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Original Article

Comparison of Miller's Classification of Gingival Recession Defects with Mahajan's Classification of Gingival Recession Defect: A Reliability Study

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Abstract

Background: Gingival recession is a common periodontal problem encountered in most populations. A number of classification systems are available to classify gingival recession defects (GRDs), but there has been a lack of consensus among the clinicians regarding the choice of classification system to classify GRDs. Recently, Miller's classification has been criticized owing to its inherent limitations. Mahajan's classification was proposed to eliminate the drawbacks of Miller's classification system. To the best of our knowledge, there has been no study testing or comparing the reliability of Miller's classification; therefore, the present study was done to compare the reliability of Miller's classification with Mahajan's classification. **Materials and Methods:** The sites selected for the study were classified for GRD according to either Miller's classification or Mahajan's classification by the two groups of four examiners. All the examiners were calibrated for the two classification systems and classified the selected sites accordingly. Kappa statistics was performed to analyze the intra- and interrater agreement among the four examiners. **Results:** A total of 609 gingival recession sites in 91 patients (49 males and 42 females) were classified. At the end of the study, Mahajan's classification had a higher intrarater ($\kappa = 0.93–0.83$) and interrater reliability ($\kappa = 0.93$) compared to Miller's classification for GRD for both intrarater ($\kappa = 0.57–0.68$) and interrater observations ($\kappa = 0.66$), respectively. **Conclusions:** Miller's classification system was less reliable than Mahajan's classification system.

Keywords: Gingival recession, Miller's classifications, prognosis, reliability, treatment plan

Introduction

Gingival recession defects (GRDs) are one of the most prevalent dental problems, for which patients seek dental care.[1] Despite the recent advancements in the management techniques to treat GRD, there has always been lack of consensus among the clinicians regarding the choice of classification system to classify GRD.[2] Classifying a disease has an immense value in identifying the condition accurately, determining the prognosis, and hence formulating the treatment plan.[3,4] Various research articles have been published to propose a comprehensive classification system to classify GRD over the past years, but none has been flawless.[2-7] Among all the classification systems, the Miller's classification system[8] [Table 1] is still considered to be the most popular, the reasons for which are its simplicity and its claim to assess the treatment outcome (prognosis) of the GRD based on its class.[2] Recent evidence has, however, suggested that time has come to either replace or improve the Miller's classification system as it lacks objectivity and scientific evidence in its support (i.e., lack of reliability or validity studies).[2,9,10] To overcome the inherent limitations of Miller's classification, Mahajan's classification was proposed [Table 2].[10] The authors of the Mahajan's classification system claimed it to be a more objective and evidence-based classification system than Miller's classification. Because it is hypothesized that the Mahajan's classification is an upgraded and improved version of already established Miller's classification system, the chances are

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Table 1: The Miller's classification of gingival recession defects

Classification	Description	Prognosis
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	100% root coverage can be anticipated (good to excellent)
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	100% root coverage can be anticipated (good to excellent)
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 (expected)
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	No root coverage (poor)

MGJ – Mucogingival junction

Table 2: The Mahajan's classification of gingival recession defects*

Class	Description	Prognosis for thin gingival profile	Prognosis for thick gingival profile
I	GRD* not extending to the MGJ	Good	Best
II	GRD extending to the MGJ/beyond it	Good	Best
III	GRD with bone or soft-tissue loss in the interdental area up to cervical 1/3 of the root surface and/or malpositioning of the teeth	Poor	Fair
IV	GRD with severe bone or soft-tissue loss in the interdental area greater than cervical 1/3rd of the root surface and/or severe malpositioning of the teeth	Poor	Guarded

GRD – Gingival recession defects, MGJ – Mucogingival junction

that the clinicians who are already accustomed to Miller's classification system will readily accept it.[10,11]

The purpose of this study was to assess and compare the Miller's classification with the Mahajan's classification system to classify GRD and objectively analyze the findings based on inter- and intrarater agreements. The study also assessed the ability of the two systems to determine the prognosis of the GRDs and how these classification systems perform when it comes to plan the treatment for various types of GRD.

Materials and Methods

Method of selection of patient

Patients with clinical finding of GRD in one or more teeth were enrolled for the study. All participants received detailed information on the study, and informed written consent was read and signed in accordance with the Helsinki declaration of 1975 as revised in 2000. Systemically healthy patients in the age range of 18–60 years with the presence of buccal recession defect in one or more teeth and willing to participate in the study were included in the study. Medically compromised patients, smokers, pregnant females, and patients unwilling for participation in the study were excluded from the study.

The selected sites were classified for GRD according to either Mahajan's classification (C_1) or Miller's Classification (C_2) by the two groups of examiners (E): Group 1 – E_1 (AM) and E_2 (MN) and Group 2 – E_3 (KA) and E_4 (DR). All the examiners were calibrated for the two classification systems and classified the GRD at two different times to assess intrarater reliability. Basic periodontal diagnostic instruments and intraoral periapical radiographs were used for examining the patients. An average time of 10 min was taken for each examination. Interrater reliability was assessed within the same group by comparing the observations made by E_1 (AM) and E_2 (MN) for C_1 and E_3 (KA) and E_4 (DR) for C_2. Intergroup comparison between C_1 and C_2 was done by comparing the observations of Group 1, i.e., E_1 and E_2, and Group 2, i. e., E_3 and E_4. The sites which could not be classified by the examiner were grouped as sites with "conflict"(C).

Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences(SPSS) version 25 (IBM Corp., India). Pearson's Chi-square and Kappa statistic were performed to assess the intra- and interrater agreement among the examiners. The level of agreement was evaluated according to the six-level nomenclature given by Landis and Koch: poor agreement – 0.00, slight agreement – 0.00–0.20, fair agreement – 0.21–0.40, moderate agreement – 0.41–0.60, substantial agreement – 0.61–0.80, and almost perfect agreement – 0.81–1.00. Statistical significance was set at alpha = 0.05.

Results

A total of 609 gingival recession sites in 91 patients (49 males and 42 females) were enrolled in the study in order to compare the reliability of Mahajan's classification system of GRD with Miller's classification of GRD. Kappa statistics was performed to analyze intra- and interrater agreement among the four examiners.

I. The kappa statistics for intrarater agreement was drawn by:
   1. Comparing the reading 1 (R1) with reading 2 (R2) of examiner 1 (AM) for C_1
   2. Comparing the reading 1 (R1) with reading 2 (R2) of examiner 2 (MN) for C_1
   3. Comparing the reading 1 (R1) with reading 2 (R2) of examiner 3 (KA) for C_2
   4. Comparing the reading 1 (R1) with reading 2 (R2) of examiner 1 (DR) for C_2.

II. The kappa statistics for interrater agreement was drawn by:
   1. Comparing E_1 (AM) with E_2 (MN) for C_1
   2. Comparing E3 (KA) with E_4 (DR) for C_2.

The kappa statistics for intrarater agreement ranged from 0.93 to 0.83 (almost perfect agreement) for C_1 [Table 3] and 0.57 (moderate agreement) to 0.68 (substantial agreement) for C_2 [Table 4]. The kappa statistics for the interrater agreement for E_1 and E_2 of C_1 was 0.93 and for E3 and E4 of C2 was 0.66, showing almost perfect agreement and substantial agreement, respectively [Table 5].

Discussion

The aim of our study was to compare the Miller's classification with the Mahajan's classification for classifying the GRD in terms of reliability and relevance in light of the current clinical evidence. At the end of the study, it was found that Mahajan's classification had a high intrarater (κ = 0.93–0.83) and interrater reliability (κ = 0.93), whereas Miller's classification for GRD was found to be less reliable for both intrarater (κ = 0.57–0.68) and interrater observations (κ = 0.66). The probable reasons were that the E_3 (KA) and E_4 (DR) found it difficult to differentiate among GRD falling in either Miller's Class I or Class III.[9-11] The reason suggested for the conflict

Table 3: Crosstab and corresponding Chi-square value intraoperator for C_1 Mahajan's classification E_1 (AM) and E_2 (MN) (1.00, 2.00, 3.00, and 4.00 are classes according to Mahajan's classification)

Count	(AM) R2					Measure of agreement (χ^2)	Count	(MN) R2					Measure of agreement (χ^2)
(AM) R1	1.00	2.00	3.00	4.00	Total		(MN) R1	1.00	2.00	3.00	4.00	Total	
1.00	110	0	2	0	112	0.93*	1.00	105	0	5	0	110	0.83*
2.00	1	8	1	0	10		2.00	0	7	6	0	13	
3.00	6	2	415	2	425		3.00	8	4	399	13	424	
4.00	0	0	6	56	62		4.00	0	0	11	51	62	
Total	117	10	424	58	609		Total	113	11	421	64	609	

*Almost perfect agreement: 0.81-1.00

Table 4: Crosstab and corresponding Chi-square value intraoperator for C_2 Miller's classification E_3 (KA) and E_4 (DR) (1.00, 2.00, 3.00, 4.00 and C [conflict] are classes according to Miller's classification)

Count	(KA) R2						Measure of agreement (χ^2)	Count	(DR) R2						Measure of agreement (χ^2)
(KA) R1	1.00	2.00	3.00	4.00	C	Total		(DR) R1	1.00	2.00	3.00	4.00	C	Total	
1.00	334	0	1	0	75	410	0.57*	1.00	295	0	0	0	70	365	0.68**
2.00	8	12	0	0	7	27		2.00	1	16	0	0	5	22	
3.00	0	0	4	0	0	4		3.00	2	0	0	0	1	3	
4.00	0	0	1	0	0	1		4.00	0	0	0	0	0	0	
C	34	0	0	0	133	167		C	19	2	1	0	197	219	
Total	376	12	6	0	215	609		Total	317	18	1	0	273	609	

*Moderate agreement: 0.41-0.60, **Substantial agreement: 0.61-0.80

Table 5: Crosstab and corresponding Chi-square values interoperator for C_1 Mahajan's classification and C_2 Miller's classification

Count	E2 (MN)					Measure of agreement (χ^2)	Count	E4 (DR)						Measure of agreement (χ^2)
E1 (AM)	1.00	2.00	3.00	4.00	Total		E3 (KA)	1.00	2.00	3.00	4.00	C	Total	
1.00	110	0	2	0	112	0.93*	1.00	350	1	0	0	59	410	0.66**
2.00	0	7	3	0	10		2.00	0	14	0	0	13	27	
3.00	0	6	415	4	425		3.00	1	0	0	0	3	4	
4.00	0	0	4	58	62		4.00	0	0	0	0	1	1	
Total	110	13	424	62	609		C	14	7	3	0	143	167	
							Total	365	22	3	0	219	609	

*Almost perfect agreement: 0.81-1.00, **Substantial agreement: 0.61-0.80

was that the examiners either failed to classify or lacked consistency to classify those defects which had bone loss and were not extending up to mucogingival junction. It was also noticed that it was confusing for the examiners to classify defects between Miller's Class III and Class IV in the absence of clear-cut objective criteria. The same examiner classified the same defects in Class III and later in Class IV based on his/her subjective interpretation about the severity of bone loss and malocclusion. The difference between interoperator readings among E_3 (KA) and E_4 (DR) was also attributed to the subjectivity in assessing the severity of Miller's Class III and Class IV type GRD.[9,10] As a consequence of these conflicts in the Miller's classification, many sites of GRD with Miller's Class I or III were either not classified or their prognosis changed drastically, e.g., whereas prognosis for Miller's Class III is fair with partial root coverage, prognosis for Miller's Class I GRD type defect is excellent and 100% root coverage is anticipated. The same problem persisted regarding the prognosis of Miller's Class III and Class IV type defects. Miller rated Class III type defects as treatable with partial root coverage and Class IV type defects were rated poor with unpredictable prognosis in his classification. It is pertinent to mention here that labeling a condition as "poor prognosis" or "unpredictable" may discourage many patients to give consent for the treatment as well as surgeons to go ahead with the treatment for GRD. None of these problems were associated with Mahajan's classification as there was clear-cut demarcation between GRD without bone loss (Mahajan's Class I or II) and GRD with interdental bone loss (Mahajan's Class III or IV). Mahajan's classification was

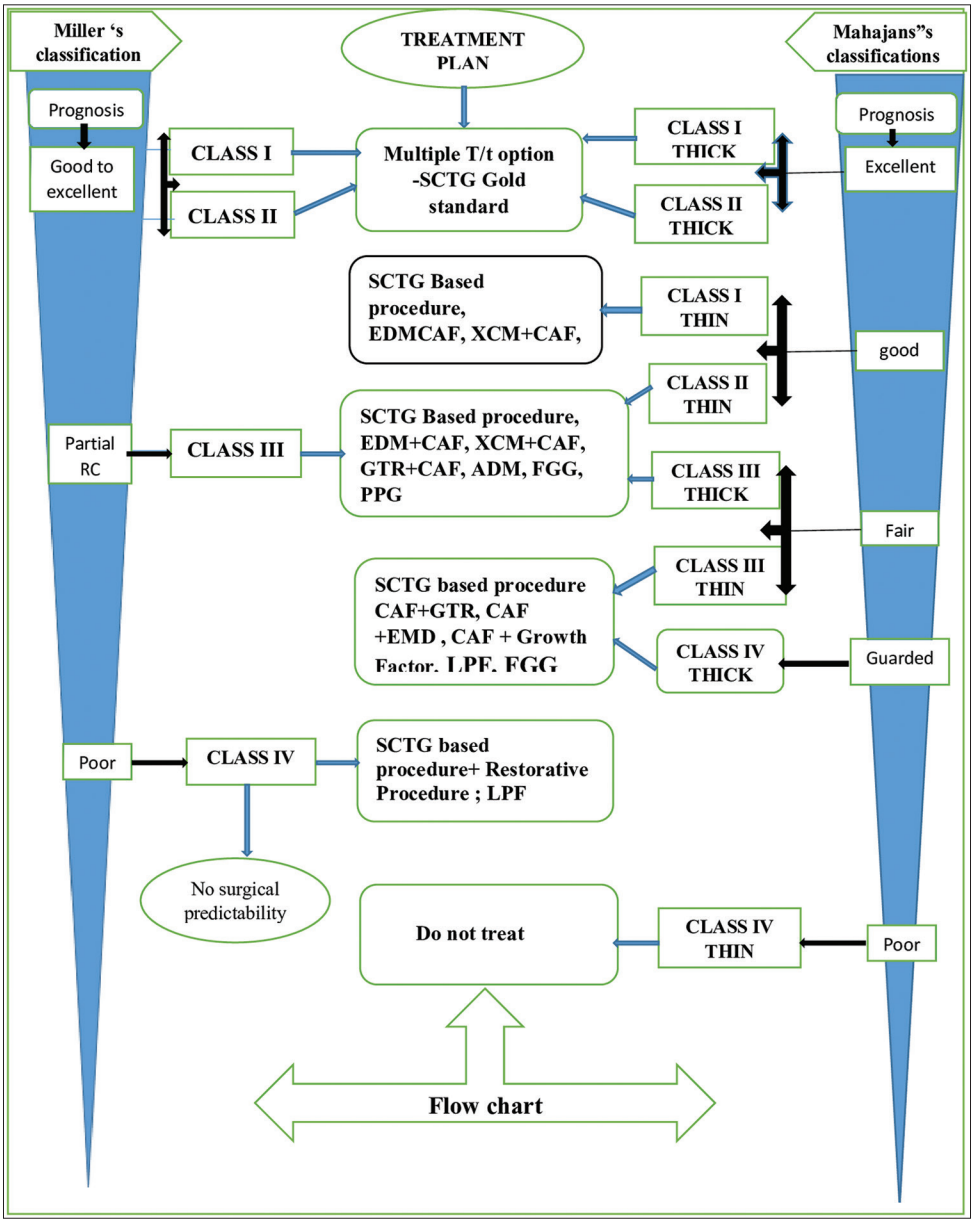

Figure 1: Flowchart showing evidence-based comparison between Miller's and Mahajan's classification for determining the prognosis and treatment plan for various classes of gingival recession defects

more objective in classifying GRD falling in Class III or IV which was evident from the fact that examiners were able to distinguish between the severities of GRD based on the extent of bone loss. When compared in terms of prognosis estimation, Mahajan's classification clearly scored better than Miller's classification as it was based on the estimation of objective criteria of gingival thickness, which is supposed to play a major role in determining the long-term prognosis of GRD.[12-15]

Because predicting the treatment outcome is one of the key features of Miller's classification system, this needs serious reassessment in light of the current evidence.[2,9,16] A recent systematic review by Chambrone and Tatakis found that most of the cases of Miller's Class III were treatable with 55%–98% cases of 100% root coverage,[17] which is contrary to the Miller's classification according to which Class III GRD has only limited predictability with chances of partial root coverage.[8] It could be possible that the lower and higher percentage of success rate of complete root coverage in Miller's Class III fall into Mahajan's Class III with thin gingival profile and Mahajan's Class III with thick gingival profile, respectively, although this still needs further investigation. The results from various studies for Classes I and II recession treatment also have a range from 9% to 90% of root coverage,[18-21] which again raises serious doubts about the Miller's classification system in assessing the predictability of various GRD treatment outcomes.[22,23] Unlike Miller's classification, the Mahajan's classification does not predict root coverage in terms of percentages, which is a complex process that should consider data from reliable studies and cannot be drawn from theoretical considerations.[9]

Another area where the two classifications were assessed and were compared included the role of these classification systems in planning and designing the treatment plans for various recession-type defects.[17] Based on the current evidence, different classes of GRD should be treated with different and specific treatment options for better treatment outcomes.[17,23-25] When both the classification systems were assessed in terms of their ability to guide the clinician to choose from various management techniques for GRD, it was found that the Mahajan's classification system gives a wider range and more specific management options for all the classes of GRD compared to Miller's classification [Figure 1].

Conclusions

At the end of the study, it may be concluded that although immensely popular, Miller's classification system has started to show up its hidden weaknesses and limitations in light of the current scientific evidence. Mahajan's classification system is based on sound scientific evidence and hence proved to be more reliable and objective as evident from the results of the present study.

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Conflicts of interest

There are no conflicts of interest.

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