Data Collection and Analysis to Facilitate Diagnosis and Treatment Planning

Creating a predictable workflow for gathering and communicating key information

Michael R. Seemann, DDS

ABSTRACT

Successful outcomes depend upon effective diagnosis and treatment planning. In the dental office, integrating treatment planning paradigms with data collection and analysis, record keeping, and patient flow and communication can help make the most complex cases efficient and manageable so they can be executed in an optimally effective manner.

Performing proper treatment for a dental malady or disease first requires an accurate assessment of the presenting conditions. A comprehensive examination, customized data collection, and data assessment through quantified risk assessment are essential to this process. Once the proper data have been analyzed and assessed utilizing a risk/prognosis protocol, a diagnostically driven, systematic evaluation of the individual patient’s periodontal, biomechanical, functional, and dentofacial risk level is the principal foundation for treatment recommendations.

Effective diagnosis and treatment planning are critical for successful treatment outcomes. Other than emergency treatment to stabilize an acute issue, future dental treatment for a prospective patient should be thoroughly analyzed, deliberated, and planned for the benefit of the patient, dentist, and office staff. In the dental practice, paradigms and systems utilized for record keeping, communication, and treatment planning can help make the most complex cases efficient and manageable so they can be handled effectively.

Performing proper treatment for a dental malady or disease first requires an accurate assessment of presenting conditions. The benefits of a comprehensive examination, particularly with a new patient of record, are well documented and established.1,2 Dedicating time to thoroughly review the patient’s condition not only allows significant information to be collected for analysis, but it also initiates a strong relationship between the care provider and the patient. In particular, it also allows the relationship to perpetuate in an open and honest environment, with a good exchange of information established from the beginning.

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LEARNING OBJECTIVES

- Describe the elements of a comprehensive exam for a new patient.
- Discuss the process and significance of collecting general, functional, and esthetic data.
- Explain the process of diagnostic assessment and the importance of communicating findings and recommendations to the patient.

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Once the initial comprehensive examination is complete, a smooth transition to obtain additional data, when needed, is essential. Rather than deciding in the moment what additional diagnostic steps should be taken, a pre-determined flow for the patient can make the process more routine, professional, and seamless. Further data collection can be successfully triaged into three categories: general, functional, and aesthetic. When the entire staff is familiar with the elements of these categories, the patient can be transitioned into that specific treatment appointment, whether immediately after the examination, or in the future at an appointment scheduled by the front office.

After the results of the comprehensive examination and data collection are accumulated, the dentist will have all essential information at his or her disposal for deliberate and construct a treatment plan. Employing a risk assessment for a given condition can clarify the effectiveness of a proposed treatment. Essentially, a determination must be made about whether treatment intervention will positively affect a negative trajectory of
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Continuing Education

The Comprehensive Examination

Executing a comprehensive examination defines the level of care. Using dedicated time for in-depth identification of presenting condition details is at the core of optimal treatment planning. Minute details provide discriminating determinants when choosing between treatment options. Examination time is sufficient for recording a host of data included in five diagnostic categories: medical, esthetic, functional, biomechanical, and periodontal. A sample of what to include in a comprehensive examination is outlined in Table 1. A new patient prophylaxis is scheduled separately, either consecutively or on a different day, depending upon the time available in the patient’s schedule.

A detailed description of each part of the comprehensive examination is beyond the scope of this article. Because the initial patient interview and initial patient consultation are of particular importance, they are discussed in more depth below.

Initial Patient Interview

The initial patient interview is not a time for marketing statements on behalf of the dental office, but rather it is an opportunity for the doctor–patient relationship to become well established and respected. Held in a quiet, confidential area, the two parties get to know one another and exchange ideas, opinions, and experiences. The initial patient interview is a time for the healthcare provider to speak with authentic presence, helping the patient feel positive and empowered when taking the steps to better his or her oral and overall health.

Initial Patient Consultation

During the comprehensive examination, it may also become evident that a greater measure of data collection is necessary to properly construct a treatment plan that will fulfill all objectives of health, function, and esthetics. The initial patient consultation allows the practitioner to articulate the need and benefits of such additional data collection. It also facilitates dialogue to verify the patient’s esthetic objectives, in conjunction with educating the patient about the functional parameters the clinician must satisfy in treatment so that any dentistry completed will not only look good, but also feel good and be long lasting. In summary, the initial patient consultation is a chance to summarize the findings of the patient’s initial examination and articulate the relevance of those findings to the patient’s life and expectations.

Triaged Data Collection

Rather than construct a new data collection recipe for each patient, this author has found that the type of information that is always needed can be categorized into three areas: general, functional, and esthetic. When the entire staff is familiar with these categories, then scheduling, staffing, and set-up requirements can be easily communicated throughout the office. This allows a seamless transition from the new patient examination to the data collection appointment for the patient.

General

The category often requiring the least amount of data collection is the “general” area. For example, consider the case of a new patient who

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**Table 1**

<table>
<thead>
<tr>
<th>Elements of a Comprehensive Patient Examination</th>
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<tbody>
<tr>
<td>Initial patient interview, which includes taking medical and dental histories, as well as discussing the patient’s objectives and expectations</td>
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<tr>
<td>Full-mouth radiographic survey</td>
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<td>Head and neck examination</td>
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<tr>
<td>Periodontal and soft tissue examination</td>
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<td>Individual tooth examination</td>
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<tr>
<td>Intraoral camera images</td>
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<tr>
<td>Cosmetic dental examination</td>
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<tr>
<td>Initial patient consultation</td>
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<tr>
<td>Initial prophylaxis (scheduled separately)</td>
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<tr>
<td>Cone-beam computed tomography (optional, as needed)</td>
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(1. AND 2.) Photographic composition should be so consistent that before and after images appear as time-lapse photography.
presents reporting to be very satisfied with his esthetics and function and whose clinical examination reveals a stable masticatory system without clinical signs of dental instability, such as mobility, wear, cracks, or other problems. No additional data collection is needed for such a patient in the "general" category. A congenital introduction to the office hygiene department is extended, and a rapport is established for long-term oral healthcare.

When the initial clinical examination reveals masticatory system instability, however, functional data collection is required.

Functional
A new patient examination revealing any of the signs and/or symptoms of instability outlined in Table 2 is an automatic assignment or trigger for "functional" data collection. At this appointment, polyvinyl siloxane impressions are taken for pouring multiple sets of first-pour quality study models. A face-bow transfer, centric relation bite registration, and a temporomandibular joint assessment enable mounting of the study models for analysis and laboratory equilibration, if needed.

Esthetic
If the patient has esthetic objectives, especially related to smile enhancement, an "esthetic" data collection appointment is needed. Information derived from esthetic data collection is listed in Table 3.

Photography is essential for accurate assessment, diagnosis, communication, and treatment. When diagnosing and treatment planning the esthetic component of dentistry, especially with smile design considerations, a qualitative photographic series is imperative. The key is making the photography diagnostic. Doing so requires great attention to detail in image composition. If images are taken without strict adherence to proper magnification and angles, false information could be derived that could cause erroneous treatment planning. For qualitative analysis of the treatment rendered, before and after images should appear as time-lapse photographic images (Figure 1 and Figure 2).

Images should include facial compositions, up-close smile images, retracted views, and intraoral perspectives to facilitate patient discussion of treatment objectives. Practitioners have also begun to incorporate video to further communicate visually with the laboratory technician. Added to these basic images are images that aid in diagnosis, such as the lips in repose; maximum smile dynamic; and profile, lateral, and selected intraoral high-magnification views.

Treatment decisions regarding the relationship of the dentition to the facial soft tissues can be made from the still photographic image better than the in-person evaluation. Facially-generated treatment planning originated in the world of removable prosthodontics, but is used extensively in current smile design treatment planning.

Significant diagnostic information can be derived from specific graphic views that not only depict the patient's individual characteristics, but also provide evaluation guidance for classification of the patient's presenting condition. There are also images that relate to one another for diagnostic value. For example, the "lips in repose" image conveys a significant amount of information about the relationship of the current maxillary sextant (ie, incisors and canines) for both developing a diagnosis and determining improvements that potential treatment steps could achieve to the presenting conditions. When paired with a "smile in maximum dynamic," a diagnostic key of maxillary lip retraction capability can alert the practitioner to the patient's dental reveal with uninhibited smiling, potentially indicating the inclusion of periodontal-restorative treatment options into the treatment plan (Figure 3 through Figure 5).

All patient views, at any magnification except for the intraoral mirrored occlusal views, are taken with the patient positioned in the "esthetic plane"—looking forward, sitting or standing erect, and with a head orientation as seen by the world on the same horizontal plane (Figure 6). Two-dimensional diagramming, whether analogue (eg, diagnostic tracing analysis) or digital (eg, digital smile analysis) can help the treating clinician visualize the possible corrections that treatment could provide.

Diagnostic Assessment
To this author's knowledge, the first person to address quantitative risk assessment was Kois in 1994. More recent isolated references can be found with more consummate dialogue written about the entire philosophy. According to Kois, "The fundamental rationale for a comprehensive treatment approach is a long-term strategy for dental health commensurate with an enhanced level of wellness for patients."

Signs Indicating Need for Functional Data Collection
- Wear
- Signs of dental instability, including mobility, erosion, and fractures
- Facial muscle soreness and/or pain
- Headaches
- Recurrent temporomandibular joint (TMJ) soreness precipitated by maximum intercuspal position/TMJ discrepancies (eg, dysfunction and constricted chewing patterns)
- Signs of intra-articular disorders that require investigation (eg, TMJ magnetic resonance imaging optional, as needed)

By segmenting a complex case into five smaller diagnostic categories, a specific risk assessment can be applied that extrapolates the effects of a specific oral disease over the remaining course of the patient's life (ie, prognosis). This allows the diagnosing clinician to determine the effect of a disease on the patient's future wellbeing if treatment was rendered.

In addition to a general health assessment, managing four dental categories (ie, periodontics, biomechanics, function, and dentofacial characteristics) ensures that existing and potential risks are identified and then reduced and/or eliminated within the most appropriate and cost-effective treatment plan.

When communicating with the patient in consultation, segmenting the various presenting conditions and their treatments into the four different categories aids patient understanding. The underlying principle is that a diagnostically driven, systematic evaluation of the individual patient's periodontal, biomechanical, functional, and dentofacial risk levels should drive treatment recommendations.

Final Patient Consultation
For extensive and/or complex cases, data collection is completed, and an agreed-upon...
time for work-up of the treatment plan determines scheduling. At this appointment, the patient receives the results of his or her examination, neatly typed in a packet with a copy of their photographs for later study. Included in the results are educational descriptions of presenting conditions and an articulated treatment plan rationale, including cost estimates. During this meeting, it is beneficial if images of similar cases can be shown to help the patient imagine treatment possibilities. As stated by Dawson, "The key to successful patient communication lies in your attitude of helping the patient to see and understand every problem."

**Conclusion**

Effective diagnosis and treatment planning are critical for successful treatment outcomes. Succinct communication facilitates this process. In our world of information overload, sorting out the facts can be overwhelming. Well-informed patients make the best healthcare decisions for themselves and their families. When dental practices take the time to collect and analyze data in a manner that enables a systematic flow of the treatment planning process—from new patient examination to the final patient consultation—the educational value for the patient, and the enhanced efficiency and accuracy for the treating dental team, can be extremely significant.

**References**

17. Dawson PE. The Concept of Complete Dentistry. Seminar One. Presented at: The Dawson Center; 1997; St Petersburg, FL.

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**TABLE 3**

**Information from an Esthetic Data Collection**

<table>
<thead>
<tr>
<th>Performed by Assistants</th>
<th>Performed by Dentists</th>
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<tr>
<td>Photography series</td>
<td>Centric relation bite registration</td>
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<tr>
<td>Polyvinyl siloxane impressions for study models</td>
<td>Diagnostic tracing analysis</td>
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<tr>
<td>Face-bow transfer</td>
<td>Temporomandibular joint assessment</td>
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<td></td>
<td>Review of esthetic objectives with patient (eg, oral or questionnaire)</td>
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</tbody>
</table>
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Michael R. Sesemann, DDS

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1. Dedicating time to thoroughly review the patient's condition not only allows significant information to be collected for analysis, but also:
   A. improves the professional relationship between dentist and dental assistant.
   B. includes the dental hygienist in treatment planning.
   C. initiates a strong relationship between the care provider and the patient.
   D. creates a multidisciplinary approach to oral care.

2. Once the initial examination is complete, further data collection can be successfully triaged into which three categories?
   A. General, functional, and esthetic
   B. Quantitative, qualitative, anecdotal
   C. Acquired by dental assistant, acquired by dentist, acquired by hygienist
   D. Biomechanical, dentofacial, periodontal

3. What outcome is achieved when quantitative data can be calculated and communicated to the patient during the consultation process?
   A. More documentation for the coding and claims processes
   B. Streamlined workflow
   C. Improved interoffice communication
   D. More informed and effective decision-making by the patient

4. The initial patient interview should include which of the following?
   A. A quiet, confidential setting
   B. An exchange of ideas, opinions, and experiences
   C. Helping the patient to feel positive and empowered
   D. All of the above

5. A new patient examination revealing any of the signs and/or symptoms of instability is an automatic assignment or trigger for which type of data collection?
   A. General
   B. Functional
   C. Esthetic
   D. Photographic

6. Making a qualitative photographic series diagnostic requires:
   A. a camera with a CMOS sensor similar to a 35-mm slide.
   B. taking all images in RAW format.
   C. great attention to detail in image composition.
   D. using a camera with video capability.

7. Which patient image conveys a significant amount of information about the relationship of the current maxillary sextant (i.e., incisors and canines) for diagnosis and treatment planning?
   A. Smile in maximum dynamic
   B. Lips in repose
   C. Up-close smile
   D. Retracted view

8. What diagnostic information can be determined from a photographic image of a patient in “maximum smile dynamic”?
   A. The retraction capability of the patient’s upper lip upon smiling uninhibitedly
   B. Whether the patient's maxillary teeth, shortened by wear, can be lengthened
   C. If the patient definitively has vertical maxillary excess
   D. The proper diagnostic and treatment position of the maxillary incisal edge of the central incisor

9. According to the article, a specific risk assessment can be used for which of the following purposes?
   A. To build trust between patient and practitioner
   B. To determine which treatments are more cost effective
   C. To provide continuing education for other members of the dental team
   D. To extrapolate the effects of a specific oral disease and its potential treatment over the remaining course of the patient's life

10. Which of the following is included as part of the final consultation at which the treatment plan is presented?
    A. Examination results
    B. Copies of diagnostic photographs
    C. Cost estimates for treatment
    D. All of the above
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