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Malocclusion Dysfunction Scale (JS-MDF Scale)- A New Frontier In Quantifying Severity Of Malocclusion.

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ABSTRACT

Various classification of malocclusion and indices have been reported in the literature. It is important to assess the clinical severity of malocclusion using a scale which can provide insights into the amount of dysfunction caused by malocclusion.The primary intention of this article is to provide a scale-based rating to classify the severity of the malocclusion on the factors by which it limits the oro-facial structures to perform the role which they are intended to do normally. The present scale considers the role of functional and psychological component along with tooth position to evaluate the severity of malocclusion.This classification is a simple yet holistic approach for evaluating severity and grading of malocclusion and evaluation of pre and post treatment orthodontic changes.

KEYWORDS: Malocclusion dysfunction scale, Indices, Malocclusion assessment, malocclusion dysfunction syndrome, classification.

INTRODUCTION

Angle in 1899first classified the malocclusion and since then many classifications and indices have been published.[1] Many indices of occlusion have also been reported in the literature like that by Massler and Frankel (1951) and many more.[2]Other indices are – Summer's Index to assess severity of malocclusion 1966, Kinnan and Bruke 1981 etc. The Handicapping malocclusion assessment record by Salzmann in 1968used functional jaw limitation in his index.[3] Evaluation of other functional components was not used in any of the scales or indices reported previously.

The first classical attempt to define and index severity of malocclusion was done by J. A. Salzmann in 1966.[4]In 1967 Salzmann developed "Handicapping malocclusion assessment record" (HMAR) to assess the severity of malocclusion which help in establishing the priority for treatment of severe kind of malocclusion or handicapping malocclusion.[5]Later Index of Treatment Need - IOTN, Dental Aesthetic Index, Peer Assessment Rating (PAR)were developed.[6-8]

The impact of malocclusion can range from being asymptomatic to severe symptoms. It can lead to unaesthetic appearance, reduced self confidence levels of the individual, difficulty in chewing, proper pronunciation of words, gingivitis and pain in the TMJ. For eg –patients with skeletal open bite can present with mouth breathing, dryness of mouth and gingiva and etiology could be deviated nasal septum or adenoids, which needs to be corrected and according to which severity of malocclusion can be assessed. Additionally, complex tongue thrust can be a cause for malocclusion. Other than that important factors and habits like bruxism, clenching or TMJ pain occlusal prematurities, asymmetries etc can be debilitating as it may lead to severe malocclusionrating here in such a scenario is important to assess the clinical severity of malocclusion using a scale which can provide insights into the amount of dysfunction caused by malocclusion. Authors intend to introduce one such scale – JS – MDF Scale. Thus, based on the rating one can evaluate treatment results pre and post- treatment scores. The primary intention of this article is to provide a scale-based rating to classify the severity of the malocclusion on the factors by which it limits the oro-facial structures to perform the role which they are intended to do normally. The objectives are to provide the researchers a scale on the name of author (JS) for malocclusion dysfunction on which they can quantify the severity of malocclusions they encounter clinically and can apply to the affected population groups.

MATERIAL AND METHODS

This is an analytical study which was conducted in the department of orthodontics and dentofacial orthopedics, in Government collegeof dentistry, Indore. Duration of study was 6 months from July to December 2018. Sample size was 60 participants which had different severity of malocclusion and were selected randomly and then analyzed by 10 experienced orthodontists.

Informed written consent was drawn from the 60 participants.

Their records were taken – Diagnostic models, intra oral and extraoral photographs, and radiographs – OPG and lateral cephalogram and were analyzed. Ethical committee clearance was obtained after the study was planned. Ethical clearance no. E/ GDC -3545

The design of the study evolved from two major steps. First was the development of the instrument and then followed by assessment of reliability and validity. During the development of the scale a team comprising of the orthodontist, prosthodontist, periodontist, oral surgeons, oral pathologist, speech therapist, psychologist and experts in oral medicine worked together. Extensive review of literature was sought and discussions were done to reach a consensus. Once the scale was formulated, it was subjected to a study comprising 60 participants in the 12-30 age group. One group (0 group) with 30 participants who had near to normal occlusion and the other group (group 1) with 30 participants who had varying degree of malocclusion.

The scale involved filling up an assessment form by the examiner. The scores were calculated for the two groups. The scores of new malocclusion dysfunction scale were compared with the Draker's HLD index.[9] The findings suggested that the scoring criteria matched significantly for those problems which are deemed to be handicapping. Also, the normal and malocclusion groups were compared to reach the conclusion that a score less than 12 was found in the groups for normal occlusion. Based on the clinical observations by 10 experienced orthodontists based on features like overjet, overbite, crossbite and crowding, the patients were categorized into mild, moderate, moderately severe and severe dysfunction.

Note – this initial classification of patients into mild, moderate and severe malocclusion is not based the new scale. It was done based on the above-mentioned criteria only by orthodontist. Later those were again rated for extensive malocclusion using new scale developed by author. And checked for interrater observability.

Accordinglyscores between 13-23 were in mild category, 24-28 were in moderate category, 29-34 were in moderately severe category and >35 was in severe category.

The instrument was developed by experts in different specialty of dentistry. The instrument was reexamined by 10 experienced orthodontist and they agreed that the content is valid measure of the concept which is being measured.

JS - MALOCCLUSION DYSFUNCTION SCALE (JS-MDF SCALE)

NAME -	**AGE/SEX –**
1. SCORING FOR FUNCTIONAL COMPONENT	
A. Respiration	
Oro-nasal	0
Oral	1
Oral respiration and gingivitis and dryness of mouth	2
Oral respiration and narrow arch and speech defect	3
B. DEGLUTITION	
Complex tongue Thrust	3
Simple tongue Thrust	2
Retained Infantile Swallow	1
NOTE 1 – Since deglutition is given as separate heading, author would prefer to keep complex tongue thrust also under this heading only. NOTE 2- Retained tongue thrust has poor prognosis but most difficult to treat is complex tongue thrust. (reference – Tongue Thrust Habit – A Review by Gowrisankar, Chetan kumar. Doi – 10.5368/aedj.2009.1.2.14-23.pdf	

Overall rating of malocclusion dysfunction syndrome (table 1).

Malocclusion Dysfunction Scale	**Score**
NORMAL OCCLUSION	<12
MILD	13-23
MODERATE	24-28
MODERATELY SEVERE	29-34
SEVERE	>35

ATTRITION SCORE OF 1 PER TOOTH

Note – Attrition per tooth here means score will be given for each tooth involved. More the number of teeth involved higher will be score. Only occlusal attrition is taken in account.

7. Mucosal Abnormalities -Cheek Biting

Morsicatio buccarum/Linea alba/irritation to buccal mucosa 1

Traumatic Ulcer: 2

Hyperkeratinization/White patch :3

Note – since cheek biting is not just a parafunctional habit, but can also result due to abnormal position of different teeth like

buccally placed maxillary third molar; that is why it is given a separate score

Lip	**1**	**Partial**	**1**	**Unilateral**	**1**
Alveolar Process	2	Complete	2	Bilateral	2
Hard Palate	3				
Soft Palate	4				
Score -					
Multiply by 3		Multiply by 4		Multiply by 5	
Final Score	Add the three scores =				
NOTE – Clefts are included here as they are associated with lot of dental abnormalities. For eg – rotations of teeth, impacted teeth, crowding, transposition etc. also they are associated with severe speech defects.					

8. Tongue Tie/Ankyloglossia

Complete	2
Partial	1

RESULTS

The index was rated by the experts on the basis of readability, clarity and comprehensiveness. Kappa statistics was applied.It measures inter-rater agreement for qualitative (categorical) items.It was applied on the basis of ratings given by different clinicians. The Content Validity ratio (CVR) was calculated for each item and was found to be in the acceptable range (>0.7). Inter-observer and intra-observer agreement and correlation coefficient was found to be 0.85 (kappa statistics) and 0.99 respectively. Figure 1, 2 and 3 depicts the scatter and box plot of the mean of Malocclusion Dysfunction (MD) and Handicapping Labio-lingual Deviation (HLD) scores in the normal and malocclusion group. Since there is no overlapping values in each group it can be concluded that the Reverse Operating Characteristic (ROC Curve) shows a 100% sensitivity and specificity. Table 1 shows the mean scores of the MD and HLD Index for normal cases and Table 2 shows the mean scores of the MD and HLD Index for orthodontic cases.

DISCUSSION

The present scale proposed by authors consider the role of functional and psychological component along with tooth position to evaluate the severity of malocclusion. This functional component has been further divided into 6 parts containing respiration, deglutition, mastication, TMJ problems, mucosal abnormalities and speech evaluation. These factors greatly limit the role of the individual to perform his job. For example, a case with complex tongue thrust habit might have difficulty in swallowing, improper interdigitations or posterior open bite can lead to difficulty in chewing or unilateral chewing. A case with temporomandibular disorder might have difficulty in mouth opening or pain/tenderness in the joint region.

Also, this classification emphasizes the role of psychological factors which get affected by the presence of malocclusion. Routine events such as cleaning mouth can get affected if severe crowding is present or mouth opening is reduced. Patients might get irritated soon, have embarrassment while smiling or laughing or refrain from meeting or making new friends. These variables are important in maintaining the well-being of the patient and hence should be evaluated. Factors such as difficulty in eating can be evaluated by asking the patient if they take more time in consuming food as compared to their other family members.

The present insurance guidelines in India don't involve orthodontic treatment under its purview as it considers it a luxury treatment.[10] If the malocclusion is severe affecting the day to day life and functioning of the individual then it should be included under insurance claims.

To grade severity of malocclusion the dental position is used. In most severe deviations the jaw functions are also affected. The amount of effect of malposition of teeth should also be graded. Dysfunction or malfunction caused by malocclusion needs rating to differentiate severity of malocclusion. Each malocclusion has different effect on periodontium, different functions of oral cavity which is graded with the help of this index.

Index of Orthodontic Treatment Need (IOTN) given by Brook has two components Dental health component (DHC) and Aesthetic component (AC).[11] And has five grades of treatment ranging from none to severe occlusion. PAR index given by Richmond comprises of 11 components. Compared to present scale none meausres the functional disability caused as aresult of malocclusion. Table 3 shows comparison of all the indices.

The functional and dento-gingival component of this classification can be used for insurance claim purpose and thereby calculating the accurate pre and post treatment scores (5). The psychological ratings are subjective hence cannot be

used for reimbursement criteria. Overall ratings can be used for the pre and post treatment assessment of the changes.

D. TMJ– (WITHOUT JOINT PATHOLOGY)

TEMPOROMANDIBULAR JOINT (Helkimo Dysfunction index)

Opening Range ☐ if >40 mm (0) ☐ 30-39 mm (1) ☐ if <30 mm (2)

Mandibular deflection during lowering ☐ if <2 mm (0) ☐ 2-5 mm (1) ☐ if >5mm (2)

TMJ dysfunction (clicking, locking, luxation) ☐ no impairment (0) ☐ evident clicking (2) ☐ palpable clicking (1) ☐ locking, luxation (3)

TMJ pain ☐ no pain (0) ☐ palpable pain (1) ☐ palpebral reflex (2)

Muscle Pain (2) ☐ no pain (0) ☐ palpable pain (1) ☐ palpebral reflex

Premature contact 1 per tooth

CO-CR discrepancy >1 mm - 1

Lateral excursion (< 7mm) Right 1 Left 1

Protusive excursion (< 7mm) 1

Midline Shift

Upper with facial >2mm – 1/displacement
Lower with Facial >2mm – 1
Upper and Lower midline in
Open and Closed Mouth - <2mm – 1
>2mm- 2

Chin Deviation

Mild (<2mm) - 1

Moderate (>2mm) – 2

Cant of the occlusion plane Anterior (Frontal Cant) – 1 per mm

Posterior (Curve of Spee) (if >3 mm) - 1 per mm

E.SPEECH EVALUATION

Sound	Severity	Scoring
S, Z, T, D, F, V, Th, Sh, Ch, Others	Difficulty in pronunciation	1
	Distortion of sound	2

2. SCORING FOR TOOTH POSITION–

Maxilla – Missing Crowded Rotated Spacing Ectopic Impacted Additional Tooth No. of Teeth Score (x 1)

Anterior

Posterior

Mandible – Missing Crowded Rotated Spacing Ectopic Impacted Additional Tooth No. of Teeth Score (x 1)

Anterior

Posterior

Sagittal **Score**

Claas III with reverse closure >3.5 mm 3 (multiply by 3)

Claas III with reverse closure <3.5 mm 2

Claas III with edge to edge bite 1

Class II >9 mm 3 (multiply by 3)

6-9 mm 2

3-5 mm 1

Vertical

Deep Bite with severe soft tissue damage 3 (multiply by 3)

Deep Bite more than 50% 2

Deep Bite less than 50% 1

Open Bite – posterior 1

Posterior with enlarged tongue 2

Anterior Edge to edge 1

< 4mm 2

>4 mm 3 (multiply by 3)

Transverse

Collapsed Maxillary arch (multiply by 3)

Bilateral 2

Unilateral 1

Collapsed Mandibular arch (multiply by 3)

Bilateral 2

Unilateral 1

Cross-bite of individual teeth with loss of clinical attachment and gingival recession 3 per tooth

Only Cross-bite of individual teeth 1 per tooth

4.SCORING FOR MUCOGINGIVAL COMPONENT–

Features	Score
Gingivitis with malalignment	1
Mucogingival problem (recession/frenal pull) OR TFO associated with malalignment	2
Mucogingival problem (recession/frenal pull) OR TFO associated with malalignment and no mobility	3
Mucogingival problems and TFO associated with Malalignment	4
Mucogingival problems with TFO and mobility associated with Malalignment	5

Advantages of JS -MDF Scale –

1. Simple yet comprehensive clinical method to evaluate severity of malocclusion.
2. Used to rate the severity of malocclusion.
3. Holistic approach of evaluating the functional impairment along with dentogingival, psychological and asymmetry of the face
4. Can be used to evaluate pre and post treatment changes
5. Can be used for insurance purposes for need of orthodontic treatment.

5. SCORING FOR PSYCHOLOGICAL EVALUATION

Perfomances And Scoring	Totally Unsatisfied (3)	Unsatisfied (2)	Satisfied (1)	Totally Satisfied (0)
Emotionally stable without being irritable				
Smiling, laughing and showing teeth without embarrassment				
Smiling and immediately covering mouth to subdue any embarrassment				
Social contact, meeting friends, relatives and new people				
Feeling low, depressed or bad about yourself				
Feel tensed because of irregular teeth and unsatisfactory oral functions.				

TFO to be evaluated using Fremitus test

LIMITATIONS OF THE STUDY

Though nearly all the cause and effects were calculated and

analyzed. Still the sample size for the study could be increased for precise results. Also, a larger number of experienced dentists not only from orthodontics specialty but other specialty can be included to validate the scale.

CONCLUSION

This classification is a simple yet holistic approach for evaluating severity and grading of malocclusion and evaluation of pre and post treatment orthodontic changes. The proposed classification is elaborate involving the multi-facets of the oral functions. It is simple to record and calculate. It can be used to quantitatively grade the severity of malocclusion (malocclusion dysfunction syndrome).

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