SCIENTIFIC ARTICLES

Public Assistance Orthodontic Treatment Needs: A Report from the State of Indiana

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Abstract

Objective: *To determine how many of the orthodontic cases covered by Indiana Medicaid between 1999-2001 would be classified pretreatment as having a malocclusion severe enough to warrant treatment.* ***Methods:*** *Six examiners were trained and then paired together to examine 249 patient orthodontic case records, consisting either of pre-treatment photographs only, pre-treatment models only, or both pre-treatment models and photos. The examiners applied the Index of Orthodontic Treatment Needs (IOTN) to assign each case a Grade of One to Five, with Grade One representing Ideal Occlusion and Grade Five being Extreme Malocclusion. When two examiners within a pair could not agree, a third examiner reviewed the case record to determine agreement.* ***Results:*** *Of the 249 patient cases examined, 9 were not gradable. In the cases where only pretreatment models were available (n=157), 10% received a Grade of One or Two (Ideal Occlusion or Mild Malocclusion, respectively). Among the cases in which both pretreatment models and photos were available (n=46), 44% of the photos were graded One or Two, while only 2% of the models were graded as One or Two. In the cases where only pretreatment photographs were available (n=37), 27% of cases were Grade One or Two.* ***Conclusion:*** *While several of the cases (11%) submitted during the time period of 1999 to 2001 to the Indiana State Medicaid Division for reimbursement were rated as having Ideal Occlusions or Mild Malocclusions, the vast majority (89 %) were scored as having either Moderate, Severe, or Extreme Malocclusion.*

Key Words: Medicaid, Index of Orthodontic Treatment Need, Occlusal Indices

Introduction

Correcting aesthetic impairment, improving physical function, and helping patients restore a sense of social-psychological well-being are some of the many goals of traditional orthodontic treatment. Individuals with significant malocclusions often encounter social discrimination in addition to problems with oral function. It is generally agreed that treatments for handicapping malocclusions that require the patient to undergo major life adjustments should be included in programs that provide health services. For example, state Medicaid programs (Title IXX) are required to provide some orthodontic coverage (1). However, it has been difficult to determine how many patients with these needs exist and how those with the greatest needs for treatment can be identified. In times of limited resources, it is important that patients needing treatment be prioritized so that those with the most severe needs can be treated (2). Treatment need indices have been used to plan the provision of orthodontic treatment in countries in which dental health services are subsidized by the government as part of the national health service or national health insurance system (3).

Several indices have been developed in an attempt to categorize malocclusions into different groups based on their urgency and need for treatment (4). These include Summers' Occlusional index, Grainger's Treatment Priority Index, and Salzmann's Handicapping Malocclusion Index (5). However, none of these indices, developed in the early 1960's, have been widely accepted in the United States for screening potential patients to determine which demonstrate sufficient needs for treatment. While the Salzmann Index was actually approved for this purpose in 1969, in 1985 the American Association of Orthodontists (AAO) stated that it "does not recognize any index rating classification or coding system as a scientifically valid measure of the need for orthodontic treatment (5)."

More recently, Brook and Shaw (1989) of the United Kingdom developed a scoring system for malocclusion, the Index of Orthodontic Treatment Need (IOTN), which categorizes patients into five grades from "no need for treatment" to "treatment need." The IOTN is now used to determine national treatment need in England, and numerous studies have established the reliability and validity of this index (6). It is particularly unique in that it contains separate components to record functional/dental health indications for treatment and aesthetic impairments. Brook and Shaw attempted to define each occlusional trait thought to contribute to the longevity and satisfactory functioning of the dentition. Furthermore, they established easily measurable cut-off points between each grading.

The dental health component of the IOTN uses several specific malocclusion parameters (i.e. overbite, overjet, etc.) to establish the severity of the malocclusion, Grade 1-5. Most traits are recorded using a millimeter rule. When the index is used, only the highest scoring trait is recorded to deter-

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mine the grading of the patient (4).

The second part of the IOTN, the aesthetic component, utilizes the Standardized Continuum of Aesthetic Need (SCAN) index developed by Evans and Shaw (1987) to record the aesthetic impairment. This scale was constructed using dental photographs from 1000 12-year-olds taking part in a large longitudinal study. A panel of six judges viewed the photographs and independently recorded their gradings on a 10 cm visual analogue scale anchored at each end by the descriptions "very attractive" (.5) and "very unattractive" (5.0). In their study, Evans and Shaw found that their scale proved successful in calibrating the judgements of dental attractiveness among different groups of individuals including orthodontists, parents, and children (7).

Since its creation by Brook and Shaw, the IOTN has been used in several other studies including the National Health and Nutrition Examination Survey (NHANES III), a large scale national survey of health care problems and needs in the United States between 1988-1991. Application of the IOTN to this survey data revealed that 57-59% of each racial/ethnic group in America has at least some degree of orthodontic treatment need. Results of this survey also indicated that incisor irregularity is a major contributor to malocclusion, affecting over half of the U.S. population (1).

While orthodontic treatment levels in the United States usually correlate with family income rather than absolute need for treatment, if the IOTN or a similar index could be employed to determine treatment need in the U.S., perhaps those patients most needing treatment would be better served, regardless of income. Standardized use of such an index could also allow state Medicaid programs (Title IXX) to prioritize which orthodontic cases would be included in the services provided under the program.

At the time of this audit, no index was in use in Indiana to determine which cases should be eligible for orthodontic treatment covered by public funding. The goal of the present study was to retrospectively use the IOTN to determine how many of the orthodontic cases paid for by Indiana Medicaid between 1999-2001 would actually be classified as severe enough for treatment.

Methods

Overview. During a period between 1999 and 2001, the Indiana State Health Coverage Program's Dental Medicaid Division recognized that it was reimbursing providers for orthodontic coverage for patients who may not have met the criteria for coverage as outlined in the provider manual (i.e. a significant craniofacial disorder). After consideration and in consultation with their surveillance contractor (Health Care Excel, Inc), the IOTN was selected for the audit because it would best allow a group of examiners to retrospectively look at these cases and draw a clear distinction regarding the severity of the patients' initial malocclusion. The Medicaid Division determined that it would seek repayment of the monies paid for the cases in which the examiners rated the patients as either having Ideal Occlusion or Mild Malocclusion, corresponding to Grades One and Two of the IOTN. The Indiana Medicaid Division would not seek to recoup its funds for those patients categorized pre-treatment as having Moderate, Severe, or Extreme malocclusions (Grades Three to Five) based on the IOTN.

Patient case recruitment. The patient cases graded in the study were obtained from clinicians in Indiana who had submitted more than ten orthodontic cases to Indiana Medicaid during the 1999-2001 time period. Using this approach, there were a total of 463 cases from 12 different practitioners, with only 249 cases that had at least some limited pretreatment records available for review.

Examiner recruitment and training. Along with the primary author of this article, an additional six examiners were recruited to help in scoring the cases. The examiners included five pediatric dentistry residents with significant training in orthodontic diagnosis and one board-certified pediatric dentist, who is also a past director of the American Board of Pediatric Dentistry.

In an attempt to standardize the six examiners, the principle author conducted a two-hour training program where an overview of the IOTN was presented to the examiners followed by a rating period. The examiners rated eight separate cases from the principle author's archives, looking at both photos and models. The photos and models were scored by each of the examiners, and the results of the scores of the eight cases were statistically analyzed. A mixed model with fixed effect for rater and random effect for sample was used to obtain least square mean score estimates for each rater. These estimates were then used to compare raters to each other to calculate the intra-class correlation coefficients. The coefficients of variance for between rater variation, between sample variation, and within sample variation were also calculated. The residual data were obtained using a mixed model, which considered random effects for both rater and sample.

Scoring of cases. The six examiners met on a separate occasion from their training to score the cases. They were paired together so that there were a total of three pairs of examiners. Each pair graded approximately one-third of the total number of cases; however, there was no attempt to ensure that each pair graded exactly one-third of the cases. The seventh examiner (the primary author), served as a third examiner for each of the three pairs when agreement between the two examiners within a pair was not obtainable. The seventh examiner only looked at cases when the two primary examiners could not come to an agreement as to the score that should be assigned. He would then independently grade the case, and the grade that matched with one of the two within the pair was the grade that the case was assigned. Fortunately, there never was an instance in which the seventh examiner could not come to an agreement with one of the two examiners within a pair. Each of the

examiners scored every case independently of the other examiner within their pair, and then the two raters compared their scores. If there was a disagreement, they would discuss it until they either reached an agreement on the score or called in the seventh examiner to facilitate an agreement. The five scoring categories used were Grades One - Five, as defined by Proffit, Fields, and Moray (1).

Results

Training session inter-rater reliability. Table 1 shows the summary statistics of the model and photo scores assigned by all seven examiners to the eight cases examined during the examiner training session. Note that Rater G was the seventh examiner. The intra-class correlation coefficient for measurement of overall rater agreement on the model scores was *moderately strong* at 0.69, while for the photo scores, it was *strong* at 0.79.

Patient case scores. A total of 249 patient cases were presented for grading by the examiners. Of these cases, nine were determined to be non-gradable, either because there were insufficient records available for the case, or because the photos or models were of such poor quality that they could not be graded. Thus, there were a total of 240 patient cases that were fully graded. For 20 of these cases, the seventh examiner had to be called in to facilitate an agreement between the two raters in a pair. The results are presented in Tables 2, 3, and 4. Note that Table 2 presents patient cases where the clinician only had pre-treatment models available, Table 3 shows cases where only pre-treatment photos were available, and Table 4 represents cases where both pre-treatment models and photos were available from the clinician for grading.

It is also important to note that in the IOTN classification directives, the examiners use the most significant, i.e. most severe, trait to determine the grade. For example, if a patient had a very minor incisor irregularity (2 mm), which would be classified as Grade Two, but also had a very severe overjet (11 mm), which would be classified as Grade Five, the overjet score determined the patient's grade. That is, the patient would be scored a Grade Five. The less severe incisor irregularity score would thus become inconsequential.

TABLE 1
Summary statistics of rater scores

Rater	N	Mean + Standard Deviation: Model Scores	Mean + Standard Deviation: Photo Scores
A	8	2.88 ± 0 .99	2.75 ± 1.28
B	8	3.00 ± 1.31	2.50 ± 0.76
C	8	3.00 ± 1.20	3.25 ± 1.04
D	8	3.38 ± 1.41	2.75 ± 1.04
E	8	3.13 ± 0.64	2.50 ± 1.20
F	8	3.25 ± 0.71	2.88 ± 0.99
G	8	3.88 ± 0.64	2.75 ± 0.89

TABLE 2
Patient cases with models only
(Number of models in each grade as determined by raters)

Charactristic & Grade	Ideal Grade 1	Mild Grade 2	Moderate Grade 3	Severe Grade 4	Extreme Grade 5	Total
No specifics described by rater	1	10	23	8	1	43
1. Incisor Irregularity	0-1 mm: 2	2-3 mm: 1	4-6 mm: 18	7-10 mm: 19	>10 mm: 11	51
2. Overjet	1-2 mm: 0	3-4 mm: 2	5-6 mm: 8; -1 to -2 mm: 0	7 - 10 mm: 10; -3 to -4 mm: 0	>10 mm: 1; <-4 mm: 0	21
3. Overbite	0-2 mm: 0	0 to -2 mm: 0	3 to 4 mm: 4; -3 to -4 mm: 5	5 to 7 mm: 2	<-4 mm: 1; >7 mm: 2	14
4. Posterior crossbite (yes)	N/A	N/A	9	0	0	9
5. Diastema >2 (yes)	N/A	N/A	11	0	0	11
6. Additional Notes			1. Deep OB w/palatal tissue impinged: 5; 1. Less extensive hypodontia: 1	2. Supernumerary teeth present: 0; 3. Partially erupted teeth, tipped & against adjacent teeth: 0	1. Impeded eruption of teeth (except 3rd molar): 0; 2. Extensive hypodontia: 1; 3. Craniofacial facial anomalies: 1	8
TOTAL	**3**	**13**	**83**	**41**	**17**	**157**

TABLE 3
Patient cases with photos only
(Number of photos in each grade as determined by raters)

Ideal- Grade 1	Mild- Grade 2	Moderate-Grade 3	Severe-Grade 4	Extreme-Grade 5	Total
0	10	12	14	1	37

TABLE 4
Patient cases with models & photos

Photo ratings
(Number of photos or models in each grade as determined by raters)

Ideal- Grade 1	Mild- Grade 2	Moderate-Grade 3	Severe-Grade 4	Extreme-Grade 5	Total
5	15	18	7	1	46

Model Ratings

Charactristic & Grade	Ideal Grade 1	Mild Grade 2	Moderate Grade 3	Severe Grade 4	Extreme Grade 5	Total
No specifics described by rater	0	1	5	1	0	7
1. Incisor Irregularity	0-1 mm: 0	2-3 mm: 0	4-6 mm: 9	7-10 mm: 5	>10 mm: 3	17
2. Overjet	1-2 mm: 0	3-4 mm: 0	5-6 mm: 2	-1 to -2 mm: 0	7 - 10 mm: 0	-3 to -4 mm: 0	>10 mm: 0	<-4 mm: 0	2
3. Overbite	0-2 mm: 0	0 to -2 mm: 0	3 to 4 mm: 2	-3 to -4 mm: 0	5 to 7 mm: 7	<-4 mm: 0	>7 mm: 0	9
4. posterior crossbite (yes)	0	0	4	0	0	4
5. Diastema >2 (yes)	0	0	3	0	0	3
6. Additional Notes			1. Deep OB w/palatal tissue impinged: 1	1. Less extensive hypodontia: 1	2. Supernumerary teeth present: 0	3. Partially erupted teeth, tipped & against adjacent teeth: 2	1. Impeded eruption of teeth (except 3rd Molar): 0	2. Extensive hypodontia: 0	3. Craniofacial facial anomalies: 0	4
TOTAL	**0**	**1**	**26**		**16**			**3**		**46**

Discussion

Of the 12 practitioners whose cases were audited, eight were general dentists, four were pediatric dentists and none were orthodontists. While it may seem surprising that no orthodontists submitted Medicaid claims for ten or more patients during this time period, considering the extremely low number of orthodontists in Indiana that are registered Medicaid Providers, it does not seem unusual. The Indiana State Health Coverage Program, Dental Medicaid Division, determined that it would attempt to recoup payments for those cases that were graded One or Two (Ideal Occlusion or Mild Malocclusion). Considering this, it was interesting to examine the grading of these 240 cases and compare the number of cases assigned Grades One and Two with those graded as Three, Four, and Five. When looking at the cases in which only pre-treatment models were available for scoring, 16 out of 157 total cases (10%) were graded as One or Two, indicating Ideal Occlusion or Mild Malocclusion (Table 2). In the group where only pre-treatment photos were available for scoring, 10 out of 37 of the cases (27%) were graded One or Two (Table 3).

The group where both models and photos were available was of particular interest (Table 4). For this group, both a set of pre-treatment models and photos were available from the clinicians for scoring. The scores for the photos indicated that 20 out of 46 (44%) were graded as having Ideal Occlusion or Mild Malocclusion (Grades One or Two). However, when the corresponding patient models in this group were examined, only 1 out of

46 (2%) was graded as One or Two. Therefore, it is clear that the models tended to be graded significantly higher in terms of the severity of malocclusions than the photos. This is consistent with a previous study by Buchanan, Downing, and Stirrups (1994) which found that when models and photos were both graded, photographs tended to be scored lower than the clinical and study cast assessment for the same patient (8).

The IOTN indicates that the most severe score should be assigned to a patient case for the group where both pre-treatment models and photos were available. Thus, in cases where there were different scores obtained for the model and photo, the examiners used the most severe score, whether it was from the photos or the models. This may help explain the fact that when Table 2 and 3 are compared (patient cases with models only versus patient cases with photos only), the models-only cases had only 10 % scored as Ideal Occlusion or Mild Malocclusion, while the photos-only cases showed 27 % having Ideal Occlusion or Mild Malocclusion.

Overall, 11% (27 out of 240) of the gradable cases were rated as either having Ideal Occlusion or Mild Malocclusion. This number may seem unreasonably high considering that all of these patients reportedly went on to have orthodontic treatment by the clinicians being audited. However, there are a couple of possible explanations for this number. First, as mentioned above, in the cases where only photos were available, the grades tended to be lower (closer to a Grade One or Two) than in the cases where only models were available. Perhaps this is because the photographic scoring tends to be somewhat more subjective in determining these scores, is more difficult to assess parameters, such as overbite and overjet.

Secondly, it is not unusual in any dental practice for some patients to have a much higher degree of concern over mild occlusional discrepancies than the clinician. For example, some patients will request orthodontic treatment for problems such as minor rotations, etc., while the clinician may determine that the patient's malocclusion is not so severe. In those cases, patient education is necessary, followed by a decision by the patient and the clinician as to whether or not they should proceed with orthodontic treatment. Considering that these cases were all third party payment cases funded by the Medicaid system (Title IXX), it would be expected that the clinician should be much more critical about initiating orthodontic treatment in patients with Ideal Occlusions or Mild Malocclusions.

Overall, the process of conducting this study went quite well with few operational difficulties. However, the examiners could have probably done a more thorough job if all of the cases had records that were standardized and of better quality. In addition, even though previous research shows acceptable discrepancies between cases graded using models only, or cases graded using photos only, it is possible that if all of the 249 cases had high quality models available for the examiners to review, the total number of cases graded as One or Two (Ideal Occlusion or Mild Malocclusion) might have been significantly less.

Furthermore, the finding that 89% of the cases were severe enough to require treatment is, as expected, much higher than the percentage classified as needing treatment in the study by Proffit *et al* (1998). When applying the IOTN to data obtained from the NHANES III, Proffit *et al* indicated that 29-41% of the general U.S. population would be classified as having orthodontic treatment need. They were looking at all patients in a general population (from NHANES III) and our study only included patients that had actually received orthodontic treatment, presumably because of some underlying need. It is important to note that Proffit *et al* defined all cases falling in Grades Two-Five as needing treatment, while the present study defined Grades Three-Five as needing treatment. This was considered when recalculating the Proffit et al's percentages and the difference in the determination of the cut-off points between need for treatment and no treatment. Jarvinen stated that recently developed indices such as the IOTN have less discernable cut-off points, and that when the IOTN is used, cut-off points can be set between Grades 4 (need for treatment) and Three (borderline need) or Grades Three and Two (little need) (3).

Conclusions

While several of the cases (11%) submitted during the time period of 1999 to 2001 to the Indiana State Medicaid Division for reimbursement were rated as having Ideal Occlusions or Mild Malocclusions, the vast majority (89%) were scored as having Moderate, Severe, or Extreme Malocclusion.

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