A CLOSER LOOK AT COMMONALITY AND DIFFERENCES BETWEEN SECTION SCORES ON THE SALZMANN EVALUATION INDEX AMONG MEDICAID PATIENTS SEEKING ORTHODONTIC TREATMENT IN PENNSYLVANIA

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ABSTRACT

Objectives: The Salzmann Evaluation Index (SEI) is the malocclusion index used by Medicaid insurance administrators in Pennsylvania. An SEI of 25 is regarded as the threshold for approval. The SEI is broken into three subsections: intra-arch deviations (IAD; discrepancies within an arch), anterior Inter-arch deviations (AIAD; incisor antagonist relationships) and posterior inter-arch deviations (PIAD; posterior antagonist). This study identified discrepancies amongst the overall SEI score and subsection scores, in approved or denied cases with a SEI$\geq$25. Differences in subsection scores may identify malocclusion characteristics, other than overall scores, which drive insurance approval.

Methods: The study sample included 570 subjects (295 approved and 275 denied). All subjects had a SEI$\geq$25. These scores along with a cephalogram, panorex, and intra/extra oral photographs, were previously sent to the administrator and a funding decision was rendered. SEI and subsection scores were compared between approved or denied treatment funding by T-Tests.

Results: There was a significant difference in the overall SEI score between approved and denied records (p<0.001), with higher scores more likely to obtain approval. No difference was found for the IAD (p=0.195). Significant difference between approved and denied scores were found for both AIAD and PIAD (p<0.001). Effective subsection weight of contribution to the overall SEI was: IAD=55.38%, AIAD=24.86%, and PIAD=19.76%.

Conclusions: Only 51.75% of subjects that had an SEI≥ 25 were awarded treatment funding. Although IAD contributes over half the total SEI, differences in this portion did not effectively influence insurance administrator decisions. There may be an inherent approval bias favoring malocclusions with crossbite, open bite, overbite, overjet, and sagittal tooth positions, rather than tooth-in-arch positions or overall SEI score.

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CHAPTER 1

INTRODUCTION

When discussing Medicaid and covered procedures, malocclusion and orthodontic treatment are in a different category of consideration. As malocclusion in and of itself is not a disease, rather it may be a gateway to the development of physical or psychosocial disorders later in life[17]. It has been shown in numerous studies that malocclusions can lead to a variety of issues within the afflicted individual. Malocclusion is associated with localized periodontal issues (such as decreased attached gingiva on the buccal of a labially displaced tooth), plaque induced periodontal issues related to inability to maintain proper oral hygiene, and trauma from increased overjet[10]. Treating these malocclusions and potential causes of trauma may enhance the patient's ability to maintain the area and decrease risk of trauma to the teeth.

The Social Security Act and what we know today as Medicaid were signed into effect by then US President, Lyndon B. Johnson in 1965[11]. Although a federal program, the government only funds half of the program and the remaining half is paid for by each individual state's government. A multitude of malocclusion indexes have been developed to assess severity and produce a definitive score for each patient's eligibility for funding[4]. The state of Pennsylvania is one of eight that use the Salzmann Evaluation Index (SEI), developed by Joseph Salzmann in 1967[11]. The Salzmann Evaluation Index examines the patient's occlusion in a number of categories pertaining to inter-arch and intra-arch relationships (Figure 6). The simplicity of the SEI and lack of need to calculate any

angles or measurements enables it to be a quick and easy means to score a patient's occlusion.

The Salzmann Evaluation Index is broken into two main sections, A) Intra-arch Deviation and B) Inter-arch Deviation. Each section is further divided into anterior and posterior sections respectively. The intra-arch section looks at teeth within one arch and their relative positioning to one another. Items such as crookedness, rotation, crowding, or missing are noted in this section for both the anterior and posterior teeth of each arch. The section on Inter-arch Deviation looks at the relationship between the teeth of the maxilla and mandible. Scores in this section relate to both functionality and esthetics of a patient's occlusion. The anterior section examines the maxillary and mandibular incisors; primarily focusing on the teeth that one can see on smiling. The posterior section of this category focuses on the relation of teeth and functionality of a patient's bite.

To be considered for orthodontic coverage through Medicaid in the state of Pennsylvania, an SEI must be completed by either a general dentist, a pediatric dentist, or an orthodontist. A score of 25 is used as the cut off point for determining orthodontic funding. Scores 25 and above are eligible, while those 24 and below are not eligible. Records and the corresponding SEI score are submitted on the patient's behalf to their insurance administrator for a decision to be rendered. Each company may have their own policy on how to establish eligibility for funding.

Although 25 is the score to be considered eligible for orthodontic funding, there is often a discrepancy between the Medicaid insurance administrator's decision and the Salzmann score. Joseph Salzmann believed that the intended purpose of a malocclusion index is to assess the priority of treatment and select the patients to treat[14]. In this theory,

if a community has N children who need orthodontic care, but the community can only afford to pay for n children, then the communal funds would cover children in descending order of scores, starting with the highest score until n children are covered[9]. Knowing this idea, it is quite interesting that Medicaid insurance administrators do not abide by this. Routinely denying patients that score above a 25 and approving patients with a lower score. Previous master's theses in the Department of Orthodontics at Temple University have shown that a discrepancy exists between Salzmann Evaluation Indexes scored by Orthodontic Providers and actual approval by the Medicaid insurance administrator[12]. A score of 25 has been shown to not correlate to approval as previously expressed[12]. A recent study examining the Medicaid insurance approval rate of cases scored over 25 was 69.7% for the company with the highest approval rate and a 39.8% acceptance rate for the company with the lowest rate[12]. There are outside factors that affect the Medicaid insurance administrator's rendered decision. These previous studies examined the Salzmann Evaluation Index Score as a whole. This study aims to look at individual sections of the SEI and identify if a particular section is driving the insurance administrator's decision. With the hopes to aid providers in better understanding how insurance administrators utilize the SEI.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Assessment of the Severity of Malocclusion

In the field of orthodontics, a key principle in the treatment of a case is the classification of occlusion. Over the years, several classification systems have been created, though the most widely accepted and one still used today, was set forth by Dr. Edward Angle in 1899[3]. Through his definition of occlusion, three classes of occlusion were created to describe the sagittal relationship of the first molars. Relying on the anterior/posterior relationship of mesiobuccal cusp of the maxillary first molar and the mesiobuccal groove of the mandibular first molar, three occlusal classes were created[3]. Though the field of orthodontics has continued to grow and is more readily understood than in 1899, the occlusal system put forth by Angle is still widely accepted today[13].

In order to properly diagnose a malocclusion, a clinician must first have a firm understanding of what is considered a normal occlusion. To aid clinicians in understanding of the ideal occlusion, Dr. Lawrence Andrews studied the casts of 120 patients that did not have nor would benefit from orthodontic treatment. Dr. Andrews used these patients to develop his 1972 study titled, *The 6 keys to normal occlusion.* In this study, Dr. Andrews defines his six keys as proper molar relationship, crown angulation (mesiodistal), crown inclination (buccolingual), no rotations present, no spaces present, an occlusal plane that is flat to a slight Curve of Spee[2]. Through

understanding the features and traits found in natural occlusion, a clinician can be properly educated to accurately diagnose malocclusion.

In addition to identifying the presence of a malocclusion, it is important to note the severity to which one's occlusion differs from the norms. This is an important diagnosis, as the severity of malocclusion is often used by both the treating clinician and insurance administrator. Many clinicians adjust the cost of treatment to account for the severity of malocclusion and estimated complexity/length of treatment. Similarly, insurance administrators consider the severity of a malocclusion when assessing an individual's needs for orthodontic coverage. As the judgment of the severity of malocclusion is an important factor in the diagnosis and treatment planning of a case, a multitude of treatment indexes have been created over the years to help clinicians assess malocclusion.

The World Health Organization classifies an ideal index as one that is reproducible, simple, accurate, sensitive, and easily administered with minimal judgement[8]. Between 1960 and 1992, 11 different occlusal indexes were created and were considered either qualitative or quantitative indexes, dependent on the methods used to define malocclusion[8]. In comparison of the two forms of indices, qualitative studies were found to have a higher risk of bias[8]. The use of arbitrary verbal markers such as "extreme or limited," to describe the need for orthodontic treatment resulted in a high level of bias. As a result of the methodological mistake, clinicians tended to categorize malocclusion based on the verbal descriptor and how they feel the occlusion fits[8]. This form of index relies heavily on a clinician's experiences and exposure to varying levels of malocclusion. On the other hand, quantitative indexes consist of a scoring rubric and a

list of different traits/features with assigned values. Such an index results in the procurement of a score used to assess the severity of malocclusion, with a higher score correlating to a higher level of malocclusion. A previous study done shows that studies based on quantitative measurements resulted in lower risk of bias[8]. Quantitative indices remove the experience of the clinician and instead rely on the proper calibration of the clinician[8].

Many insurance administrators rely on the use of a quantitative index to assess the need for orthodontic treatment within their patient population. This allows the insurance administrator to provide funding to those individuals most in need for orthodontic treatment. The use of a quantitative index for the orthodontic treatment needs index results in a scored result that can be compared across individuals. Traditionally, insurance administrators have a cut-off score that signifies a malocclusion considered severe enough to require coverage[5]. Dependent on the current resources of the company and the population of the area under coverage, the cut-off score can be adjusted.

An orthodontic treatment need index should be reliable, valid, and have high levels of both sensitivity and specificity[5]. A reliable index is one that is reproducible and would allow the same score to be determined regardless of the clinician assessing the case[5]. A valid index measures what it is intended to measure. An index with high sensitivity should be able to identify those individuals in need of orthodontic treatment and distinguish them from those not needing treatment (specificity)[5]. The use of such indexes allows the clinician to properly diagnose and treatment plan for an individual while also getting an understanding of which individuals may receive treatment funded by their insurance administrator.

2.2 Understanding Medicaid Insurance and Handicapped Malocclusion

The Social Security Act was signed into effect by then US President, Lyndon B. Johnson in 1965[11]. Within the Social Security Act were a variety of sections or "Titles" addressing different facets of American life. Title XIX (19) established what we now know as Medicaid and aimed to provide care (of which orthodontics was included) to the "medically indigent."[16] While a national program, the federal government only funds half of the program and the remaining half is paid for by each individual state's government. For this reason, the definition of "handicapped malocclusion" and how it is determined, is left up to the individual state[11].

When discussing Medicaid and covered procedures, malocclusion and orthodontic treatment are in a different category of consideration. As malocclusion in and of itself is not a disease, rather it may be a gateway to the development of physical or psychosocial disorders later in life[17]. Unless receiving orthodontics to treat a direct injury or disorder, orthodontic treatment can be seen as a form of preventative measure against potential physical and psychosocial disorders[17]. It has been shown in numerous studies that malocclusions can lead to a variety of issues within the afflicted individual. Malocclusion is associated with localized periodontal issues (such as decreased attached gingiva on the buccal of a labially displaced tooth), plaque induced periodontal issues related to inability to maintain proper oral hygiene, and trauma from increased overjet[5]. Treating these malocclusions and potential causes of trauma may enhance the patient's ability to maintain the area and decrease risk of trauma to the teeth. While physical disorders from malocclusion may be more abundantly clear, orthodontists must consider the impact the

malocclusion is having on their patient's quality of life. We must consider that children are in a very fragile stage of development and may be impacted by bullying or teasing brought on by their malocclusion in such a way that they develop low self-esteem or may be prevented from being a full participant in society[17]. It has been found that those who are considered to have more appealing dentofacial features are regarded as friendlier and more likely to succeed, whereas those with malocclusion are more likely to be victimized[5].

Since the advent of the Social Security act, a multitude of malocclusion indexes have been developed to assess severity and produce a definitive score for each patient's eligibility for funding[2]. While numerous indexes have been developed, no one study has been selected as the best and in 1990 the AAO announced that it is against the use of indexes in determine the treatment needs of patients[9]. Despite this stance from the AAO, many states still use indexes as a means to quantifiably identify patients for state funding. The state of Pennsylvania is one of eight that use the Salzmann Evaluation Index (SEI), developed by Joseph Salzmann in 1967[11]. Joseph Salzmann defined the handicapped malocclusion as one that would potentially affect the function, speech, or overall esthetics of the dentofacial complex while creating a risk to the oral health and overall wellbeing of the individual. The Salzmann Evaluation Index examines the patient's occlusion in a number of categories pertaining to inter-arch and intra-arch relationships within the following criteria: missing, crowded, or rotated teeth, open or closed spaces, overbite, overjet, crossbites, and the overall dental Classification (Class I, II, or III). The SEI is popular due to its overall simplicity and lack of need to calculate any angles or measurements enables it to be a quick and easy means to score a patient's occlusion.

In addition to its overall ease of use, an index must be regarded as both reproducible and repeatable to be considered an effective index. This would indicate that should another clinician examine the same subject using the same index of malocclusion, they would score the same. There have been a multitude of studies examining the reproducibility of various malocclusion indexes, including the Salzmann Evaluation Index. A study published in 1972, by Dr. John Grewe and Dr. Donald Hagan, evaluated the precision and risk of bias for the SEI, Occlusal Index (OI), and Treatment Priority Index (TPI)[7]. The study found that all three indices had high levels of reproducibility between examiners. A similar study by Gray and Demirjian in 1977, examined the Handicapping Labio-Lingual Deviation (HLD) Index, in addition to the SEI, OI, and TPI[6]. This study sought to examine the accuracy and reproducibility of these indices. The study found that all four of the indices examined are both highly accurate and reproducible. These studies indicate that the use of indices such as the Salzmann Evaluation Index are effective and accurate means to measure malocclusion and are reliable for results scored by multiple clinicians. Such indices provide insurance administrators with accurate information to properly determine individuals with the highest requirement of treatment.

2.3 Scoring the Salzmann Evaluation Index

As mentioned previously, a Salzmann Evaluation Index must be completed by a general dentist, a pediatric dentist, or an orthodontist and submitted to the patient's respective Medicaid insurance administrator to be considered for orthodontic coverage in the state of Pennsylvania. Historically, a score of 25 is used as the benchmark for orthodontic funding with scores above 25 being considered eligible and those 24 and below are not. Once an SEI score has been determined, the remainder of patient records (as detailed in a later section) are taken. Records and the corresponding SEI score are submitted on the patient's behalf to their insurance administrator for a decision to be rendered. Once received by the company, an employee reviews the records, completes their own SEI Score, and determines the patient's status. Participating insurance administrators are financially compensated by the Pennsylvanian government. Each company may have their own policy on how to establish eligibility for funding. Commonly, the patient must be under the age of 21 and have permanent dentition. However, there are exceptions where a patient with a retained primary tooth may be considered.

In order to ensure the accuracy of scores generated when completing a Salzmann Evaluation Index, a guideline is provided below. The scoring should be completed based off initial impression of the occlusion, the SEI was designed to be completed without the use of radiographs. The SEI consists of two main sections the Intra-arch Deviations and the Inter-arch Deviations. Each section is broken down into anterior and posterior sections respectively. In the SEI, the anterior section consists of the central and lateral

incisors. The posterior section accounts for the canines, first premolars, second premolars, and first molar. The first section of the SEI, the intra-arch section, examines teeth within one arch and notes positioning of one tooth to another. Characteristics such as missing, crowding, rotations, and spacing are noted in this section. The Inter-arch Deviation section notes characteristics of the relationship between the teeth of the maxilla and mandible. Overjet, overbite, crossbite, and open bite of the anterior incisors is noted in the anterior section. The posterior segment notes the mesial/distal relation of the mandibular teeth to the maxillary teeth as well as noting presence of crossbite or open bite in the maxilla. Further details on definitions and proper scoring are provided below:

1. **Intra-Arch Deviations**
    a. Overall Scoring Principle:
        i. Each affected tooth in this section is awarded one point. The score of the maxillary anterior is doubled.
        ii. The maximum score for line one (maxillary anterior) is 8 and the maximum for line three (mandibular anterior) is 4.
    b. Characteristics
        i. <u>Missing teeth</u>
            1. Scored by the number of missing teeth. Retained roots and unerupted teeth are considered missing.
        ii. <u>Rotated Teeth</u>
            1. Disruption to the continuity of the dental arch where there is sufficient space to address mispositioned crown without movement of other teeth in the dental arch

iii. Crowded Teeth

1. Lack of adequate space for proper alignment without moving other teeth. Marked irregularity of visible tooth crown that inhibits the continuity of the dental arch due to insufficient space
2. A tooth cannot be counted as both crowded and rotated

iv. Spacing

1. Open
    a. Open spacing results when the interproximal papilla is visible between two adjacent teeth
    b. In the anterior, count each interproximal papilla that is visible as an individual score
    c. In the posterior
        i. Only score a point for open spacing when the interproximal papilla are visible on either side of a tooth
        ii. A maximum of 2 teeth per quadrant per arch can be scored in this section
2. Closed
    a. A space is present/interproximal papilla can be seen, however the space is insufficient for the eruption of a tooth

b. A tooth can't be scored as both closed spacing and crowded

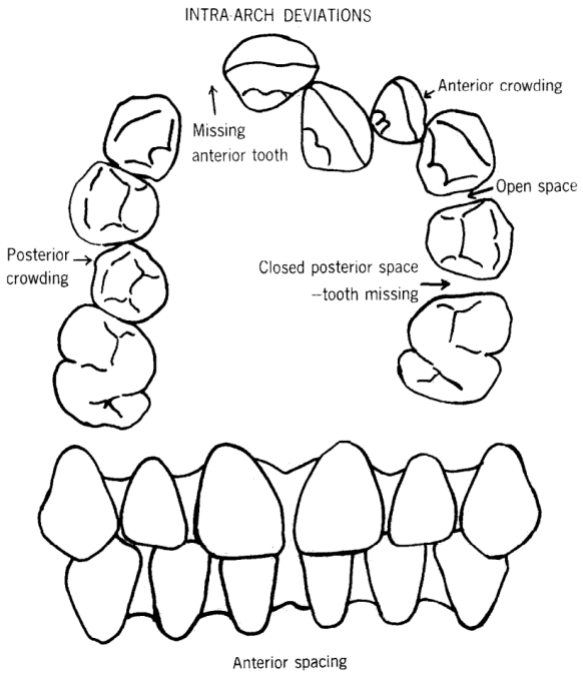


Figure 1- Intra-Arch Deviations[15]

2. **Inter-arch Deviation**

   a. Overall Scoring Principle:

      i. Each affected tooth in this section is awarded one point. The score of the anterior segment is doubled.

   b. Overjet

      i. The inclination or positioning of the maxillary incisors toward the upper lip that allows the mandibular incisors to occlude on or over the palatal mucosa lingual

   c. Overbite

      i. Maxillary incisors are occluding directly on or over the labiogingival mucosa of the mandibular incisors

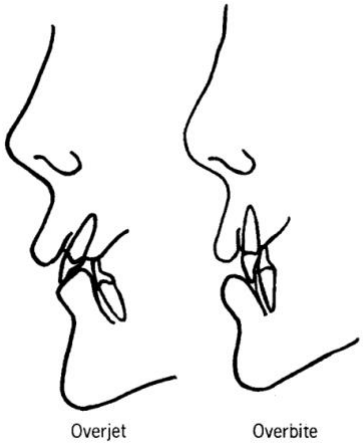


Figure 2- Inter-Arch Deviations – Overjet and Overbite[15]

d. Anterior Crossbite

    i. In occlusion, the maxillary incisors are lingual to the mandibular incisors

e. Posterior Crossbite

    i. Posterior teeth are malpositioned either buccally or lingually and out of contact in relation to the opposing teeth.

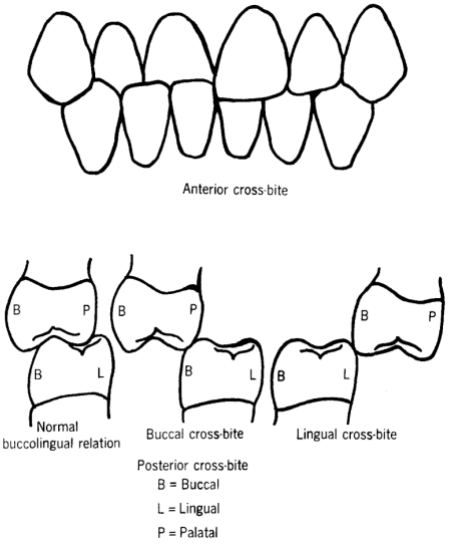


Figure 3- Inter-Arch Deviations – Anterior and Posterior Crossbites[14]

f. Anterior Open Bite

    i. Presence of vertical spacing between the maxillary and mandibular incisors when the posterior teeth are in occlusion

g. Posterior Open Bite

    i. Presence of vertical spacing between maxillary and mandibular teeth (Canines, premolars, or first molars) when the remainder of the teeth are in occlusion

    ii. Cusp to cusp occlusion is not scored as posterior open bite

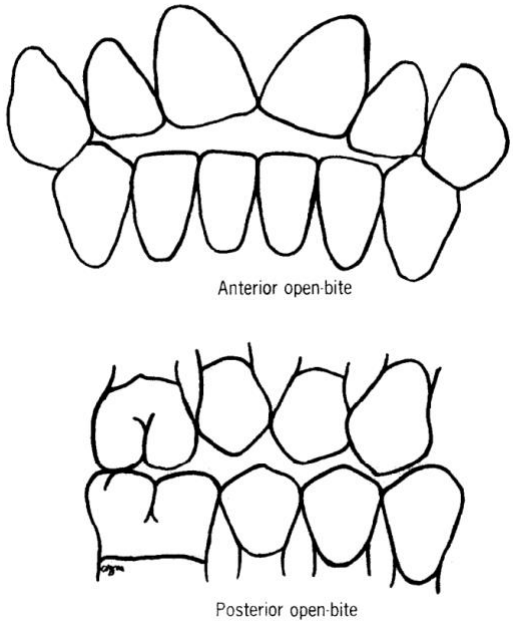


Figure 4- Inter-Arch Deviations – Anterior and Posterior Open Bites[14]

h. Mesiodistal Deviation of Posterior Teeth

    i. Scored by relating the mandibular teeth to the maxillary teeth. A point is awarded for each mandibular tooth affected. The forward

or rear shift of the mandibular teeth in relation to accepted normal occlusal relationship between the posterior teeth of the maxillary and mandibular arches. Mandibular teeth in a Class II position are marked as distal, whereas teeth positioned in Class III are marked as mesial.

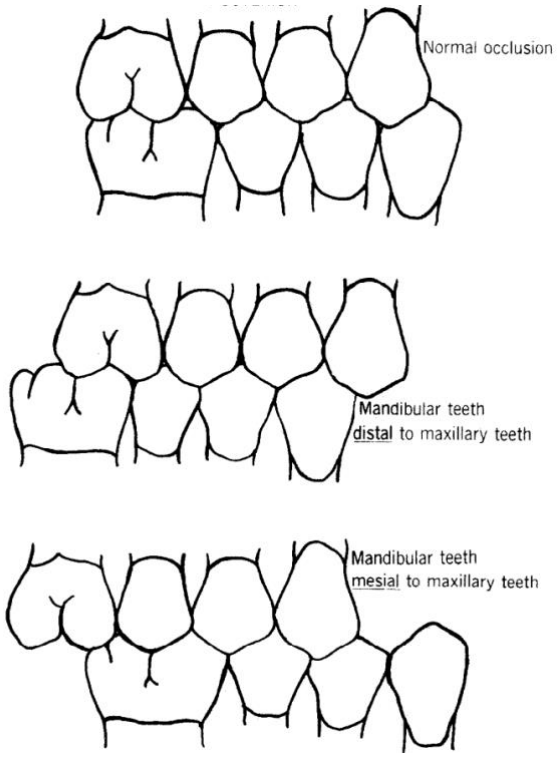
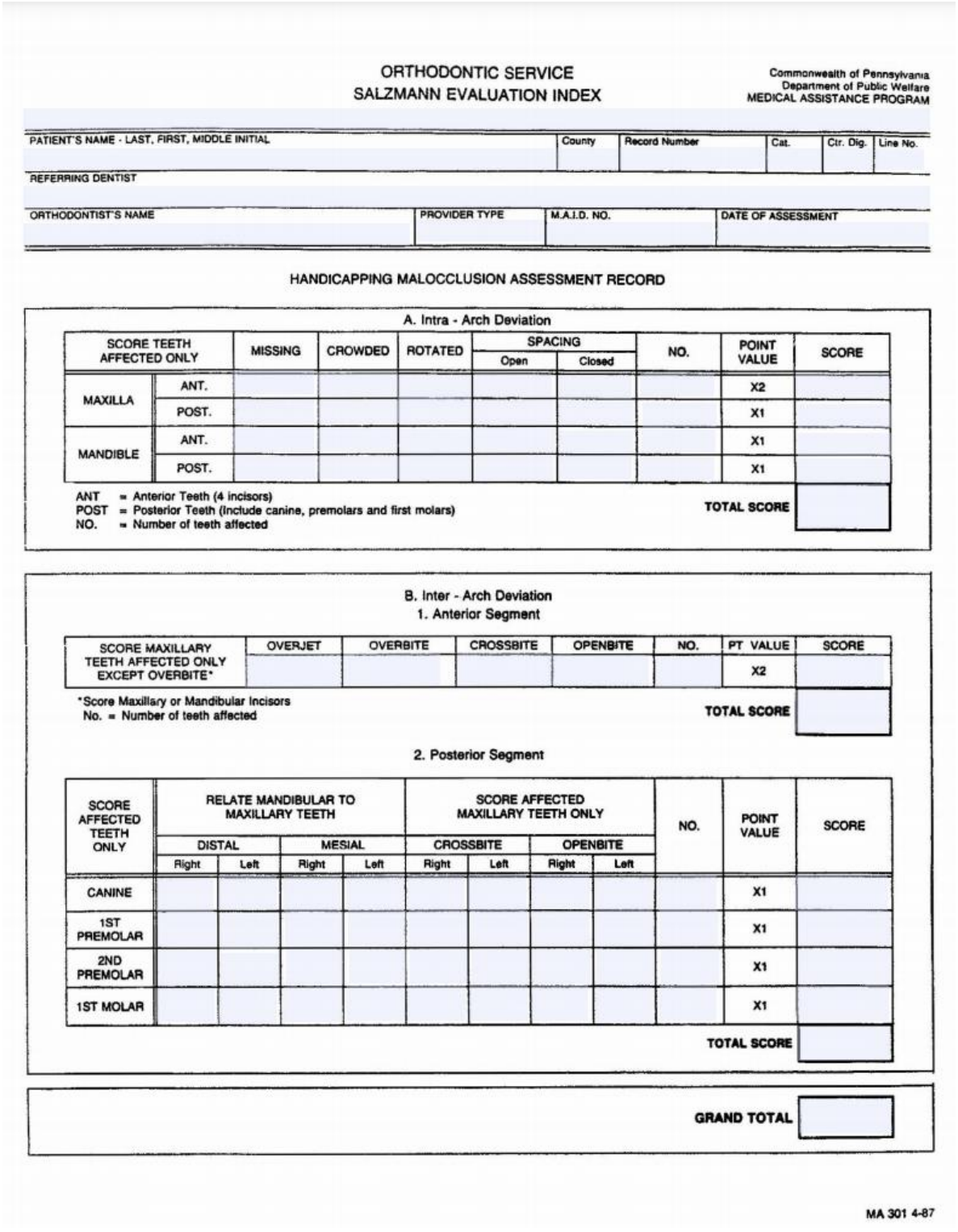


Figure 5- Inter-Arch Deviations – Mesiodistal Deviation of Posterior Teeth[14]



ORTHODONTIC SERVICE
SALZMANN EVALUATION INDEX

Commonwealth of Pennsylvania
Department of Public Welfare
MEDICAL ASSISTANCE PROGRAM

PATIENT'S NAME - LAST, FIRST, MIDDLE INITIAL	County	Record Number	Cat.	Ctr. Dig.	Line No.

REFERRING DENTIST

ORTHODONTIST'S NAME	PROVIDER TYPE	M.A.I.D. NO.	DATE OF ASSESSMENT

HANDICAPPING MALOCCLUSION ASSESSMENT RECORD

A. Intra - Arch Deviation

SCORE TEETH AFFECTED ONLY		MISSING	CROWDED	ROTATED	SPACING		NO.	POINT VALUE	SCORE
					Open	Closed			
MAXILLA	ANT.							X2	
	POST.							X1	
MANDIBLE	ANT.							X1	
	POST.							X1	

ANT = Anterior Teeth (4 incisors)
POST = Posterior Teeth (Include canine, premolars and first molars)
NO. = Number of teeth affected

TOTAL SCORE

B. Inter - Arch Deviation

1. Anterior Segment

SCORE MAXILLARY TEETH AFFECTED ONLY EXCEPT OVERBITE*	OVERJET	OVERBITE	CROSSBITE	OPENBITE	NO.	PT VALUE	SCORE
						X2	

*Score Maxillary or Mandibular Incisors
No. = Number of teeth affected

TOTAL SCORE

2. Posterior Segment

SCORE AFFECTED TEETH ONLY	RELATE MANDIBULAR TO MAXILLARY TEETH				SCORE AFFECTED MAXILLARY TEETH ONLY				NO.	POINT VALUE	SCORE
	DISTAL		MESIAL		CROSSBITE		OPENBITE				
	Right	Left	Right	Left	Right	Left	Right	Left			
CANINE										X1	
1ST PREMOLAR										X1	
2ND PREMOLAR										X1	
1ST MOLAR										X1	

TOTAL SCORE

GRAND TOTAL

MA 301 4-87

Figure 6- The Salzmann Evaluation Index

Following completion of the individual sections of the SEI, each subsection score is added together to get the overall score. This score is a measure of the handicapped malocclusion present in relation to the assessment record criteria. Each section is weighted in relation to the effect the section has on the function, health, and esthetics of the oral complex. According to the metrics and criteria of the SEI, a higher score correlates to a more sever malocclusion. The SEI does not intended to examine the presence of occlusal deviation examined in epidemiologic studies on malocclusion. Factors such as diagnosis, treatment planning, and case complexity are not taken into account in this assessment.

2.4 Past Studies Examining Orthodontic Treatment and Medicaid Funding

According to a study in a 2017 study by Minick et al., a large discrepancy of Medicaid funded orthodontic treatment exists across the United States[11]. This study compared rates of funding between 2006 and 2015, a period that saw the financial recession of 2008 and the introduction of the Affordable Care Act in 2010. As mentioned previously, the funding decision is rendered by the individual state and may select which evaluation index it would like to use. Over the course of this time period, the study found that while there is variation in the age limit for Medicaid coverage and the records required, there was an overall decrease in the overall reimbursement rate and expenditure on orthodontic care[11]. This decrease in overall reimbursement and expenditure indicates an increased limitation on access to orthodontic care for children on Medicaid insurance.

In 2021, a study was conducted by Moran that examined the characteristics of funding for Medicaid patients within the state of Pennsylvania. This study sought to examine the approval rating by Medicaid insurance administrators for cases scored above 25 on the SEI by Orthodontic Residents at Temple University. In the state of Pennsylvania, a Salzmann score of 25 is the cutoff for Orthodontic coverage, indicating that scores 25 or above are eligible for funding. This study examined the correlation between subjects who scored above 25 on the SEI and their chances of being approved. The study found that there was an overall approval rating of 52.3%, with a range of 33.3%-69.7% when individual Medicaid insurance administrators were examined. The study noted that this range was statistically significant, indicating that there are differences in approval rating between Medicaid insurance administrators in the state of

Pennsylvania. The results of this study indicate that Medicaid insurance administrators are evaluating cases differently than the initial consideration that a score above 25 should be funded. The statistical difference in approval rates indicates that which Medicaid Program a child has at the time of submission, influences their chances of receiving coverage for orthodontic treatment.

Past studies have indicated that the level of agreement between Medicaid insurance administrators and Orthodontists in the state of Pennsylvania is 52.3%[12]. This low level of agreeance indicates that the Medicaid insurance administrators may be using an outside evaluation index that orthodontists are not aware of or are valuing aspects of malocclusion and sections of the SEI more than others. While past studies have examined the approval rating of malocclusion indexes in varying states, no study examining the individual sections scores within a malocclusion index has been identified. This study aims to fill this void and examine the variance of scores for accepted cases compared to those denied by the insurance administrator. This is done in hopes that by identifying sections of the SEI that the insurance administrator's value more, Orthodontists can more accurately understand the types of malocclusions that Medicaid insurance administrators are deeming "handicapped malocclusion."

CHAPTER 3

AIMS OF THE INVESTIGATION

Purpose: To evaluate differences in Salzmann Evaluation Index scores between cases approved and denied by Medicaid insurances. This study aimed to identify characteristics that distinguish scores for Medicaid approved or denied patients.

Specific Aims:

1. Identify differences between SEI section scores for patients who have an overall SEI score ≥25 and are approved or denied by the respective Medicaid insurance

Hypothesis: This study investigates two hypotheses:

1. There is a variance of scores received for each section between patients that are approved or denied by a Medicaid insurance
2. There is a statistical difference in the average score per section of approved and denied by the two Medicaid insurance administrators used in this study

The aim of this study was to determine if there are statistical differences between cases approved and denied by Medicaid insurances that score over 25 on the Salzmann Evaluation Index (SEI). When a case is approved or denied by a Medicaid insurance administrator, there is no indication or explanation provided for the decision rendered. Through comparison of SEI section scores for approved and denied cases, this study

hoped to identify areas where cases may differ. Identification of such differences or similarities may lead to an understanding of how Medicaid insurance administrators are viewing SEI scores and aid in orthodontic education in evaluation of malocclusion.

CHAPTER 4

MATERIALS AND METHODS

The patients used for this study came from the screening clinic that is run by Temple University's Orthodontic Residency Program. Many of the patients screened in this clinic have Medicaid insurance. Each Medicaid patient screened in the clinic (from first stage of full permanent dentition until the age of 21) has a Salzmann Evaluation Index completed and submitted to their respective Medicaid insurance administrator. Each SEI is completed by an Orthodontic Resident in the program. In addition to the SEI, complete clinical records were taken and submitted to the insurance administrator for determination of need for orthodontic treatment and their approval or denial. These clinical records include the SEI, a Treatment Plan Form, intraoral and extraoral photographs, a Panoramic radiograph, and a Lateral Cephalometric radiograph. In addition to the above requirements, Company 1 required an intra oral scan that includes the lingual view. While multiple Medicaid insurances are accepted in the Orthodontic clinic, a previous study found that 82% of the orthodontic patient's screened at Temple University come from two insurances[12]. For this reason, this study is choosing to examine just these insurances (Company 1 and Company 2).

The inclusion criteria for this study was as follows: patients between the age of 10 and 21, who have a Medicaid insurance administrator (Either Company 1 or Company 2), and had a SEI scored by a Temple Orthodontic Resident from the years 2020 and 2021. Only scores of 25 and above were analyzed for the purpose of this study.

The following individuals were excluded from this study: any patient who was under the age of 10 or over the age of 21, had a Medicaid insurance administrator other than Company 1 or Company 2, had private or no insurance, or the SEI scored by a Temple Orthodontic Resident was below 25.

Prior to any collection of data, an IRB protocol was submitted. Following IRB approval, the Director of Clinical Affairs was notified and provided with a copy of the IRB protocol. Following approval from the director, the IT Department was contacted to conduct a search of Axium for initial data collection. This data was collected for all patients screened in the Orthodontic Clinic at Temple University between the inclusion dates of January 1, 2020 to December 31, 2021. The initial spreadsheet generated contained patient sensitive information (Patient name, Age at Screening appointment, chart number, and insurance administrator) and was stored within a HIPAA compliant system in Orthodontic Department. Date of birth was not contained in the initial spreadsheet, rather the age at record screening appointment was used.

At this time, each individual was compared to the inclusion/exclusion criteria. Any individuals found to not meet the inclusion criteria were marked as completed on the initial data collection sheet (Appendix A). Should an individual be found to meet the inclusion/exclusion criteria, the individual's deidentified data was moved to the data collection spreadsheet in Microsoft Excel (Appendix B). When data was moved from the original data sheet to the Study Data Spreadsheet, all identifiers were removed and only referred to by a random identifier. These steps were repeated for each subject until all subject records have been reviewed. Once all subjects were reviewed, the initial spreadsheet with PHI was deleted.

Once identified as a subject meeting the inclusion criteria, additional information was collected from Axium. While patients can be sorted based off the initial screening code entered in Axium, the scored SEI is not accessible without accessing a patient's electronic chart. The total SEI score was recorded as well as the scores for the following sections: Intra-Arch Deviation (Anterior Maxilla, Posterior Maxilla, Anterior Mandible, Posterior Mandible), Inter-Arch Deviation (Anterior Segment, Posterior Segment (Canine, 1st Premolar, 2nd Premolar, 1st Molar)). An example of the sample table is shown in Appendix B.

The scored Salzmann Evaluation Index was used to identify the score for each subsection of the SEI found in the right-hand column demarked as 'Score,' totaling 9 scores. In example, within the "Intra-Arch Deviation Section" the total score for the Anterior Maxilla was collected. In this section, the total allowed score for line one (Anterior Maxilla) is 8. The subsequent three lines have a maximum score of 4 each. For this section, only the Central and lateral incisors are considered as anterior dentition. The canine is classified as a posterior tooth with the premolars and first molars.

All raw data was collected in Microsoft Excel and an ANOVA was performed to compare the average of each score category between the accepted and denied cases. Results were examined within the two individual insurance administrators as well as an overall assessment of the patient pool.

CHAPTER 5

RESULTS

Between January 1st, 2020 and December 31st, 2021, a total of 1293 individuals were screened in the Temple University Department of Orthodontic that fit the criteria for inclusion in the initial spreadsheet. After comparison of these initial screened individuals to the inclusion criteria, the total sample size was reduced to 570 individuals. This study strictly examined patients that had a Salzmann Evaluation Index of 25 or greater. All patients that scored less than 25 were not included in this study. Of the total 570 subjects included in this study, 295 were approved and 275 were denied Medicaid Coverage. Of the two insurance administrators included in this study, 334 individuals were from Company 1 and 236 subjects were from Company 2.

The first hypothesis sought to determine if a discrepancy existed within each section between cases approved and denied by Medicaid insurance administrators. Prior to examining each of the nine individual subsections, the subject pools were examined based on the three main sections of the SEI. The SEI is broken into three subsections: intra-arch deviations (IAD; discrepancies within an arch), anterior Inter-arch deviations (AIAD; incisor antagonist relationships) and posterior inter-arch deviations (PIAD; posterior antagonist). Table 1 displays the comparison of the overall subject pool for these three subsections. This study identified discrepancies amongst the overall SEI score and subsection scores, in approved or denied cases with a SEI$\geq$25. The table indicates that a significant difference (p<0.001) exists between the overall SEI score, the Anterior Inter-arch Deviation (AIAD) score, and the Posterior Inter-Arch Deviation

(PIAD) score between approved and denied cases. With the cases being approved having a significantly higher score for the overall and AIAD and PIAD subsections. No significant difference (p=0.195) was found for the Intra-Arch Deviation (IAD).

Table 1: Total Subject Pool SEI Scores: Accepted Vs Denied

		Significance Value
Overall SEI	A: $\bar{x}$=32.74±6.1 D: $\bar{x}$=29.87±4.87	p<0.001
IAD	A: $\bar{x}$=17.25±3.36 D: $\bar{x}$=17.48±2.97	p=0.195
AIAD	A: $\bar{x}$=8.66±5.02 D: $\bar{x}$=6.86±5.02	p<0.001
PIAD	A: $\bar{x}$=6.83±3.33 D: $\bar{x}$=5.51±3.12	p<0.001
A=Approved, D=Denied, $\bar{x}$=Mean		

The overall subject pool was further broken down into two groups and examined based on the individual's insurance administrator (Company 1 or Company 2). Examination of the subject pool in these two groupings found that the overall SEI, AIAD, and PIAD section scores remained significant (p<0.001). Neither company showed a significance within the IAD section.

Table 2: Company 1 SEI Scores: Accepted Vs Denied

		Significance Value
Overall SEI	A: $\bar{x}$= 33.03±5.97 D: $\bar{x}$=30.13±5.08	p<0.001
IAD	A: $\bar{x}$=17.31±3.27 D: $\bar{x}$=17.45±3.04	p=0.34
AIAD	A: $\bar{x}$=8.95±4.96 D: $\bar{x}$=7.71±5.20	p<0.001
PIAD	A: $\bar{x}$=6.79±3.33 D: $\bar{x}$=5.57±3.04	p<0.001
A=Approved, D=Denied, $\bar{x}$=Mean		

Table 3: Company 2 SEI Scores: Accepted Vs Denied

		Significance Value
Overall SEI	A: $\bar{x}$=32.34±6.21 D: $\bar{x}$=29.29±4.35	p<0.001
IAD	A: $\bar{x}$=17.18±3.46 D: $\bar{x}$=17.45±2.85	p=0.21
AIAD	A: $\bar{x}$=8.36±5.09 D: $\bar{x}$=6.39±4.66	p<0.001
PIAD	A: $\bar{x}$=6.88±3.33 D: $\bar{x}$=5.41±3.30	p<0.001
A=Approved, D=Denied, $\bar{x}$=Mean		

Following examination of the three main sections of the SEI, the SEI scores were broken into and examined in the 9 subsection categories. As described earlier, the three main sections are further broken into the following subsections: Intra-Arch Deviation (Anterior Maxilla, Posterior Maxilla, Anterior Mandible, Posterior Mandible), Inter-Arch Deviation (Anterior Segment and Posterior Segment). The inter-arch posterior segment deviation is further broken by tooth into Canine, 1st Premolar, 2nd Premolar, 1st Molar. An example of the table is shown in Appendix B.

The overall subject pool of 570 was examined for comparison of the nine subsection scores between those cases approved and denied. This study identified discrepancies amongst the individual subsection SEI scores, in approved or denied cases with a SEI≥25. The overall sample population results are depicted in Table 4 and indicate that a significant difference (p<0.001) exists in the majority of subsections. A significant difference exists in the overall SEI score (p<0.001), the Anterior Maxilla of the Intra-Arch Deviation (p<0.01), all subsections of the inter-arch deviation (Anterior Segment and Posterior Segment (Canine, 1st Premolar, 2nd Premolar, 1st Molar) (p<0.001) were found to be significantly different.

Table 4: Total Subject Pool SEI Scores by Subcategory: Accepted Vs Denied

		Significance Value
Overall SEI	A: $\bar{x}$=32.8±6.113 D: $\bar{x}$=29.87±4.857	p<0.001
Ant Maxilla (IAD)	A: $\bar{x}$=6.96±1.742 D: $\bar{x}$=7.23±1.345	p=0.010
Posterior Maxilla (IAD)	A: $\bar{x}$=3.43±1.343 D: $\bar{x}$=3.38±1.125	p=0.591
Ant Mandible (IAD)	A: $\bar{x}$=3.39±1.052 D: $\bar{x}$=3.42±0.984	p=0.830
Posterior Mandible (IAD)	A: $\bar{x}$=3.50±1.141 D: $\bar{x}$=3.52±1.312	p=0.622
Anterior (AIAD)	A: $\bar{x}$=8.77±5.097 D: $\bar{x}$=6.82±5.052	p<0.001
Canine	A: $\bar{x}$=1.91±1.136 D: $\bar{x}$=1.61±0.987	p<0.001
First Premolar	A: $\bar{x}$=1.73±1.072 D: $\bar{x}$=1.39±0.996	p<0.001
Second Premolar	A: $\bar{x}$=1.64±1.130 D: $\bar{x}$=1.32±1.039	p<0.001
Molar	A: $\bar{x}$=1.49±1.079 D: $\bar{x}$=1.20±0.960	p<0.001
A=Approved, D=Denied, $\bar{x}$=Mean		

Data was separated by insurance administrators and the same ANOVA analysis was run. Separation of data based on insurance administrator found that the overall SEI score and the inter-arch deviation subsections remained significant between approved and denied cases for both company 1 (Table 5) and company 2 (Table 6) (p<0.05). The anterior intra-arch deviation section was no longer significant in Company 1 (p=0.124), however remained significant for Company 2 (p<0.05).

Table 5: Company 1 SEI Scores by Subcategory: Accepted Vs Denied

		Significance Value
Overall SEI	A: $\bar{x}$=33.16±5.996 D: $\bar{x}$=30.17±5.094	*p*<0.001
Ant Maxilla (IAD)	A: $\bar{x}$=7.00±1.662 D: $\bar{x}$=7.22±1.408	*p*=0.124
Posterior Maxilla (IAD)	A: $\bar{x}$=3.41±1.329 D: $\bar{x}$=3.41±1.090	*p*=0.843
Ant Mandible (IAD)	A: $\bar{x}$=3.42±1.071 D: $\bar{x}$=3.46±0.963	*p*=0.709
Posterior Mandible (IAD)	A: $\bar{x}$=3.58±1.285 D: $\bar{x}$=3.43±1.193	*p*=0.224
Anterior (AIAD)	A: $\bar{x}$=9.05±5.026 D: $\bar{x}$=7.03±5.252	*p*<0.001
Canine	A: $\bar{x}$=1.90±1.076 D: $\bar{x}$=1.62±0.939	*p*=0.005
First Premolar	A: $\bar{x}$=1.69±1.088 D: $\bar{x}$=1.45±0.986	*p*=0.037
Second Premolar	A: $\bar{x}$=1.63±1.171 D: $\bar{x}$=1.31±0.986	*p*=0.003
Molar	A: $\bar{x}$=1.51±1.110 D: $\bar{x}$=1.24±0.963	*p*=0.013
A=Approved, D=Denied, $\bar{x}$=Mean		

Table 6: Company 2 SEI Scores by Subcategory: Accepted Vs Denied

		Significance Value
Overall SEI	A: $\bar{x}$=32.41±6.233 D: $\bar{x}$=29.30±4.330	p<0.001
Ant Maxilla (IAD)	A: $\bar{x}$=6.91±1.828 D: $\bar{x}$=7.24±1.224	p=0.042
Posterior Maxilla (IAD)	A: $\bar{x}$=3.46±1.361 D: $\bar{x}$=3.32±1.193	p=0.333
Ant Mandible (IAD)	A: $\bar{x}$=3.37±1.034 D: $\bar{x}$=3.35±1.023	p=0.784
Posterior Mandible (IAD)	A: $\bar{x}$=3.46±1.341 D: $\bar{x}$=3.65±1.023	p=0.409
Anterior (AIAD)	A: $\bar{x}$=8.46±5.171 D: $\bar{x}$=6.43±4.645	p=0.003
Canine	A: $\bar{x}$=1.93±1.200 D: $\bar{x}$=1.61±1.080	p=0.049
First Premolar	A: $\bar{x}$=1.78±1.057 D: $\bar{x}$=1.28±1.010	p<0.001
Second Premolar	A: $\bar{x}$=1.66±1.089 D: $\bar{x}$=1.33±1.140	p=0.025
Molar	A: $\bar{x}$=1.48±1.049 D: $\bar{x}$=1.14±0.957	p=0.015
A=Approved, D=Denied, $\bar{x}$=Mean		

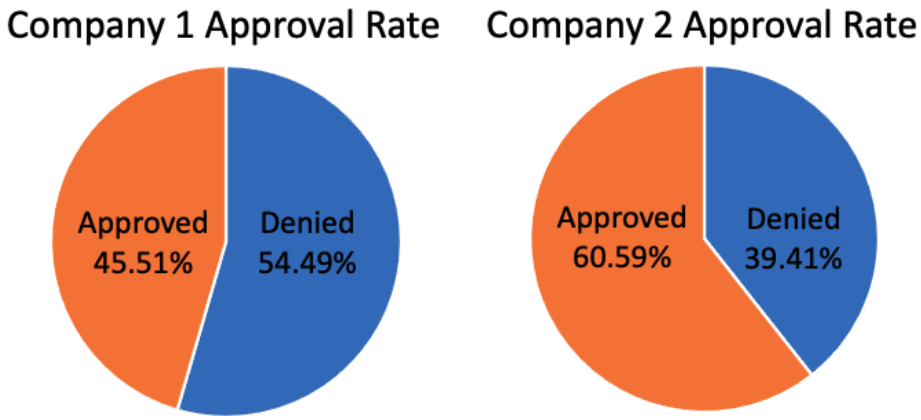
This study examined all screened cases with an SEI score over 25. The SEI scores of all 570 individuals were analyzed and an effective weight contribution per subsection was calculated. The intra-arch deviation subsection accounted for over half of the SEI score, averaging a contribution of 55.38%. The anterior inter-arch deviation subsection contributed 24.86% of the overall SEI. The Posterior Inter-arch deviation accounted for just 19.76% of the overall SEI Score. The effective weight contribution data is summarized below in Table 7.

Table 7 – Overall Effective Weight Contribution by Subsection

	% of overall SEI Score contribution
Intra-Arch Deviation	55.38%
Anterior Inter-Arch Deviation	24.86%
Posterior Inter-Arch Deviation	19.76%
Total	100%

An SEI score of 25 is the threshold for Medicaid insurance administrator coverage. Of the 570 subjects included in this study, 295 were approved for Medicaid coverage. This finding indicates that while all subjects included in this study were scored an SEI of 25 or higher, only 51.75% of subjects were approved. The remaining 48.25% were denied coverage. When broken down by insurance administrator, it is found that of the 334 individuals with Company 1, 152 were approved (45.51%) and 182 were denied (54.49%). Of the 236 individuals in this study with Company 2, 143 were approved (60.59%) and 93 were denied (39.41%). A depiction of this can be seen in Figure 7.

Figure 7- Approval Rate by Company



A logistic regression analysis was conducted for the overall sample population. The model was run using sex, race, insurance administrator, and all subscores of the SEI. Overall the model was significant with $p<0.001$. A Nagelkerke R Square value of 0.153 was found. Indicating that the model predicted 15% of the variance of patient acceptance. The model accurately predicted 64.7% of the sample. A summary of the overall population Logistic regression analysis is seen in Table 8. The logistic regression found that the Intra-arch deviation subsection of the maxillary posterior as well as the inter-arch deviation subsection of anterior, canine, and first molar were all significant ($p<0.05$). In all four categories, a higher score indicated a larger likelihood of approval. The logistic regression analysis indicated that individuals with Company 2 were 1.949 times as likely to be approved.

Table 8 – Overall Sample Population Logistic Regression Analysis

	B	**S.E.**	**Wald**	**df**	**Significance Value**	**Exp(B)**
Ant Maxilla (IAD)	-0.071	0.061	1.347	1	$p=0.246$	0.931
Posterior Maxilla (IAD)	0.165	0.081	4.115	1	$p=0.043$	1.180
Ant Mandible (IAD)	0.136	0.094	2.098	1	$p=0.147$	1.146
Posterior Mandible (IAD)	0.024	0.081	0.087	1	$p=0.768$	1.024
Anterior (AIAD)	0.100	0.019	26.925	1	$p<0.001$	1.105
Canine	0.211	0.091	5.328	1	$p=0.021$	1.235
First Premolar	0.098	0.118	0.683	1	$p=0.409$	1.102
Second Premolar	0.078	0.117	0.445	1	$p=0.505$	1.081
Molar	0.204	0.112	3.347	1	$p=0.067$	1.1226
Sex	-0.163	0.180	0.818	1	$p=0.366$	0.849
Age	-0.039	0.030	1.673	1	$p=0.196$	0.962
Insurance	0.668	0.182	13.473	1	$p<0.001$	1.949
Constant	-2.441	0.879	7.714	1	$p=0.005$	0.087

The second hypothesis evaluated the relationship of the SEI scores submitted to both Medicaid insurance administrators. This hypothesis sought to evaluate if there was a statistical difference between the average subsection scores being approved by the two companies. An initial ANOVA analysis was conducted to compare the SEI scores submitted to each insurance administrator. The results indicated that there was no statistical difference between scores submitted to Company 1 vs Company 2. Further evaluation compared the average scores amongst the approved cases for both companies for all subsections and found no statistical difference. Similar results were found when the denied scores were examined, indicating no statistical differences found between the SEI scores approved and denied between Company 1 and Company 2.

CHAPTER 6

DISCUSSION

The Salzmann Evaluation Index is used by the state of Pennsylvania, along with seven other states, to aid in funding decisions for Medicaid patients that are seeking orthodontic treatment. The proper records are collected by the healthcare provider and submitted to the patient's Medicaid insurance administrator. Previous master's theses in the Department of Orthodontics at Temple University have shown that a discrepancy exists between Salzmann Evaluation Indexes scored by Orthodontic Providers and actual approval by the Medicaid insurance[12]. A score of 25 was shown to not correlate to approval as previously conveyed[12]. These previous studies examined the Salzmann Evaluation Index Score as a whole. The objectives of this study was to assess the individual sections of the SEI and identify if a particular section is driving the insurance administrator's decision.

Medicaid insured patients make up a large portion of the patient population in the Department of Orthodontics at Temple University. This large population provides a wealth of information to examine for trends and characteristics of Medicaid patients. As well as identify any issues with the Medicaid administrators with which the individuals are insured. Between January 1, 2020 and December 31, 2021, 1293 individuals were screened in the Department of Orthodontics at Temple University that were insured by either Company 1 or Company 2. The two companies used in this study were selected on the basis that they insure 82% of the Medicaid patients seen at Temple University[5]. The

remaining companies were not included in this study due to lack of patient population and sample size.

The aim of this study was to identify differences between SEI section scores for patients who have an overall SEI score $\geq$25 and are approved or denied by the respective Medicaid insurance administrator. The first hypothesis sought to determine if a discrepancy existed within each section between cases approved and denied by Medicaid insurance administrators. The overall sample was examined and a comparison between approved and denied cases was done for the three main sections of the SEI. The SEI is broken into three subsections: intra-arch deviations (IAD; discrepancies within an arch), anterior Inter-arch deviations (AIAD; incisor antagonist relationships) and posterior inter-arch deviations (PIAD; posterior antagonist). These subsections can be seen in Figure 6. This comparison revealed that a significant difference (p<0.001) exists between the overall SEI score, the Anterior Inter-arch Deviation (AIAD) score, and the Posterior Inter-Arch Deviation (PIAD) score between approved and denied cases. This indicates that approved cases are scoring higher overall on the SEI and within the individual sections of AIAD and PIAD. Understanding this shows that Medicaid insurance administrators typically approve cases that not only score higher overall on the SEI but additionally in the AIAD and PIAD subsections. Indicating that anterior and posterior inter-arch deviations may be of importance to Medicaid insurance administrators, while intra-arch deviations are not as valued. This comparison was run again for both Company 1 and Company 2 and the findings were the same. Indicating that both companies value inter-arch deviations over intra-arch deviations when evaluating the SEI for approval.

Following this initial examination, the three main sections of the SEI were further broken down and examined in the following 9 subsection categories: Intra-Arch Deviation (Anterior Maxilla, Posterior Maxilla, Anterior Mandible, Posterior Mandible), Inter-Arch Deviation (Anterior Segment and Posterior Segment). The inter-arch posterior segment deviation is further broken by tooth into Canine, 1st Premolar, 2nd Premolar, 1st Molar. An example of the table is shown in Appendix B.

Again, the initial analysis examined the overall patient population of 570 individuals. Comparison of the approved and denied SEI scores by each individual subsection found that amongst the overall population, a significant difference existed between the overall SEI score ($p<0.001$), the Anterior Maxilla of the Intra-Arch Deviation ($p<0.01$), and all subsections of the inter-arch deviation (Anterior Segment and Posterior Segment (Canine, 1st Premolar, 2nd Premolar, 1st Molar)) ($p<0.001$) were found to be significantly different. This finding reiterates the finding found when the SEI was examined by the three main subsections. It would be expected that a significant difference exists in the overall SEI score for approved and denied cases, as those approved tend to score higher than those denied. However this further examination confirms that those cases approved by Medicaid insurance administrators have statistically higher scores for the inter-arch deviation. Indicating that the insurance administrators place more value on inter-arch deviations versus issues found intra-arch.

The overall population was broken down based on insurance administrator and the analysis was run for both Company 1 and Company 2. Similar results were found for both, with significant differences being found for the overall SEI score and all subsections of the inter-arch section ($p<0.05$). When separated, the anterior intra-arch

deviation subsection was no longer significant for Company 1 (p=0.124), while it remained significant for Company 2 (p<0.05). This may indicate that Company 1 did not value this section of SEI when evaluating subjects for approval or denial. Versus Company 2 who may have valued anterior intra-arch deviations. This may also be attributed to the fact that the patient population was not large enough to attain significance for Company 1 once the overall population was split by insurance administrator. However, it should be noted that there was a greater patient population for Company 1 (n=334) vs. Company 2 (n=236). With this information, one would expect Company 2 to no longer be significant if it were due to population size. Thus leading to the conclusion that Company 2 placed greater value on the anterior intra-arch deviation than Company 1.

It is important to take into consideration when evaluating the SEI and its various sections, that while an overall score of 25 is regarded as the threshold for approval, the sections that we discuss contribute in different increments to the overall score. As a part of this study, the effective weight contribution of each section was determined. It was found that the intra-arch deviation (IAD) section contributed to over half of the overall SEI score (55.38%). While the remaining 44.62% was contributed by the anterior inter-arch deviation (AIAD =24.86%) and posterior inter-arch deviation (PIAD=19.76%). This in combination with the previously noted results indicate that while the intra-arch deviations account for over half of the overall SEI score, the Medicaid insurance administrators are placing greater emphasis and value on the inter-arch deviation sections which contribute less to the overall score. Placing value on a section that does not contribute as much to the overall score. This disparity may contribute to some of the

discrepancy seen in cases scored over 25 and the rates of approval vs denial. A case that scores over 25, but most of the points arise from the intra-arch deviation section may not be valued or assessed as evenly to a case with a similar overall SEI score with minimal contributed points from the intra-arch deviation, and more from the inter-arch deviations.

As noted prior, an SEI score of 25 is considered the threshold for approval. This study solely examined individuals with an SEI of 25 or greater, indicating that all subjects in this study were eligible for Medicaid coverage. It is interesting to note that of the 570 total individuals in this study, only 295 were approved. This is a Medicaid approval rating of 51.75%. This alone indicates that a disparity exists in the use of the SEI score by the Medicaid insurance administrators. When examined by company, it is found that of the 334 individuals with Company 1, only 45.51% were approved (152/334). While of the 236 individuals with Company 2, 60.59% were approved (143/236). This information, when taken in consideration with the earlier findings that both companies are receiving similar SEI scores, indicates that the two companies are using different criteria to evaluate cases submitted to them. These findings are similar to those found by Moran (2021) which was conducted on the same patient population demographic. Finding that a significant difference existed between the approval ratings of both companies.

A logistic regression analysis was run for the overall sample population. For all variables considered, the model predicted 15% of the variance of patient acceptance and accurately predicted over 64% of the sample. This is of interest, as of the records submitted to insurance administrators (SEI, a Treatment Plan Form, intraoral and extraoral photographs, a Panoramic radiograph, and a Lateral Cephalometric radiograph),

the SEI is the only quantitative metric. Should the insurance administrators rely heavily on the SEI, one would have expected to see a higher percentage of both the variance of patient acceptance and model prediction found in this model. This may indicate that outside factors or the individual interpretation of the photographs and radiographs are influencing the insurance administrator's decision.

As expected, in those sections found to be significant in the logistic regression analysis, the higher the score, the higher the chance for case acceptance. For example, for every unit score increase in the canine subsection of the posterior inter-arch deviation, an individual is 1.235 times as likely to be approved. Similar statements can be made regarding the remaining significant subsections. However, of most interest is the influence of insurance administrator on case acceptance. When all other variables are held constant, it was found that having Company 2 as the insurance administrator increased likelihood of approval by 1.949 times. This indicates that if the same individual was submitted to both Company 1 and Company 2 and all else was held similar, the case is almost twice as likely to be approved by Company 2 vs Company 1. This would be indicative that chance of approval is heavily dependent on the insurance administrator the individual has. Indicating that Company 1 and Company 2 evaluate the SEI in different ways. It must be taken into consideration that in addition to the SEI, Treatment Plan Form, intraoral and extraoral photographs, Panoramic radiograph, and Lateral Cephalometric radiograph, Company 1 requires submission of an intraoral scan as a part of the clinical records. Company 2 has no such requirement and does not receive an intraoral scan. This is a confounding factor that must be accounted for and may be influencing Company 1's decision regarding coverage. If orthodontic coverage is of

great importance to the individual or family when selecting a Medicaid insurance administrator, they should select Company 2 over Company 1.

Study Limitations and Suggestions For Future Research

A limitation of this study is the Salzmann Evaluation Index. While studies have been done into the SEI and results indicate high levels of reproducibility and repeatability, there is still room for error and inconsistency with application of the SEI criteria. While all residents at Temple Orthodontics are trained in the initial phase of their residency to complete an SEI, learning about the scoring system and criteria is vastly different from application on a live patient. As residents begin to see patients clinically and complete the SEI, they may waver from their initial training and form their own interpretation of the SEI criteria. At this time, the Temple Orthodontic Residency program consists of 12 individuals (six per year). An inherent variation can be assumed to exist among 12 individuals completing a scored form. However, this limitation may be overcome by the large sample size of the study and that this variability was present for all Medicaid insurance administrators and would not affect how the company interprets or responds to the submission.

Another limitation of this study is that it only used Medicaid individuals from one location. With a clinic situated in North Philadelphia, the patient population seen in the Temple Orthodontics' screening clinic may not fully represent the Medicaid patient population of the state of Pennsylvania as a whole. The population of North Philadelphia may present with its own characteristics of occlusion that differ from other areas of the

state. Change in population characteristics may have influenced a change in the results of this study and the approval ratings by company. However, this study did incorporate a large sample size that should decrease the potential bias from one office/location.

At the time this study was done, a movement has begun amongst both the AAO and Medicaid insurance administrators to move toward "automatic qualifiers." Automatic qualifiers are defined characteristics of malocclusion, that if an individual were to meet one, would gain them automatic approval for orthodontic coverage. However, no set list of automatic qualifiers has been agreed upon. While the AAO has released their own proposal for a national index, no set list has been released by the state of Pennsylvania. This leaves determination of automatic qualifiers and their use up to the individual insurance administrator. Again leaving such decisions to the individual Medicaid company may lead to discrepancy in approval ratings. Future research is needed into the use of automatic qualifiers and the effect on case approval.

Future research is needed to continue to explore characteristics in cases approved or denied for Medicaid coverage. While this study identified that Medicaid companies place favor on approving cases with high inter-arch deviations, further research is needed to identify the exact characteristic of inter-arch discrepancy companies may be looking at. It may be advantageous to expand on this present study and examine the gathered subjects for characteristics within the inter-arch deviation sections. Evaluation of the patient population for characteristics within the anterior inter-arch deviation (overjet, overbite, crossbite, open bite) and the posterior inter-arch deviation (Class II/Class III malocclusions, open bites, crossbites) may provide further insight and help identify the

exact characteristic that Medicaid insurance administrators are looking for when they base their judgement of approval or denial.

This study investigated subjects with an overall SEI score of 25 or greater. While this score was chosen as it is the regarded threshold for approval, this limits the view of the study to a particular segment of Medicaid cases. Inclusion of individuals with an SEI score below 25 may broaden the overall range of scores and characteristics seen within each section. This may reveal additional characteristics that Medicaid insurance administrators seek. Further information regarding characteristics of approval may be seen in the cases scored below 25 that are approved for coverage.

This research thesis sought to increase the understanding of characteristics of malocclusion that Medicaid insurance administrators look for when approving cases for orthodontic treatment in Pennsylvania. The information gathered by this research thesis has the potential to help orthodontists educate their Medicaid patients on likelihood of coverage by their insurance administrator.

CHAPTER 7

CONCLUSIONS

In conclusion, the results of this study indicate that statistically significant differences exist in the SEI scores and subsection scores between cases approved and denied by Medicaid insurance administrators in Philadelphia, Pennsylvania.

- There is no statistical difference in the scores being submitted to Company 1 and Company 2
- The overall SEI score and inter-arch deviation section scores are significantly greater in cases approved for Medicaid coverage than those that are denied coverage
- Across the overall population, there is no difference in scores between approved and denied cases for Intra-Arch deviation scores
- Company 2 approves a greater percentage of individuals than Company 1
- Individuals with Company 2 are almost twice as likely to be approved as individuals with Company 1

These findings suggest that Medicaid insurance administrators may be valuing inter-arch deviations more than intra-arch deviations. As well as suggest that Company 1 and Company 2 are evaluating individuals in different ways and may cause concern for access to care.

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APPENDIX A
EXAMPLE OF INITIAL DATA COLLECTION SHEET

Name	Age At Screening Records	Chart Number	Insurance Administrator

APPENDIX B
EXAMPLE OF INCLUDED DATA COLLECTION SHEET

Number of Sample	Random Identifier	Sex	Age at Screening Records	Insurance Administrator	Approval Status	Overall Salzmann Score	Intra-Arch Deviation				Inter-arch Deviation				
							Maxillary Anterior	Maxillary Posterior	Mandibular Anterior	Mandibular Anterior	Anterior	Posterior			
												Canine	1st Premolar	1st Premolar	1st Molar
1	0.101491123	M	17	Company 1	Denied	29	8	4	4	4	2	1	2	2	2
2	0.562781467	M	20	Company 2	Denied	28	8	2	4	5	6	2	0	0	1
3	0.324621631	F	13	Company 2	Denied	28	6	2	4	4	8	0	2	2	0
4	0.925495732	M	12	Company 1	Approved	37	6	3	3	4	16	2	1	1	1
5	0.777545031	F	19	Company 2	Approved	21	8	2	4	3	8	0	2	2	2
6	0.173704089	F	12	Company 1	Denied	28	8	4	0	0	16	0	0	0	0
7	0.486222225	M	17	Company 1	Denied	25	8	4	4	4	0	1	2	1	1
8	0.490495290	M	13	Company 1	Denied	34	6	3	4	1	12	2	2	2	2
9	0.993572047	M	14	Company 2	Denied	30	8	4	3	4	0	3	2	4	2
10	0.578745291	M	11	Company 1	Denied	37	8	4	2	4	12	2	3	2	2
	…														
570	0.026470513	F	16	Company 2	Approved	30	8	5	4	5	6	0	0	2	0