ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2021; 7(3): 03-10

www.oraljournal.com
Received: 04-05-2021
Accepted: 06-06-2021

Dr. Sachin Gusain
Subharti Dental College, Meerut, Uttar Pradesh, India

Dr. Pradeep Raghav
Subharti Dental College, Meerut, Uttar Pradesh, India

Dr. Kumar Amit
Subharti Dental College, Meerut, Uttar Pradesh, India

Dr. Sakshi Rakhyani
Subharti Dental College, Meerut, Uttar Pradesh, India

Dr. Sukanya
Subharti Dental College, Meerut, Uttar Pradesh, India

Corresponding Author:
Dr. Sachin Gusain
Subharti Dental College, Meerut, Uttar Pradesh, India

Orthodontic indices

Dr. Sachin Gusain, Dr. Pradeep Raghav, Dr. Kumar Amit, Dr. Sakshi Rakhyani and Dr. Sukanya

DOI: https://doi.org/10.22271/oral.2021.v7.i3a.1272

Abstract
Objective: This article will discuss some of the most commonly used indices in orthodontics
Materials and Methods: A comprehensive literature from orthodontic relevant sources and information was searched with the help of Pubmed, Medline, Google scholar, Scopus using keyword like orthodontic indices.
Result: It had been widely agreed that no particular index or method available that are truly inclusive of all recommended criteria. Therefore, different indices or method had been developed according to different requirements.
Conclusion: The use of indices in orthodontics allows more uniform interpretation and application for criteria for treatment need and changes. Still there is a need of a development of index which can be universally accepted in terms of reliability and validity.

Keywords: orthodontic indices, malocclusion indices, dental esthetic index, Index of orthodontic treatment need

Introduction

What is an index and why we use it?

An index is a tool used to provide a numerical value describing the status of a case on a graded scale. In orthodontics, indices are essential component in diagnosis or assessing treatment need, severity, complexity and outcome.

Orthodontic indices are one of the tools that are available for orthodontists to grade and assess malocclusion [1]. Orthodontic indices can be useful for an epidemiologist to analyse prevalence and severity of malocclusion in any population [2].

Evaluation of dental malocclusion is an essential component in establishing the diagnosis and treatment need of the orthodontic patient but problems in studying malocclusion is the availability of a suitable method for recording and objectifying the occurrence and severity of orthodontic problem. Thus, orthodontic indices are used in clinical and epidemiological studies of malocclusion. An index comprises of numerical values describing the relative status of a population on a graduated scale with definite upper and lower limits, which is designed to permit comparison with other populations classified by the same criteria and methods [3]. However, none of the indices can be considered ideal for all purpose, accurate, valid and reliable for assessing the malocclusion for the priority of treatment need, allocating limited resources and assessing treatment outcomes [4].

Requirements of an ideal index (WHO) [5]

1. Classification is expressed by a finite scale with definite upper and lower limits; running by progressive gradation from zero (absence of disease), to the ultimate point (disease in its terminal stage).
2. The index should be equally sensitive throughout the scale.
3. The score should correspond closely with the clinical importance of the disease stage it represents.
4. Index value should be amendable to statistical analysis.
5. The index must be reproducible.
6. The index should also be simple, accurate and yield itself to modification for the collection of data.

7. The examination procedure should require a minimum of judgment.
8. The index should be simple enough to permit the study of a large population without undue cost in time or energy.
9. The examination required should be performed quickly, to evidence to a group variation.
10. The index should be valid during time.

General requirements of an index

- Validity (can the index measure what it was designed to measure?)
- Reliability (Reproducibility) (does the index give the same result when recorded on two different occasions, and by different examiners?)
- Acceptability to profession and public.
- Simplicity and cheapness.

This article will discuss some of the most commonly used indices in orthodontics

Table 1: Most commonly used indices in orthodontics

Diagnostic indices	Angle Classification System (1899) [6] Incisal Categories of Ballard & Wayman (1964) [7] Five-point System of Ackerman & Profit (1969) [8]
Treatment complexity indices	Mal-alignment Index (Van Kirk & Pennel, 1959) [9] Occlusal Feature Index (Poulton & Aaronson, 1961) [10] The Bjork Method (1964) [11] Summers' Occlusal Index (1971) [12] The FDI Method (Baume *et al*. 1973) [13] Little's Irregularity Index (1975) [14] Discrepancy Index (DI) (2004) [15]
Treatment need indices	Handicapping Labio-lingual Deviation index (HLD) (Draker, 1960, 1967) [16] Swedish Medical Board Index (SMHB 1966; Linder Aronson, 1974, 1976) [17, 18] Dental Aesthetic Index (DAI) (Cons *et al.* 1986) [19] Index of Orthodontic Treatment Need (IOTN) (Brook & Shaw, 1989) [20] Index of Complexity, Outcome & Need (ICON) (Daniel & Richmond, 2000) [4]
Treatment outcome indices	Peer Assessment Rating Index (PAR) (Richmond *et al.* 1992) [21] Cast-Radiograph Evaluation (CR-EVAL) (1999) Index of Complexity, Outcome & Need (ICON) (2000) [21]
Multi-purpose orthodontic indices	Index of Orthodontic Treatment Complexity (IOTC) (Liewellyn *et al*. 2007) [22] Index of Complexity, Outcome & Need (ICON) (2000) [21]

Diagnostic indices

These indices provide descriptive classification of the dentition or skeletons. As all these indices were covered in other lectures, this lecture will just enumerate them.

1. Angle's classification [6]

The Angle classification of malocclusion was described by Edward H Angle in 1899 and is based on the relative anteroposterior position of the first permanent molars. **(**Fig 1)

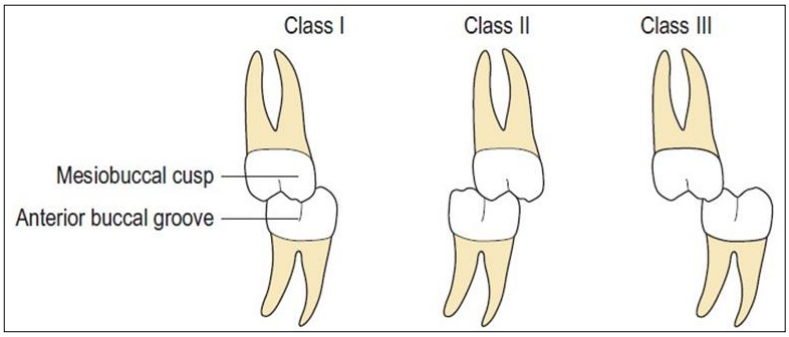

Fig 1: Angle's classification

2. Canine classification (Fig 2)

The canine relationship is based upon anteroposterior position of canines.

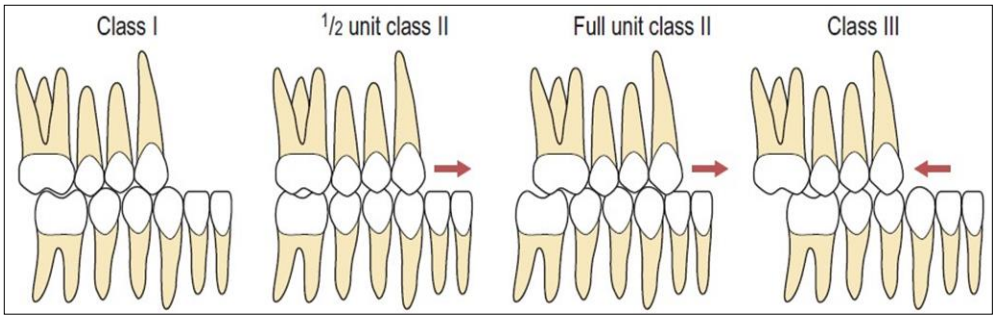

Fig 2: Canine classification

3. Incisor classification (Fig 3) [7]

The British Standards Institute classification is based upon anteroposterior position of incisors.

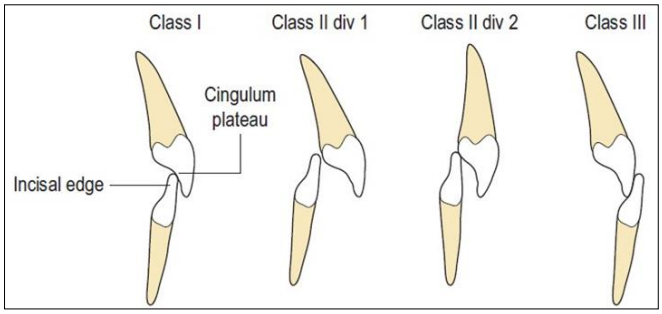

Fig 3: Incisor classification

4. Skeletal classification (Fig 4)

Usually assessed by lateral cephalometric radiographs:

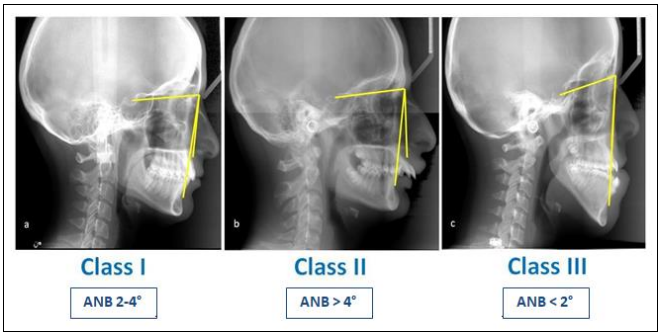

Fig 4: Skeletal classification

Treatment complexity indices

1. Little's irregularity index (LII) [14] **Fig 5**

This index assesses irregularity of lower labial segment to establish the severity of malocclusion and priority of treatment by measuring linear displacement of five anatomic contact point (from mesial of right lower canine to mesial of left lower canine). Then, these displacements are summed and the model cast is ranked on a scale ranging from 0-10.

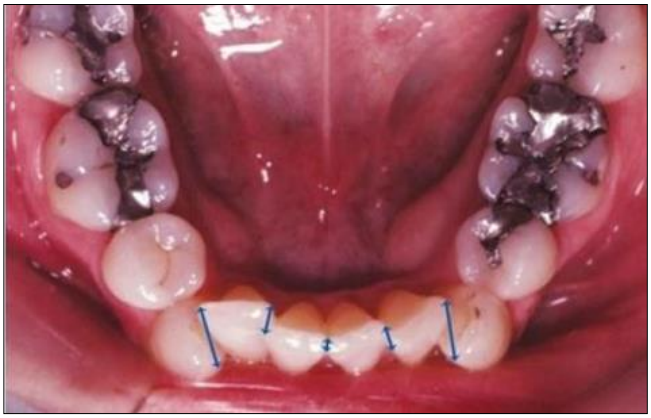

Fig 5: Little's irregularity index

Example: The irregularity index assesses the total of the millimeter distances from the contact point on each incisor tooth to the contact point that it should touch, as shown by the lines. For this patient, the irregularity index is 10 mm.

2. Discrepancy index (DI) [15] **Fig 6**

This index used to evaluate the difficulty of the cases presented for the American Board of Orthodontics examination. It evaluates criteria from dental models and cephalometric radiographs. These are overjet, overbite, openbite, crowding, occlusion, lingual/buccal posterior crossbite, cephalometric variables.

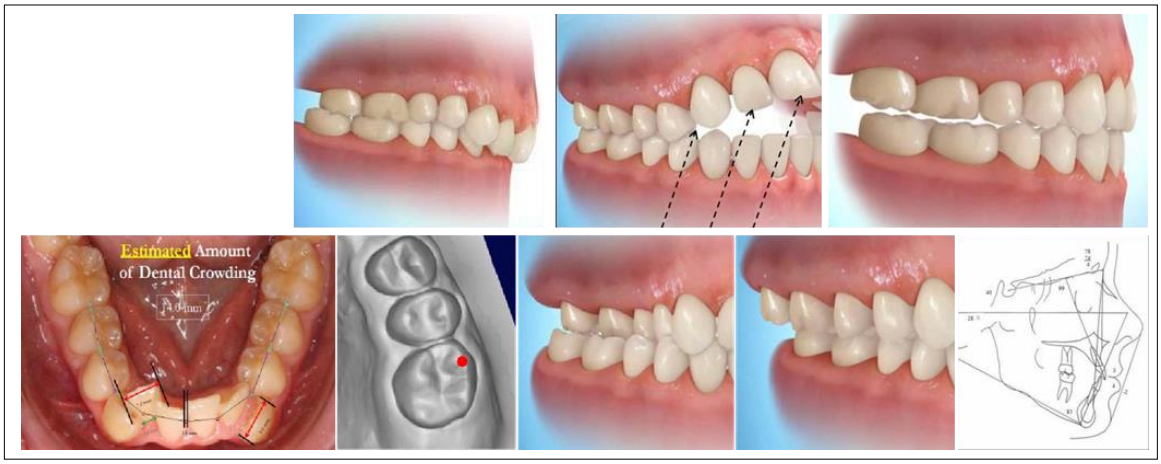

Fig 6: Discrepancy index (DI)

Discussion

Treatment need indices

1. Index of orthodontic treatment need (IOTN) [20]

This index is used to rank malocclusions in terms of various occlusal features and perceived aesthetic impairment. The intention is to identify those individuals who would receive the greatest benefit from orthodontic treatment. IOTN has two components:

- Dental Health Component (DHC)
- Aesthetic Component (AC)

- **Dental health component (DHC):** The DHC records the worst occlusal feature of the malocclusion that impacts on dental health on a dental cast with a specially designed ruler. A hierarchal scale is used to identify the worst feature. In order of reducing dental health impact these are: Missing teeth > Overjet > Crossbite > Displacement of contact points > Overbite. The acronym MOCDO can be used to remember this hierarchal scale. Once the worst occlusal feature has been recorded, the malocclusion can be characterized into one of five

grades:

- Grade 1 No need for treatment
- Grade 2 Little need for treatment
- Grade 3 Moderate need for treatment
- Grade 4 Great need for treatment
- Grade 5 Very great need for treatment

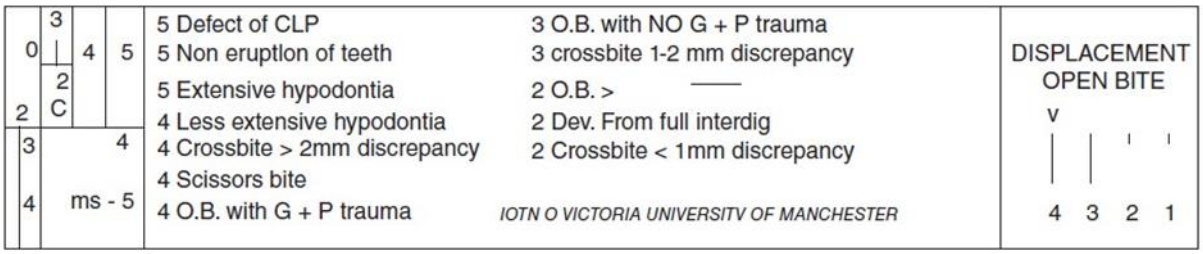

Fig 7: IOTN ruler

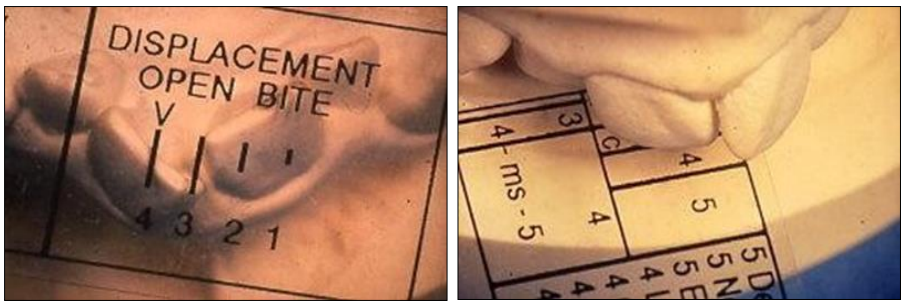

Fig 8: Dental health component (DHC)

- **Aesthetic component (AC):** It consists of 10 color photographs showing different levels of dental attractiveness. The patient is asked to close the front teeth together and the examiner compares the appearance of the patient's teeth with the visual 1-10 scale. Sometimes, the patients (or parents) are also asked to choose a photograph which most closely represents their own dental appearance to give a score according to this scale (1: the most attractive and 10: the least attractive). Treatment needed can be categorized according to the score given as follows:
  Score 1 or 2: No need for treatment
  Score 3 or 4: Slight need for treatment
  Score 5, 6, or 7: Moderate/borderline need for treatment
  Score 8, 9, or 10: Definite need for treatment

A total score combining the DHC and AC can be given to define treatment need.
IOTN has its limitations when it is applied to the mixed dentition patients and the AC component can be considered as subjective assessment. Nonetheless, the DHC component of the IOTN provides a structured method for the assessment of a malocclusion.

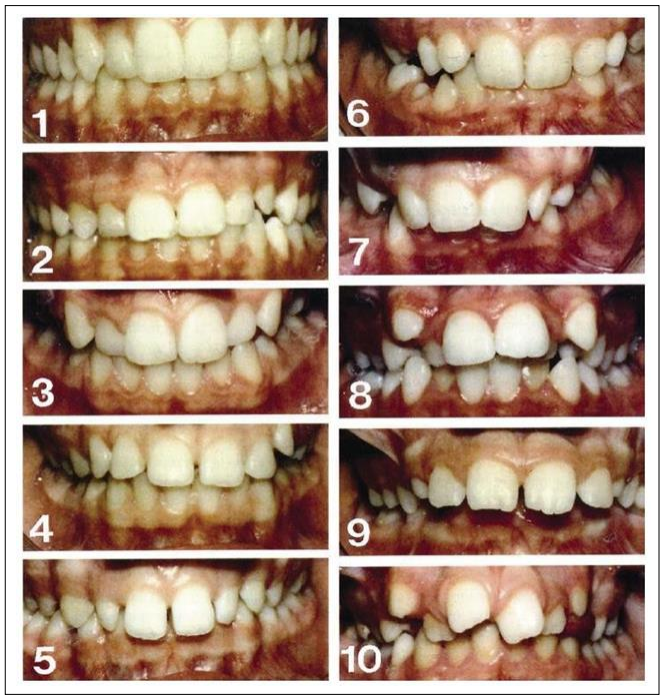

Fig 9: The AC of IOTN

Treatment outcome indices

1. Peer assessment rating index (PAR Index) [20]

This index has been developed to:

- Provide a single score assessing the degree of malocclusion (Pre-treatment PAR score).
- Assess the quality and standard of orthodontic treatment results, and the degree of improvement by comparing pre- and post-treatment PAR scores on a dental cast using a specially designed ruler. It measures the following features of the malocclusion:
  Anterior crowding (×1): Upper and lower labial segment contact point displacements.
  Buccal occlusion (×1): Left and right molar relationship, crossbites and lateral open bites
  Overjet (×6)
  Overbite (×2)
  Centrelines (×4)

The score for each feature is multiplied by weighting factors (given in brackets above), so that some occlusal features bear more importance than others.

The difference between pre- and post-treatment PAR scores can be calculated and from this the percentage change in PAR score is derived.

PAR reduction < 30%: Worse or no better
PAR reduction > 30%: Improved
PAR reduction > 70%: A high standard of treatment
PAR reduction of 22 points or greater: Greatly improved

Since the pre-treatment PAR score gives an indication of the severity of a malocclusion. Obviously it is difficult to achieve a significant reduction in PAR in cases with a low pre-treatment score.

PAR index is totally dependent on the patient's study models and does not account for improvement in the facial profile, tooth inclinations, arch width and spacing between posterior teeth. It also is not appropriate for assessment of mixed dentition treatment results. However, it is a valid and reliable tool in assessing performance of practitioners or services.

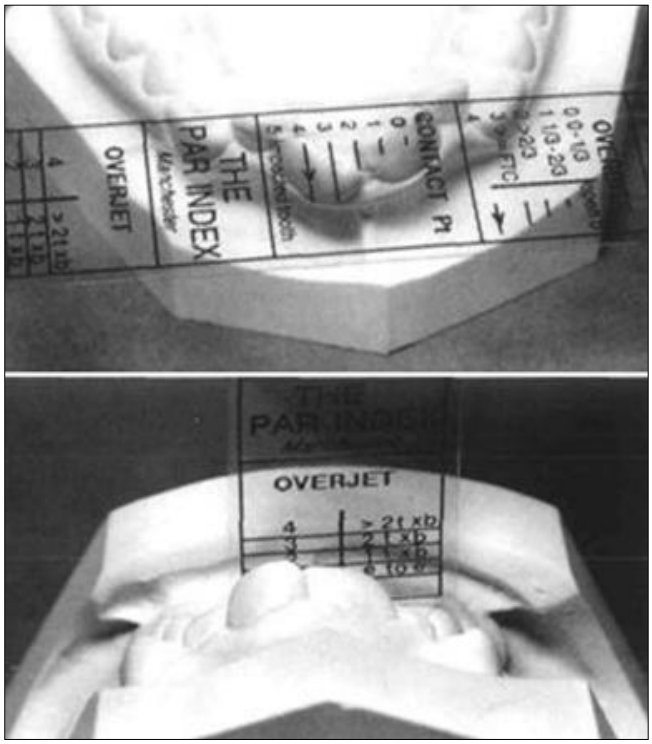

Fig 10: PAR scoring

2. Cast-radiograph evaluation (CR-EVAL)

The American Board of Orthodontics Cast-Radiograph Evaluation (ABO CR-EVAL) was developed to evaluate orthodontic treatment outcomes of the cases presented for the American Board of Orthodontics examination. It has been subsequently considered as a precise and objective index when compared to other indices.

The CR-EVAL included eight criteria:
Alignment/rotation: Study model
Marginal ridges: Study model
Buccolingual inclination: Study model
Overjet: Study model
Occlusal contacts: Study model
Occlusal relationship: Study model
Interproximal contacts: Study model
Root angulation: Panoramic radiograph

Post-treatment study models and panoramic radiographs are measured according to the above eight criteria and scored 0, 1, or 2 depending on the amount of deviation from the standards established by the ABO. The sum of points of these criteria for each treated case represents the overall score of the ABO CR-EVAL.

Total score > 30 points: Unacceptable or incomplete treatment results
Total score of 20-30 points: Needs re-evaluation and then will be passed or considered incomplete
Total score < 20 points: Satisfactory treatment results

CR-EVAL offers an objective and stringent assessment of treatment outcomes, especially for detailed tooth position. When compared to the PAR index, it adds angulation, spacing and crowding of buccal segments, and root parallelism. Additionally, it uses the final models only to assess treatment outcomes, unlike the PAR index where both pre- and post-treatment models.

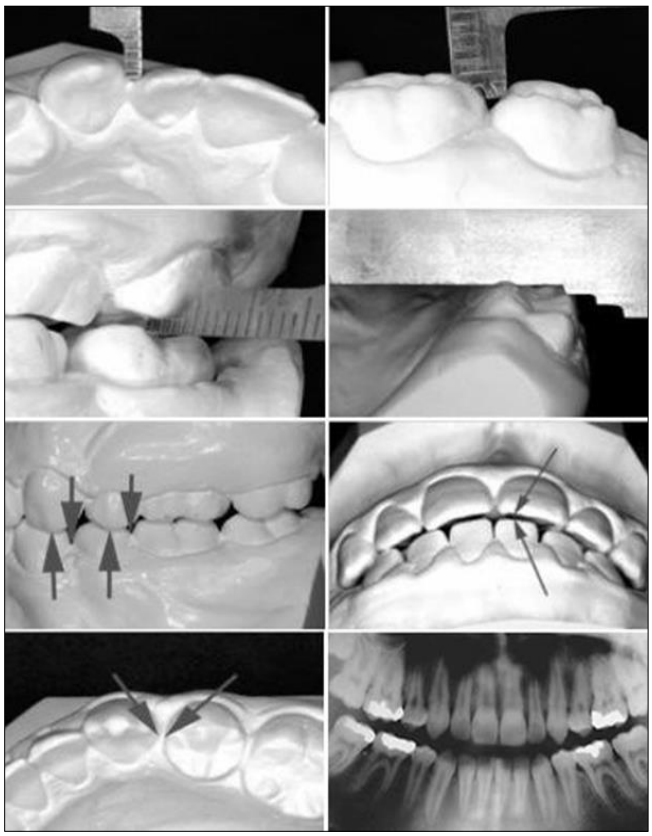

Fig 11: ABO CR-EVAL scoring

Multi-purpose orthodontic indices

1. Index of complexity, outcome, and need (ICON) [21]

This index was developed to evaluate the complexity of a case, as well as treatment need and outcome. It incorporates features of both IOTN and PAR indices:

IOTN AC (x7)
Crossbite (x5)
Upper arch crowding and spacing (x5)
Buccal segment anteroposterior relationships (x3)
Anterior vertical relationship (x4)

Table 2: Evalutaion of different analysis qualitative and quantitative

Index	Description
Angle (1899) [1]	• Formulated to aid in proper treatment planning. • Based on the molar relationship present, the malocclusion was classified in 3 different types. • In 1992, Houston et al 23 considered Angle classification as the only internationally recognized classification mostly used in epidemiological studies. • The index has been criticized by Graber (1972), Rinchuse (1988) [24]
Stallard (1932) [25]	• Malocclusion symptoms present along with general dental status are recorded.
McCall (1944) [26]	Include rotated incisors, deep bite, open bite, proclination/retroclinaton, tooth displacement, arch constriction, molar relationship, posterior crossbite, anterior crowding.
Sclare (1945) [27]	• Include superior protrusion with/without incisor crowding, labially placed canines, lingually placed incisors, rotation of incisors, crossbite, open bite and deep bite, Angle classification of molar relationship, arch constriction with/without incisor crowding.
Index of tooth position Massler & Frankel (1951) [8]	• Involve grading of the tooth displacement and rotation. • Incidence and prevalence of malocclusion in a population group is evaluated using the data.
Malalignment index Van Kirk & Pennel (1959) [9]	• Displacement and rotation of the tooth are measured. • Quantitatively defines tooth displacement (<1.5 mm or >1.5 mm) and tooth rotation (<45º or >45º)
Fisk (1960) [28]	• Patients are grouped according to the dental age. • Malocclusion is divided according to 3 planes of space: 1. Sagittal relationship: Angle's molar classification, canine classification, anterior crossbite, overjet. 2. Transverse relationship: Posterior crossbite, scissor bite 3. Vertical relationship: Openbite, deepbite
Bjork, Krebs & Solow (1964) [29]	• Primarily developed for epidemiological purpose with little emphasis on treatment need. • Registration of malocclusion symptoms based on detailed definitions. • Data obtained could be analyzed by computers. • Following three parts are considered: 1. Anomalies of dentition: Tooth anomalies, abnormal eruption, mal-alignment of individual teeth. 2. Occlusal anomalies: Deviation in the positional relationship between upper and lower dental arches in sagittal, vertical and transverse plane. 3. Deviations in space conditions: Spacing or crowding.
Incisal categories Ballard & Wayman (1965) [7]	• Also known as British Standards Institute Classification • As posterior teeth relation did not influence the incisor occlusion, this classification is considered more reliable to Angle classification. • Based on the relationship of incisal edges of upper and lower incisors.
Five-point system Ackerman & Profit (1969) [30]	• Venn diagram is used to represent major characteristics of malocclusion. • Includes information about skeletal jaw proportions. • Includes all 3 planes of space. • Includes evaluation of crowding and asymmetry intra-arch. • Five-step procedure of assessing malocclusion: 1. Alignment: crowding, spacing. 2. Profile: convex, straight, concave. 3. Crossbite: Relationship of dental arches in the transverse plane, as indicated by bucco-lingual relationship of posterior teeth. 4. Angle classification: Relationship of the dental arches in the sagittal plane 5. Bite depth: Relationship of the dental arches in vertical plane, as indicated by the presence/absence of anterior/posterior open bite and posterior collapsed bite.
WHO/FDI method Baume *et al*. (1979) [13]	• Method of measuring occlusal traits developed by Federation Dentaire' Internationale (FDI) Commission on Classification & Statistics for Oral Conditions (COCSTOC). • Five major groups are recorded as follows: 1. Gross anomalies 2. Dentition: Absent teeth, supernumerary teeth, malformed incisors, ectopic eruption 3. Spaced condition: Diastema, crowding, spacing 4. Occlusion: a. Incisor segment: Maxillary/mandibular overjet, overbite, openbite, crossbite b. Lateral segment: antero-posterior relations, open bite, posterior crossbite 5. Orthodontic treatment need judged subjectively: Not necessary, doubtful, necessary.
Memorandum of orthodontic screening & indications for orthodontic treatment (1990) [31]	• Proposed by Danish National Board of Health to assess orthodontic treatment need
Grade index scale for assessment of treatment need (GISATN) Salonen, Mohlin *et al*. (1992) [32]	• Developed in Sweden as a malocclusion index for treatment need
5-year-olds' index	• Most used index in deciduous dentition for cleft lip and palate cases

Atack *et al*. (1997) [33]	• Performed directly of models or photographaps of models. • Prognosis is divided into five following groups: 1. Excellent: Positive overjet with average inclined/retroclined incisors, no crossbite/openbite, good maxillary shape and palatal anatomy 2. Good: Positive overjet with average inclined/ proclined incisors, unilateral crossbite or crossbite tendency, open bite tendency around cleft site 3. Fair: Edge-to-edge bite with average inclined or proclined incisors; or reverse overjet with retroclined incisors, unilateral crossbite, +/- open bite tendency at cleft site 4. Poor: Reverse overjet with average inclined or proclined incisors, unilateral crossbite, bilateral crossbite, open bite around cleft site 5. Very poor: Reverse overjet with proclined incisors, bilateral crossbite, poor maxillary arch form and palatal vault anatomy
Handicapping labiolingual deviation index (HLDI) Draker (1960) [16]	• Measurement include cleft palate, traumatic deviations (all or none), overjet, overbite, mandibular protrusion, anterior openbite and labio-lingual spread. • The Maryland version of HLD; the HLD (Md) index34 modified the HLD's original scoring formula for overjet and overbite. • The modified HLD (CalMod) index included deep impinging bites and crossbites of individual anterior tooth with tissue destruction (Parker 1998) [35]
Malocclusion severity estimate Grainger (1960-61) [36]	• Defined 7 measurements are: Overjet, overbite, anterior open bite, congenitally missing maxillary incisors, molar relationship, posterior crossbite, tooth displacement (actual and potential). • Six malocclusion syndromes are defined as follows: 1. Positive overjet and anterior openbite 2. Positive overjet, positive overbite, distal molar relationship and posterior crossbite with maxillary teeth buccal to mandibular teeth 3. Negative overjet, mesial molar relationship and posterior crossbite with maxillary teeth lingual to mandibular teeth 4. Congenitally missing maxillary incisors 5. Tooth displacement 6. Potential tooth displacement
Occlusal feature index (OFI) Poulton & Aaronson (1961) [10]	• Measures four occlusal features: lower anterior crowding, cuspal interdigitation, vertical overbite and horizontal overjet. • Scoring done according following criteria: 1. Slight: No need for orthodontic treatment 2. Mild: Some variation from ideal occlusion but not sufficient to need treatment 3. Moderate: Orthodontic treatment indicated and would be beneficial 4. Severe: Treatment essential
Occlusal index (OI) Summers, Arbor (1966, 1971) [12]	• Valid tool for measuring occlusion and malocclusion for epidemiological purpose. • Different scoring scheme for deciduous, mixed and permanent dentition. • Nine weighted and defined measurements are: Molar relation, overbite, overjet, posterior crossbite, posterior openbite, tooth, displacement, midline relation, maxillary median diastema, congenitally missing maxillary incisors • Seven malocclusion syndromes are: 1. Overjet and openbite 2. Distal molar relation, overbite, overbite, posterior crossbite, midline diastema and midline deviation 3. Congenitally missing maxillary incisors 4. Tooth displacement 5. Posterior open bite 6. Mesial molar relation, overjet, overbite, posterior crossbite, midline diastema and midline deviation 7. Mesial molar relation, mixed dentition analysis & tooth displacement
Swedish medical board index (SMBI) SMHB (1966); Linder-Aronson (1974, 1976) [17, 18]	• Developed by Swedish Medical Health Board • Treatment need is represented by 4 categories (Grade 1 to 4); • Later Linder-Aronson revised the index by adding fifth category of Grade zero. • Categorized as Grade 4-0; very urgent need, urgent need, moderate need, little need and no need. • Features like esthetically and/or functionally handicapping anomalies such as cleft lip and palate, aplasia, occlusion, deep bite, open bite, crossbite, scissors bite, overjet, crowding, spacing, rotation, retained teeth are considered.
Treatment priority index (TPI) Grainger (1967) [37]	• Eleven weighted and defined measurements are: upper anterior segment overjet, lower anterior segment overjet, overbite of upper anterior over lower anterior, anterior openbite, congenital absence of incisors, distal molar relation, mesial molar relation, posterior crossbite (buccal), posterior crossbite (lingual), tooth displacement, gross anomalies. • Seven malocclusion syndromes are: Maxillary expansion syndrome, overbite, retrognathism, openbite, prognathism, maxillary collapse syndrome, congenitally missing incisors

References

1. Jenny J, Cons NC. Comparing and contrasting two orthodontic indices, the Index of Orthodontic Treatment Need and the Dental Aesthetic Index. American Journal of Orthodontics and Dentofacial Orthopedics 1996;110(4):410-6.
2. Borzabadi-Farahani A. An overview of selected orthodontic treatment need indices. Principles in Contemporary Orthodontics. Croatia: In Tech 2011, 215-36.
3. Russell AL. A system of classification and scoring for prevalence surveys of periodontal disease. J Dent Research 1956;35:350-9.
4. Jago JD. The epidemiology of dental occlusion: A critical appraisal. J Pub Health Dent 1974;34:80-93.
5. World Health Organization. An international

methodology for epidemiological study of oral disease. Manual No.5: Epidemiological studies of periodontal disease. First draft. Geneva 1966.
6. Angle EH. Classification of malocclusion. Dent Cosmos 1899;41:248-64.
7. Ballard CF, Wayman JB. A report on a survey of the orthodontic requirements of 310 army apprentices. Dent Pract Dent Rec 1965;15:221-6.
8. Massler M, Frankel JM. Prevalence of malocclusion in children aged 14-18 years. Am J Orthod 1951;37:751-68.
9. Van Kirk LK, Pennell EH. Assessment of malocclusion in population groups. Am J Orthod 1959;45(10):752-58.
10. Poulton DR, Aaronson SA. The relationship between occlusion and periodontal status. Am J Orthod 1961;47(9):690-9.
11. Bjork A, Krebs AA, Solow B. A method for epidemiological registration of malocclusion. Acta Odontol Scand 1964;22:27-41.
12. Summers CJ, Arbor A. The Occlusal Index: A system for scoring and identifying occlusal disorders. Am J Orthod 1971;59(6):552-67.
13. Baume LJ, Horowitz HS, Summers CJ, Dirks BO, Brown WAB, Carlos JP. A method for measuring occlusal traits. Int Dent J 1973;23:530-37.
14. Little RM. The Irregularity Index. Am J Orthod 1975;68:554-63.
15. Cangialosi TJ, Riolo ML, Owens Jr SE, Dykhouse VJ, Moffitt AH, Grubb JE *et al*. The ABO discrepancy index: a measure of case complexity. American Journal of Orthodontics and Dentofacial Orthopedics 2004;125(3):270-8.
16. Draker HL. Handicapping labio-lingual deviations: A proposed index for public health purposes. Am J Orthod 1960;46:295-305.
17. Linder-Aronson S. Orthodontists in the Swedish public dental health service. Transactions Eur Orthod Soc 1974, 233-40.
18. Linder-Aronson S, Fridh G, Jensen R. Need of Orthodontic treatment and orthodontic specialists in Sweden. Swed Dent J 1976;68:383-402.
19. Cons NC, Jenny J, Kohout FJ. DAI: The Dental Aesthetic Index. Iowa City, Iowa: College of Dentistry, University of Iowa 1986.
20. Brook PH. Shaw WC. The development of an index of orthodontic treatment priority. Eur J Orthod 1989;20:309-20.
21. Daniels C, Richmond S. The Development of the Index of Complexity, Outcome & Need (ICON). J Orthod 2000;27(2):143-48.
22. Llewellyn SK, Hamdan AM, Rock WP. An Index of Orthodontic treatment Complexity. Eur J Orthod 2007;29:186-192.
23. Houston WJB, Stephens CD, Tulley WJ. A Textbook of Orthodontics, Great Britain: Wright 1992, 1-13.
24. Rinchuse DJ. Ambiguities of Angle's classification. Angle Orthod 1988;59:295-298.
25. Stallard H. The general prevalence of gross symptoms of malocclusion. Dent Cosmos 1932;74:29-37.
26. McCall JO. A study of malocclusion in pre-school and school children. Dent Items Interest 1944, 131-33.
27. Sclare R. Orthodontics and the school children: A survey of 680 children. Br Dent J 1945;79:278-80.
28. Fisk R. When malocclusion concerns the public. Can Dent Assoc J 1960;26(7):397-412.
29. Bjork A, Krebs AA, Solow B. A method for epidemiological registration of malocclusion. Acta Odontol Scand 1964;22:27-41.
30. Proffit WR, Ackerman JL. Rating the characteristics of malocclusion: A systematic approach for planning treatment. Am J Orthod 1973;64(3):258-69.
31. Danish National Board of Health. Memorandum of orthodontic screening and indications for orthodontic treatment. P.O. Box 2020, DK1012 Copenhagen K 1990.
32. Salonen L, Mohlin B, Gotzlinger B, Hellden L. Need and demand for orthodontic treatment in adult Swedish population. Euro J Orthod 1992;14:359-368.
33. Atack NE, Hathorn IS, Semb G, Dowell T, Sandy JR. A new index for assessing surgical outcome in unilateral cleft lip and palate subjects aged five: reproducibility and validity. Cleft Palate Craniofac J 1997;34:242-246.
34. Han H, Davidson WM. A useful insight into 2 occlusal indexes: HLD (Md) and HLD (CalMod). Am J Orthod Dentofacl Orthopedics 2001;120:247-253.
35. Parker WS. The HLD (CalMod) index and the index question. Am J Orthod Dentofac Orthopedics 1998;114:134-141.
36. Grainger RM. Malocclusion Severity estimate Progress Report, Series VI. Burlington Orthodontic Research Centre 1960-61:9-11.
37. Grainger RM. Orthodontic Treatment Priority Index. Public Health Service Publication No. 1000, Series 2, No. 25, US Government Printing Office, Washington DC 1967.
38. Salzmann JA. Handicapping malocclusion assessment to establish treatment priority. Am J Orthod 1968;54(10):749-69.
39. Eismann D. A method of evaluating the efficiency of orthodontic treatment. Trans Eur Orthod Soc 1974, 223-32.
40. Mars M, Plint DA, Houston WJB, Bergland O, Semb G. The Goslon Yardstick: A new system of assessing dental arch relationship in children with unilateral cleft lip and palate. Cleft Palate J 1987;24(4):314-322.
41. Evans R, Shaw WC. Preliminary evaluation of an illustrated scale for rating dental attractiveness. Euro J Orthod 1987;9:314-318.
42. Espeland LV, Ivarsson K, Stenvik A. A new Norwegian index of orthodontic treatment need related to orthodontic concern among 11-year-olds and their parents. Comm Dent Oral Epidemio 1992;20:274-279.
43. Russo E, Grippaudo C, Marchionni P, Deli R. Il ROMA index come metronomo della terapia ortodontica nel paziente in crescita. Procedings National Congress of SIDO, Firenze 1998.
44. Cangialosi TJ, Riolo ML, Owens SEJ. The ABO discrepancy index: A measure of case complexity. Am J Orthod Dentofac Orthop 2004;125(3):270-8.
45. Salzmann JA. http://www.americanboardorthod.com/professionals/downloads/Discrepancy%20Index%Scoring%20system.pdf