The orthodontist is trained to diagnose the underlying causes of a wide variety of malocclusions and to execute appropriate treatment plans to bring about the correction of such malocclusions. In addition, the orthodontist must strive for treatment excellence and efficiency.

**Treatment excellence** is achieved when treatment outcomes satisfy measurable treatment goals. The Peer Assessment Rating (PAR) Analysis, the Andrews Grading System and the American Board of Orthodontic Grading System are examples of measurement tools that help define, in part, the desired static occlusal results.

**Treatment efficiency** occurs when treatment outcomes are achieved on or before the expected time as defined in the original treatment plan. The number of office visits, length of treatment time in months, and the amount of time the patient is scheduled in the chair are quantifiable expressions that can be used to measure treatment efficiency.

The *Pathway to Excellence* illustrated in Figure 1 provides a visual flow chart of the sequence necessary to provide consistent outcomes. While the conscientious orthodontist strives for excellence with every patient, treatment plans can be disrupted by unexpected complications. These unexpected complications may appear mid-treatment as a ‘surprise’ Class II molar relationship, a ‘spontaneous’ open bite, or the recognition of mandibular asymmetry that was not identified during the beginning treatment planning phase.

In an attempt to meet the original treatment goals, these mid-treatment surprises require unplanned for mechanical solutions such as extended periods of elastic wear and/or headgear wear or even unplanned extractions. In some cases, orthognathic surgery is required.

The goal-oriented approach to diagnosis and treatment planning demonstrates that unexpected outcomes usually are the result of unrecognized subtle clues during the diagnostic phase and/or a lack of clear and measurable treatment goals. This chapter illustrates how the combination of a complete set of diagnostic records (over and above the standard set of records usually taken) and a clear understanding of measurable treatment goals that include the recognition of orthodontic limitations can yield a higher standard of excellence in treatment within a more predictable time frame.
Roth Approach to Diagnosis and Treatment

As the number of active orthodontic patients in the clinician’s practice increases, it becomes challenging to achieve consistent, predictable treatment excellence “on time.” It often is difficult to make time for unplanned, additional patient appointments in an already busy clinic schedule. Cases not progressing as planned require months of extended treatment time, additional office visits, and more chair time per visit resulting in extended treatment time for patients. Often, additional diagnostic records and conference time with parents and the patient’s dentist may be necessary. Additional procedures and unplanned, drawn-out appointments frequently will lead to patient/parent dissatisfaction, increased doctor stress, and adverse effects on office profitability.

When an orthodontic practice becomes too busy, too stressful and/or not enjoyable, the orthodontist may begin to feel overworked. This feeling of being overworked can be correlated with increases in the number of days worked per year and the number of active patients relative to patients entering the retention phase of treatment. Figure 2 charts the number of pre-treatment patients, active patients and those entering retention over a 16-year period. In 1990, the number of active patients greatly exceeded the number of patients entering retention. However, note the balance achieved in 1995 between patients starting active treatment and those entering retention.

The orthodontist has the option to continue to diagnose and treatment plan as in the past or to make changes. By analyzing finished treatment outcomes and with the help of peer analysis, new diagnostic and treatment skills can be identified that can be used to improve treatment outcomes and make the practice more enjoyable and fulfilling. The purpose of this chapter is to share the author’s professional experience in measuring specific diagnostic and treatment changes and their effects on the quality of the orthodontic practice.

Figure 2. Total patient load.

SEVEN MEASURABLE TREATMENT GOALS

The Roth-Williams two-year postgraduate program (seven four-day sessions attended over two years) was synthesized from the collective clinical and didactic experiences of Drs. Ronald Roth and Robert Williams. The course was designed to teach qualified orthodontists skill sets involving diagnosis, treatment planning and treatment execution. The treatment approach was built on seven evidenced-based measurable goals common to all fields of dentistry.

Functional occlusion. This goal is clearly defined in its static state by Dr. Larry Andrews. The dynamic state is well-documented by the principles of mutually protected occlusion.

Optimal facial balance. Although optimal facial balance traditionally has been described through the “eye of the beholder,” there are definable parameters that can be used to help guide the practitioner in making treatment decisions.

Optimal dental and gingival aesthetics. The advent of cosmetic dentistry has focused attention on and provided analysis of this goal. Recent studies define components of what constitutes a beautiful smile as viewed by lay persons and dentists. Gingival symmetry, gingival shape and contour, buccal corridor and
arch form, upper lip length line relative to the upper lip, smile arc and optimal dental proportions all are measurable components of an attractive smile.

**Improving the health of the temporomandibular joint and associated structures health.** This goal is a measurable goal as defined by Crawford.\(^{17}\)

**Maintenance of periodontal health.** Preserving periodontal health after orthodontic treatment is critical to the maintenance of the occlusion and the health of the bone and gingival tissues.

**Relative dental stability.** The patient’s perception of the quality of treatment is defined by the stability of the treatment results.

**Satisfying the patient’s chief concerns.** It is important to listen to patients describe their perceived problems in their own words for these are the reason that they are seeking treatment. The clinician must align a patient’s chief concerns with measurable treatment goals.

The **Roth-Williams** approach to diagnosis and treatment teaches strategies to achieve these goals and provides skill sets that are easily implemented in the clinic. Since all participants come from different orthodontic training programs, clinical experiences and varying continuing education courses, the take-home changes for each orthodontist will differ. Many orthodontists believe that the **Roth-Williams** approach will only work in small practices; however, a systematic management style, a well-trained staff and attention to detail will allow this philosophy to be incorporated seamlessly into a practice of any size.

**METHODS AND MATERIALS**

The populations for the samples measured were obtained from the author’s private practice. Beginning in January of each year, the office schedule was used to retrieve the first 100 patients who consecutively started treatment. Exclusion criteria included transfer in-out patients, patients with impacted cuspids, adults, and partial treatment cases. Group 1 consists of 100 patients who began treatment in 1990 and who were not treated using the **Roth-Williams** approach. Group 2 consists of 100 patients who began treatment in 1992 immediately after the **Roth-Williams** approach was implemented in the practice. Group 3 consists of 100 patients who began treatment in 1997, five years after the implementation of the **Roth-Williams** diagnostic and treatment approach.

The data for determining treatment efficiency were collected by the author and the measurements taken for treatment excellence were analyzed by two orthodontists.\(^{18}\)

**Group 1: Pre-Roth-Williams Patient Sample**

A single, soft sheet of wax was used to capture an “intended” seated condylar position. The wax was chilled to preserve wax stability. Hand-held models were used to simulate the relationship of the mandible to the maxilla as captured by the single pink wax wafer. The diagnosis and treatment plans were formulated from these data.

**Group 2: Patients Treated in the First Year of Implementation of the Roth-Williams Approach**

Changes in diagnostic procedures (Fig. 3) included:

1. Taking an ear bow face bow on every starting patient
2. Using a two-piece wax technique to register the position of the mandible relative to the maxilla by means of an estimated hinge axis measured with a Panadent Articulator\(^{19}\)
3. Performing a centric occlusion-centric related head film conversion as needed.

Changes in treatment procedures included:

1. Strategic bracket repositioning appointments
2. Routine use of the estimate hinge axis positioner for finishing
Group 3: Patients Who Began Treatment Five Years After Implementation of the Roth-Williams Approach

Patients in this group:
1. Began treatment after the Roth-Williams diagnostic and treatment protocols had undergone five years of maintenance and refinement
2. Were converted from .018 slot to .022 slot bracket sizes (Siamese brackets, fully programmed appliances)
3. Wore thermal activated wires in the early stages of their orthodontic treatment.

RESULTS

Figure 4 shows that after implementation of the Roth-Williams approach, the mean number of office visits decreased by more than two (Group 2 patients). There was an additional decrease in office visits of 3.5 for Group 3 patients five years later when slot bracket sizes were changed from .018 to .022 (same fully programmed slot) and nickel-titanium wires were used during leveling.

This reduction of almost six office visits is significant. In a practice that starts 200 patients per year, a reduction of almost six office visits results in a reduction of almost 1,200 fewer office visits per year (200 patients times six office visits = 1,200). In a 12-month period, this translates into a saving of 100 office visits per month or almost two fewer work days per month required to care for patients (assuming 50 patients/day are seen in the clinic). Figure 5 demonstrates that the reduction in the number of office visits was consistent for each patient sample group regardless of treatment sub-group.

Figures 6 and 7 demonstrate the ‘on time’ improvement by sample group and by treatment sub-groups, respectively. More cases finished ‘on time’ than were originally treatment planned. The significance of ‘on time’ treatment results supports the findings seen in Figure 2; i.e., a re-
Figure 4. Reduction in mean number of office visits by sample groups.

Figure 5. Reduction in mean number of office visits by treatment sub-groups.

turn to balance in the number of patients in active treatment and those flowing into retention in a timely and planned transition. Figure 2 shows that the practice returned to treatment efficiency in 1995 (five years after Roth-Williams protocols were put into practice) and continued to maintain a balance of active patient starts and patients entering retention. Note the parallelism in these numbers from 1995 on. This balance yields both an increase in patient satisfaction and office profitability.

While treatment efficiency is important, an improvement in the quality of the treatment outcomes is more important. Treatment outcomes for patients in each group were independently scored by two orthodontists using the PAR Index and the Andrews Grading System, and, as can be seen in Figure 8, showed continued improvement in occlusal quality.

Figure 9 shows the effects on the quality of treatment outcomes using the Roth-Williams diagnostic and treatment protocols. In this figure, clinical excellence is set arbitrarily at 3.5 or above using the Andrews Grading System. Scores of 3.0 or below indicate treatment outcomes that required dental compensations for underlying skeletal discrepancies. This delineation is the author’s interpretation and is based on using the six ‘keys to occlusion’ as a guide.

Performing a complete and accurate diagnosis is the essence of the Roth-Williams approach. This allows the orthodontist to recognize different skeletal patterns and to assess more accurately the relationship of the mandible to the maxilla. The Roth-Williams approach also stresses the need to consider the limits of orthodontic tooth movement.

There was an increased prevalence of upper premolar extractions (see Chapter 15) as illustrated by the case in Figure 10. The percent of upper premolar extractions was 10.8% in Group 1, 20.6% in Group 2 and 19.3% in Group 3.
more open bites (see Chapter 6). Previously, these undiagnosed cases required mid-treatment changes that extended treatment time and increased the number of office visits. To regain control of the case, increased or even excessive use of Class II elastics, headgear or eventual extraction of upper premolars had to be employed. On occasion, the treatment outcome would be compromised by excessive discrepancy in the seated condylar position and maximum intercuspation.

The results of this study support the assertion that more cases will be completed ‘on time,’ some even faster than expected, with fewer mid-treatment changes when using the Roth-Williams treatment protocols. During the seven-year span from Group 1 to Group 3, the author sensed a growing ease with which treatment goals were achieved, which is demonstrated by the results of this study.

The results of another recent study that compared treatment results using a twin bracket system to treatment results using a self-ligation bracket system with an interactive clip showed that the number of office visits and treatment times were less when using the self-ligation bracket system.²⁵

CONCLUSIONS

This study looked at the effects of implementing the Roth-Williams diagnostic and treatment protocols on 1) the problem of treatment times that were extended beyond what originally was planned and 2) treatment inefficiency. Objective measuring guides were used to measure the changes in treatment excellence and treatment efficiency upon implementation of the Roth-Williams approach.

No one specific change in diagnostic or treatment protocol can be rated as more important than any other change; the complete diagnostic and treatment process must be viewed as important to the practice. These findings support the idea that the Roth-Williams approach should be embraced as a total package rather than just picking one or another aspect of the protocol. While there is a world-wide clinical perception that
Figure 10. Clinical example of an upper premolar extraction case illustrating the slight prevalence of upper premolar extraction cases in Groups 2 and 3.

CPI Effects:
1. ANB angle larger
2. Mandibular Plane angle greater
3. Saddle angle more obtuse

Figure 11. Effects on diagnosis of mandibular position after centric occlusion-centric relation head film conversion using CPI.
it is the Roth bracket prescription\textsuperscript{26} that is the sole key to producing successful clinical outcomes, it is clear that a thorough and systematic diagnosis with measurable treatment goals also is critical to producing highly consistent results on time.

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