinent to mention that the objectivity of all these classification systems was assessed by the proposers of these systems, and actual reliability of these systems needs further assessments.

**Limitations**

Despite the fact that classifying lingual and palatal GRD cannot be underestimated, majority of the systems which gained popularity classified only buccal GRD. The reason behind their popularity may be the practical approach of these systems which make them simple to apply and hence clinically useful.

It is also worth mentioning that one of the limitations of our study was that it lacked statistical analysis due to limited data available on the subject. The authors suggest future research to compare and analyze various GRD classification systems based on actual validation of the classification results on the treatment outcomes of the patients treated for GRD.

**Table 3: The Norland and Tarnow’s classification**

Classification	Criteria
Normal	Interdental papilla fills embrasure space to the apical extent of the interdental contact point/area
Class I	The tip of the interdental papilla lies between the interdental contact point and the most coronal extent of the interproximal CEJ (space present but interproximal CEJ is not visible)
Class II	The tip of the interdental papilla lies at or apical to the interproximal CEJ but coronal to the apical extent of the facial CEJ (interproximal CEJ visible)
Class III	The tip of the interdental papilla lies level with or apical to the facial CEJ

CEJ: Cementoenamel junction

**Table 4: The Cairo’s classification of gingival recession defects**

RT1	Gingival recession with no loss of interproximal attachment. Interproximal CEJ was clinically not detectable at both mesial and distal aspects of the tooth
RT2	Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss was less than or equal to the buccal attachment loss
RT3	Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss was higher than the buccal attachment loss

RT: Recession type, CEJ: Cementoenamel junction

**CONCLUSION**

Despite the fact that Miller’s classification is still very popular, inherent drawbacks associated with the Miller’s system have started to emerge, suggesting either a modification or replacement of the Miller’s classification system with some of the more recent and updated classification systems.

**Financial support and sponsorship**

Nil.



**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Susin C, Haas AN, Oppermann RV, Haugejorden O, Albandar JM. Gingival recession: Epidemiology and risk indicators in a representative urban Brazilian population. *J Periodontol* 2004;75:1377-86.
2. Wennstrom JL, Zucchelli G, Pini Prato GP. Mucogingival therapy – Periodontal plastic surgery. In: Lang NP, Lindhe J, editors. *Clinical Periodontology and Implant Therapy*. 5<sup>th</sup> ed. Oxford: Blackwell Munksgaard RD; 2003. p. 955-1028.
3. Bjorn H. Free transplantation of gingiva propria. *Swed Dent J* 1963;22:684.
4. Levine RA. Covering denuded maxillary root surfaces with the subepithelial connective tissue graft. *Compendium* 1991;12:568, 570, 572.
5. Grupe HE, Warren RF. Repair of gingival defects by a sliding flap operation. *J Periodontol* 1956;27:290-5.
6. Tarnow DP. Semilunar coronally repositioned flap. *J Clin Periodontol* 1986;13:182-5.
7. Langer B, Langer L. Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 1985;56:715-20.
8. Zabalegui I, Sicilia A, Cambra J, Gil J, Sanz M. Treatment of multiple adjacent gingival recessions with the tunnel subepithelial connective tissue graft: A clinical report. *Int J Periodontics Restorative Dent* 1999;19:199-206.
9. Pini Prato G, Tinti C, Vincenzi G, Magnani C, Cortellini P, Clauser C, *et al.* Guided tissue regeneration versus mucogingival surgery in the treatment of human buccal gingival recession. *J Periodontol* 1992;63:919-28.
10. Mahajan A. Periosteal pedicle graft for the treatment of gingival recession defects: A novel technique. *Aust Dent J* 2009;54:250-4.
11. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Ann Intern Med* 2009;151:264-9, W64.
12. Murphy EA. *The Logic of Medicine*. 2<sup>nd</sup> ed. Baltimore: The Johns Hopkins University Press; 1997. p. 119-36.
13. Sullivan HC, Atkins JH. Free autogenous gingival grafts 3. Utilization of grafts in the treatment of gingival recession. *Periodontics* 1968;6:152-60.
14. Mlinek A, Smukler H, Buchner A. The use of free gingival grafts for the coverage of denuded roots. *J Periodontol* 1973;44:248-54.
15. Liu WJ, Solt CW. A surgical procedure for the treatment of localized gingival recession in conjunction with root surface citric acid conditioning. *J Periodontol* 1980;51:505-9.
16. Benque EP, Brunel G, Gineste M, Colin L, Duffort J, Fonvielle E. Gingival recession. *J Periodontol* 1984;3:207-41.
17. Miller PD Jr. A classification of marginal tissue recession. *Int J Periodontics Restorative Dent* 1985;5:8-13.
18. Pini-Prato G. The miller classification of gingival recession: Limits and drawbacks. *J Clin Periodontol* 2011;38:243-5.
19. Karras DJ. Statistical methodology: II. Reliability and validity assessment in study design, part B. *Acad Emerg Med* 1997;4:144-7.
20. Smith RG. Gingival recession. Reappraisal of an enigmatic condition and a new index for monitoring. *J Clin Periodontol* 1997;24:201-5.
21. Nordland WP, Tarnow DP. A classification system for loss of papillary height. *J Periodontol* 1998;69:1124-6.
22. Mahajan A. Mahajan's modification of Miller's classification for gingival recession. *Dent Hypotheses* 2010;1:45-50.
23. Mahajan A, Kashyap D, Kumar A, Mahajan P. Reliability study of Mahajan's classification of gingival recession: A pioneer clinical study. *J Indian Soc Periodontol* 2014;18:38-42.
24. Cairo F, Nieri M, Cincinelli S, Mervelt J, Pagliaro U. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: An explorative and reliability study. *J Clin Periodontol* 2011;38:661-6.
25. Kumar A, Masamatti SS. A new classification system for gingival and palatal recession. *J Indian Soc Periodontol* 2013;17:175-81.
26. Kumar A, Gupta G, Puri K, Bansal M, Jain D, Khatri M, *et al.* Comparison of the clinical applicability of Miller's classification system to Kumar and Masamatti's classification system of gingival recession. *J Indian Soc Periodontol* 2015;19:563-8.