Software Requirements Specification

for

Thousand Smiles Digital Charts – Dental and Hygiene Subsystem

Version 0.9.3

Prepared by Syd Logan and Dr. David Irwin

Thousand Smiles Foundation

3/8/2020

Table of Contents

1. Introduction....1
1.1 Purpose....1
1.2 Document Conventions....1
1.3 Intended Audience and Reading Suggestions....1
1.4 Product Scope....1
1.5 References....2
2. Chart Content....2
2.1 Tooth Condition/Treatment Needed Chart....2
2.1.1 Content....3
2.2 Treatment Completed Today....9
2.2.1 Content....9
2.3 X-Rays....9
2.3.1 Content....10
2.4 Free Form Notes....14
3. Printing....15
4. Other Nonfunctional Requirements....15
4.1 Performance Requirements....15
4.2 Safety Requirements....15
4.3 Security Requirements....15
4.4 Software Quality Attributes....16
4.5 Business Rules....16
5. Other Requirements....16

Revision History

Name	Date	Reason For Changes	Version
Syd Logan	12/21/2019	Initial Revision	0.9
Syd Logan	12/27/2019	Add hyperlink for NOM English translations	0.9.1
Syd Logan	03/08/2020	Make it more clear this is intended for use by hygienists as well as dentists. Add new mouth chart suggested by Dr. Irwin. Add discussion of tooth chart coloring suggested by Dr. Irwin, using Opendental as a possible source of inspiration.	0.9.2
Syd Logan	3/08/2020	Add some detail as to how X-Rays are viewed.	0.9.3

1. Introduction

1.1 Purpose

The purpose of this document is to outline the basic requirements associated with the Dental portion of the Thousand Smiles Digital Chart. The overall requirements of the system are described in a separate document. This document focuses specifically on Dental requirements.

The dentists and hygienists to which this functionality is directed currently use paper charts to record the overall dental condition of the patient, and any treatments performed. In addition, the dentist will record free form notes as applicable.

The overall goal of these requirements is not to change what is currently being recorded in the paper chart, but how – by replacing it with a digital version. The paper charts that have been used by Thousand Smiles dental staff have proven sufficient for our needs for many years. And there has been little indication from interviews of the dental staff that there is need for wholesale change.

However, it will be the case that use of the digital charts will inspire ideas that may extend beyond what is the current version of this requirement documents. The architecture and design of the Thousand Smiles Digital Charts allows for that expansion.

1.2 Document Conventions

There are no specific conventions associated with this document.

1.3 Intended Audience and Reading Suggestions

The intended audience includes:

Thousand Smiles Board Members: Board members should read this document to become familiar with the overall overall scope of recording dental data in the digital charts project. This knowledge may prove helpful as background when evaluating logistics and expenditures associated with the implementation of the system, e.g., equipment purchases.

Implementation Team: This document spells out requirements which guide the implementation of the system. It is not intended to be a design document, rather it spells out the requirements that a design must follow to be considered valid.

Dental Staff: This document must be read and approved by the end user(s) of the system, the dentists and hygienists which provide dental care at our clinics. Not all dentists will need to be involved, just those who have volunteered to become involved with the requirements process. This document will likely go through some number of revisions towards eventual approval. The dentists should read this document critically and identify omissions, errors, and changes so that they can be dealt with.

1.4 Product Scope

The dental charts portion of the digital chart is intended to provide the dentists and hygienists with the following capabilities:

- Ability to manage the data associated with the evaluation, diagnosis, and treatment of a child that the dentist or hygienists is tasked with at a Thousand Smiles clinic. The data collected here is specific to dentistry, collected at time of use. Some of the data will record the diagnosis of the patient, some will record the care given, and optionally some of the data will comprise care to be given at a future time.
- Ability to refer to a patient history that consists of evaluation, diagnosis, and treatments made by dental or hygiene at prior Thousand Smiles clinics on a per-clinic basis.
- View other portions of the digital chart associated with a child as relevant to dental and hygiene, including X-Rays and medical history.
- Eliminate the need for paper charts to the extent possible.

The benefits we hope to realize by migrating surgery screening from paper charts to digital charts include:

- Increased access to data by other specialists. We aim to make the data recorded by dental is more easily located and viewed by other specialists involved with the care of the child during his or her visit at one of our clinics
- Increased reporting functionality. Migrating to a database-backed chart allows the organization to more readily generate reports; for example, number of children, types and numbers of procedures, incident counting (e.g., number of children seen with a specific condition). This data could be used for various purposes, both clinical and administrative in nature.

1.5 References

This document makes reference to the following documents

- *Standard Official Mexicana NOM-024-SSA3-2010* *https://github.com/slogan621/tscharts/blob/master/docs/nom/NOM-024-SSA3-2012_English.pdf*

2. Chart Content

The dental chart consists of the following components:

- Tooth Chart
- Treatment Completed Today
- X-Rays
- Free-Form Notes

Each of these components is available to dental staff when the patient has been checked in to the tablet at a dental chair.

The following subsections describe the data collected and displayed in each of the above listed components, as well as specific requirements of each.

2.1 Tooth Condition/Treatment Needed Chart

The Tooth Condition/Treatment chart represents the care, diagnosis, and treatment of a child for all past and current clinic visits. There is one Tooth Condition/Treatment Chart per patient.

2.1.1 Content

The Tooth Condition/Treatment chart consists of a graphic tooth chart (see Figure 2.1, below).

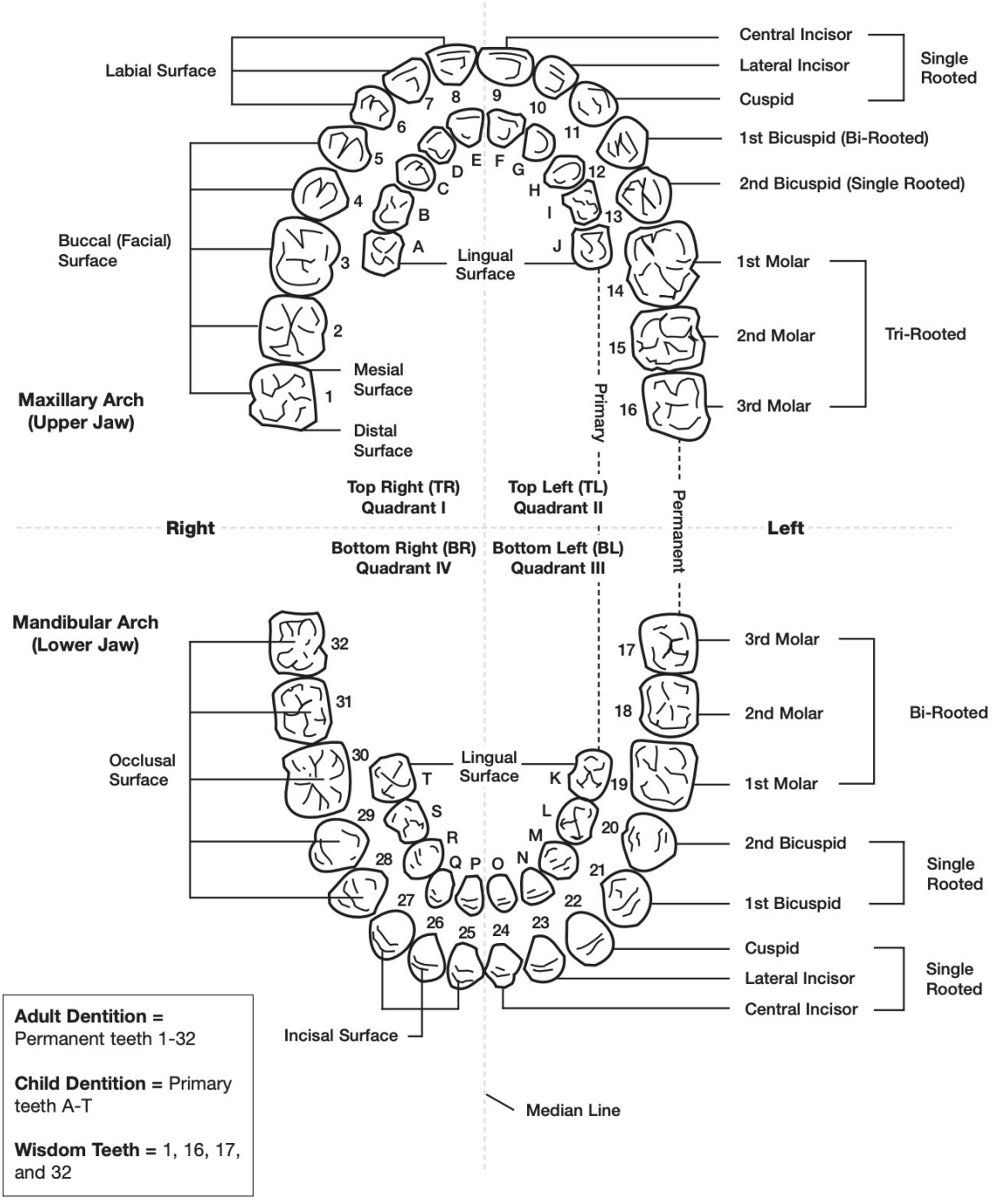

Figure 2.1 Tooth Chart

Each tooth in the tooth chart graphic may be clicked on. Clicking on a tooth will result in the display of a table listing a summary of problems, treatments, and status for the tooth which was selected. Each unique problem, treatment, and status is displayed as a separate line in this table. If a problem has multiple treatments, then each is given a separate row in this table.

The table will provide the following functions:

- Add – add a new problem/treatment for the tooth to the list.
- Remove – remove an existing problem/treatment from the list
- Edit – modify an existing problem/treatment in the list

Free-form notes can be added for each row in the table.

Color will be used in the tooth chart to identify which teeth have the following:

- No problems
- Problems with treatments yet to be performed
- Problems with all treatments completed
- Tooth missing

Each problem and treatment shall be selected from a list of recognized ADA problems and treatments where each term used corresponds to an ADA Code on Dental Procedures and Nomenclature (CDT Code) (XXX is there a corresponding list in Mexico?). Each term and treatment should have a corresponding Spanish language equivalent.

If a problem or treatment is not available then it can be added as free-form text by the dentist via the tablet keyboard. However, a search of the available terms shall be performed for each word entered by the dentist and offered as an alternative so that dentists are forced to use terms known to the system, rather than making up their own terms.

Each treatment will indicate the date of creation, and the date the treatment was completed.

The software will allow the users to associate a surface with each problem or treatment recorded for the patient. The surfaces include:

- Labial
- Occlusal
- Buccal

The following figure illustrates how surfaces and conditions are represented in Opendental:

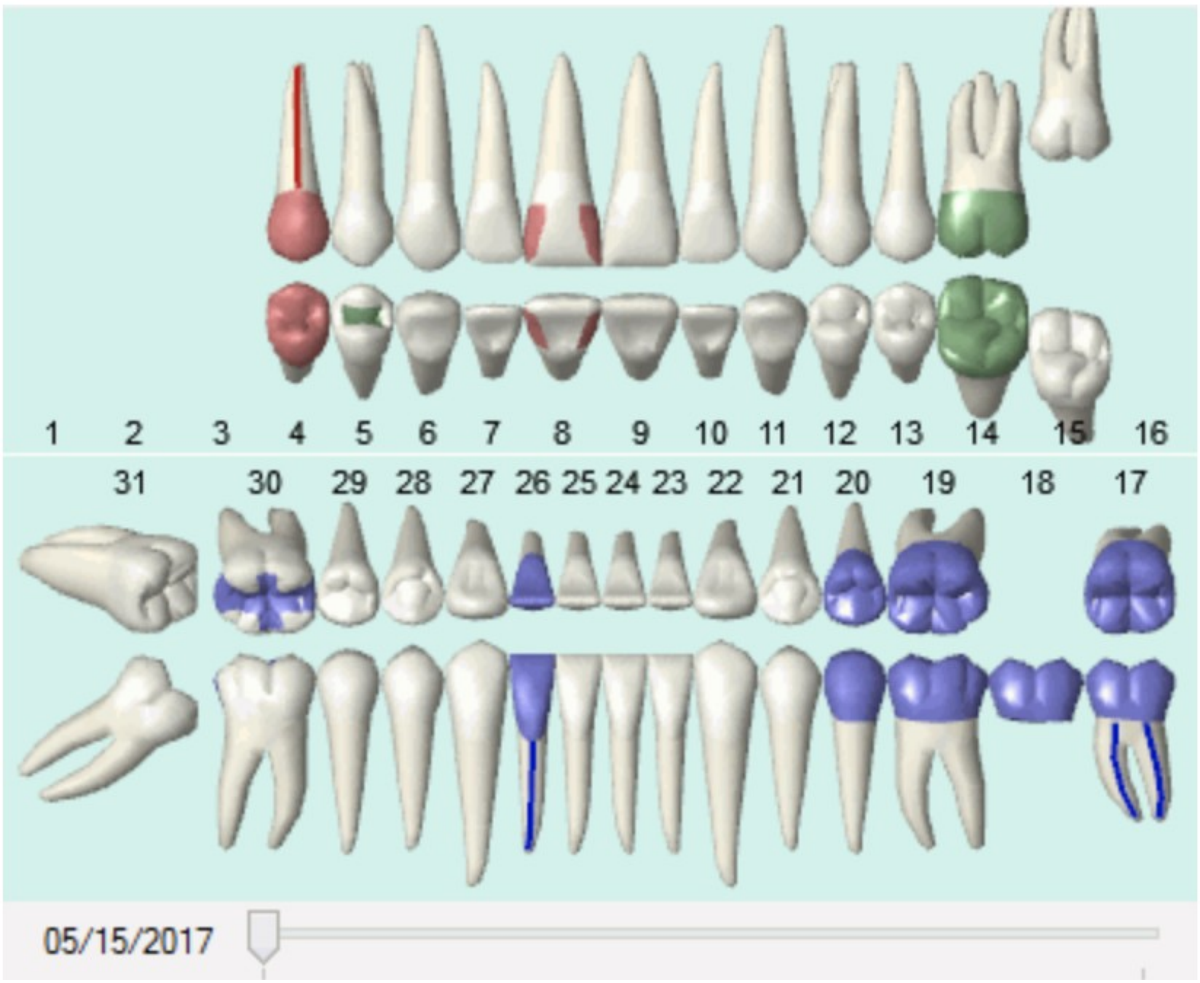

Figure 2.2 Surfaces and Colors Chart in Opendental

The above graphic represents various tooth surfaces (listed above) as well as indication as to how Opendental uses color to indicate where conditions exist, and treatments are completed, among other things.

The following colors are defined in Opendental (and are configurable):

Definitions

Name	Color	Hide
Treatment Planned		
Complete		
Existing Current Prov		
Existing Other Prov		
Referred Out		
Treatment Planned (light)		
Complete (light)		
Existing Current Prov (light)		
Existing Other Prov (light)		
Referred Out (light)		
Main Background		
Text		
Highlighted Text		
Highlighted Background		
Background on TPs		
Text on TPs		
Condition		
Condition (light)		

Figure 2.3 Color codes in Opendental

One thing that the flat graphic (Figure 2.1) does not indicate are the individual conditions, where these conditions are located on the various surfaces, and the treatment states. Open issues in our design include:

- Do we want to graphically represent the surfaces of the mouth, or is the flat graphic (Figure 2.1) preferable?
- What do we want to indicate? Treatment state (scheduled, completed, or just location)?
- To what extent do we want to color the charts to begin with? For example, as seen in the following graphic, Figure 2.1 has been "colored" by drawing circles and an 'X" over and around areas relevant to the exam/treatment. It does not indicate the actual condition or treatment, it just helps to identify which teeth have (or have had) some condition or treatment. Perhaps this is all we need? If so, we could possibly automate it.

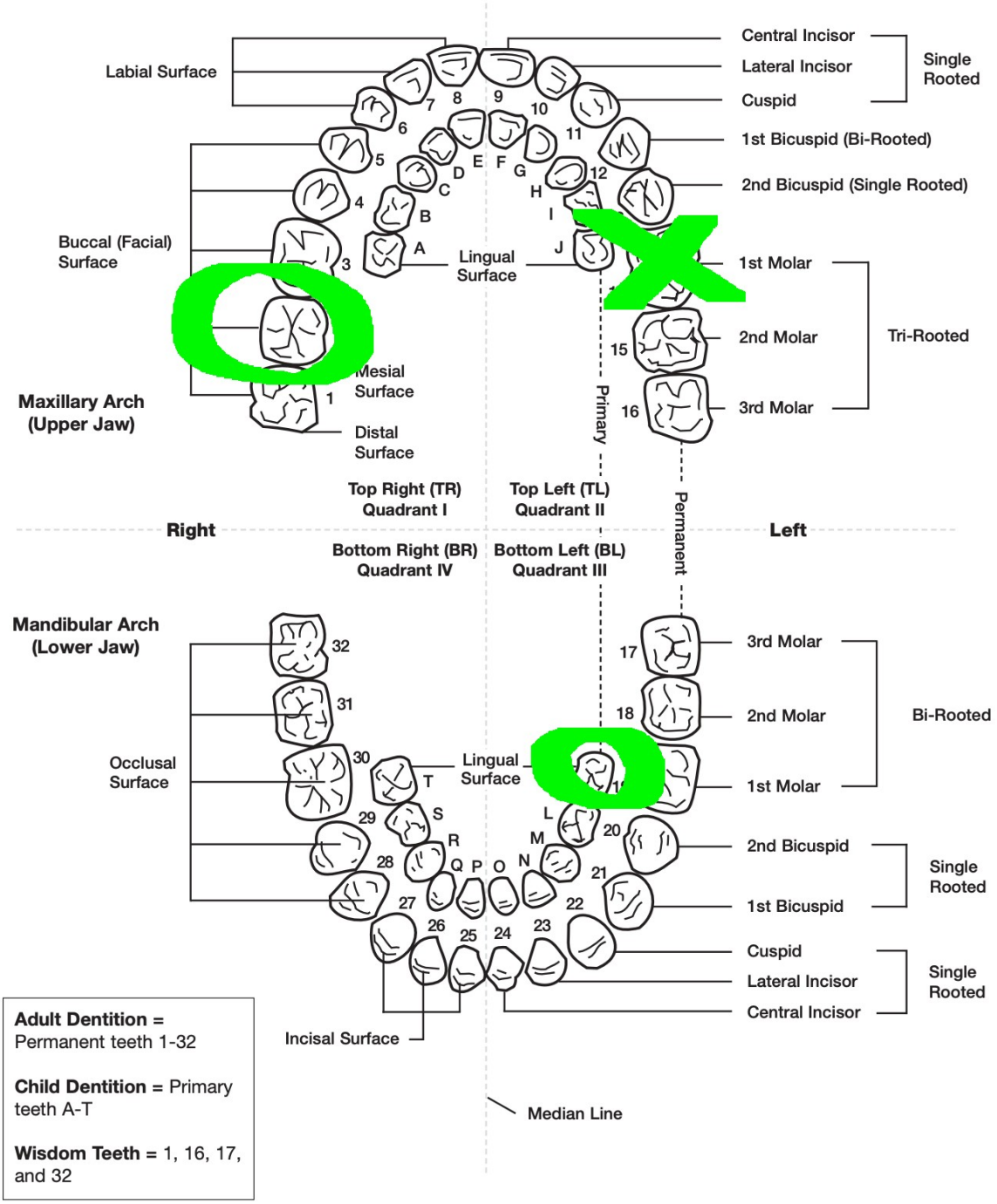

Figure 2.4 Using simple color to indicate what teeth have issues at a glance.

Alternately, and might indicate with colors various conditions. In Figure 2.5, teeth in green have had conditions successfully treated, while those in red indicate conditions are noted in the chart, but have yet to be resolved. Clicking on the tooth itself might display a dialog with a summary of the condition and treatment planned or completed.

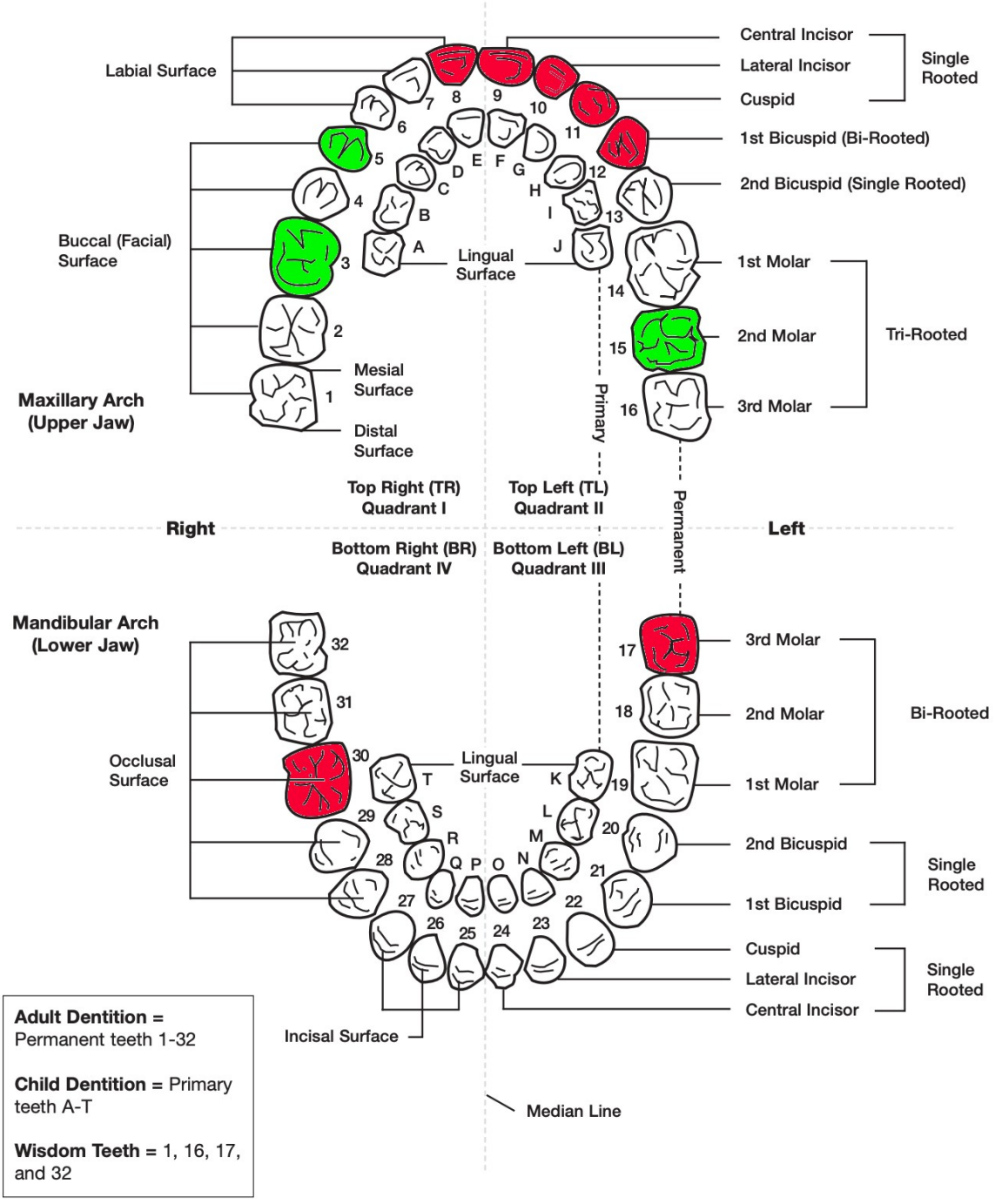

Figure 2.5 Treatment completed (Green) and Treatment planned (Red)

Ideally, the color can be automated. Meaning, f a dentist or hygienists adds a condition or changes the state of the treatment, the software can color the tooth chart automatically. This would be preferable to having the dentist or hygienists draw on the tooth interactively, if only because it is a simpler thing to implement in software. As long as we keep the use of color to a minimum, automation is perhaps the best solution.

2.2 Treatment Completed Today

The Treatment Completed Today section consists of a series of checkboxes that indicate additional visit-related data that does not correspond to an item covered by the Tooth Condition/Treatment Needed Chart (Section 2.1 above). Each item in the checkbox allows for free-form notes to be added by the dentist. If an item is not checked, then it does not apply to the patient.

2.2.1 Content

The list of check boxes includes the following.

- Examination []
- Prophy (cleaning) []
- SRP UR [] LR [] UL [] LL []
- X-Rays Viewed []
- Head and Neck Oral Cancer Exam []
- Oral Hygiene Instruction []
- Flouride Tx Varnish []
- Nutritional Counseling []
- Orthodontic Evaluation [] Tx []
- Oral Surgery Evaluation [] Tx []
- Local Anesthetic 20% Benzocaine Topical [] Lidocaine [] #of carps ____ Septocaine [] # of carps ____ Other [] _____

Underlines in the above indicate editable text. Use of “Other” in Local Anesthetic should be avoided by ensuring that any commonly used local anesthetics are listed rather than entered as free form text.

2.3 X-Rays

The dentist or hygienist may view X-Rays taken for the currently checked-in patient from all clinic, present and prior, Each X-Ray will be displayed as a thumbnail. The dentist may zoom in and out using his or her fingers (pinch-zooming). A select number of enhancements may be applied such as histogram equalization (contrast) and false coloring. The dentist may save any enhancements made as new images in the patient record.

2.3.1 Content

A list of all X-Rays for the patients is available by clicking on the X-Ray button on the left of the screen. The list will be organized by clinic, as shown in Figure 2.3.1 below

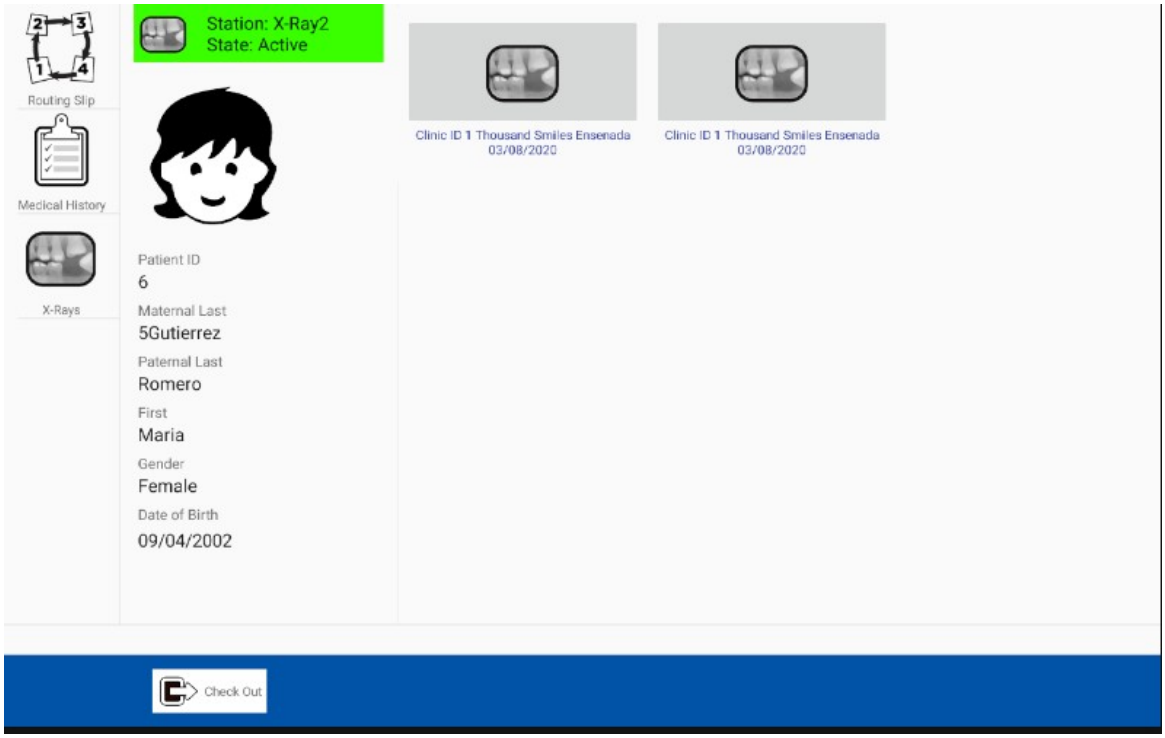

Figure 2.3.1 X-Ray Clinic Selector

Clicking on one of the clinics in the X-Ray Clinic Selector will show all the X-Rays that were scanned for the patient at that clinic, as shown in Figure 2.3.2:

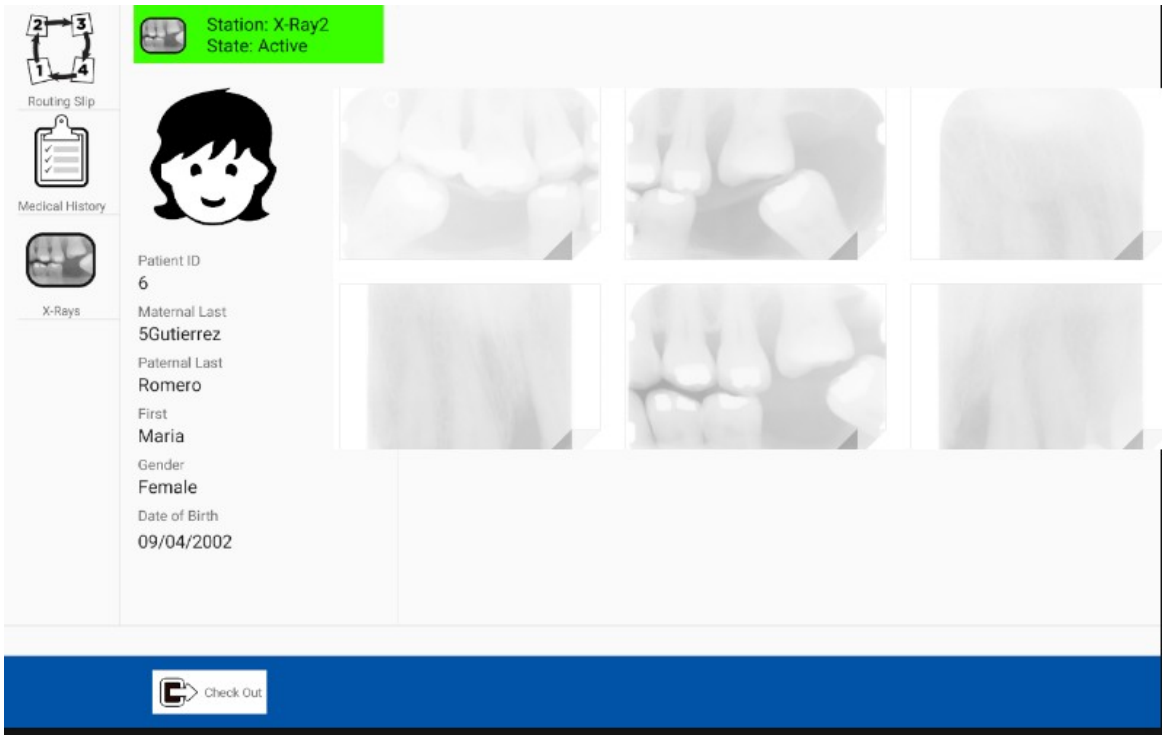

Figure 2.3.2 Patient X-Rays for the Selected Clinic

Clicking on an X-Ray will display it. In Figure 2.3.3, the image is shown in its original form.

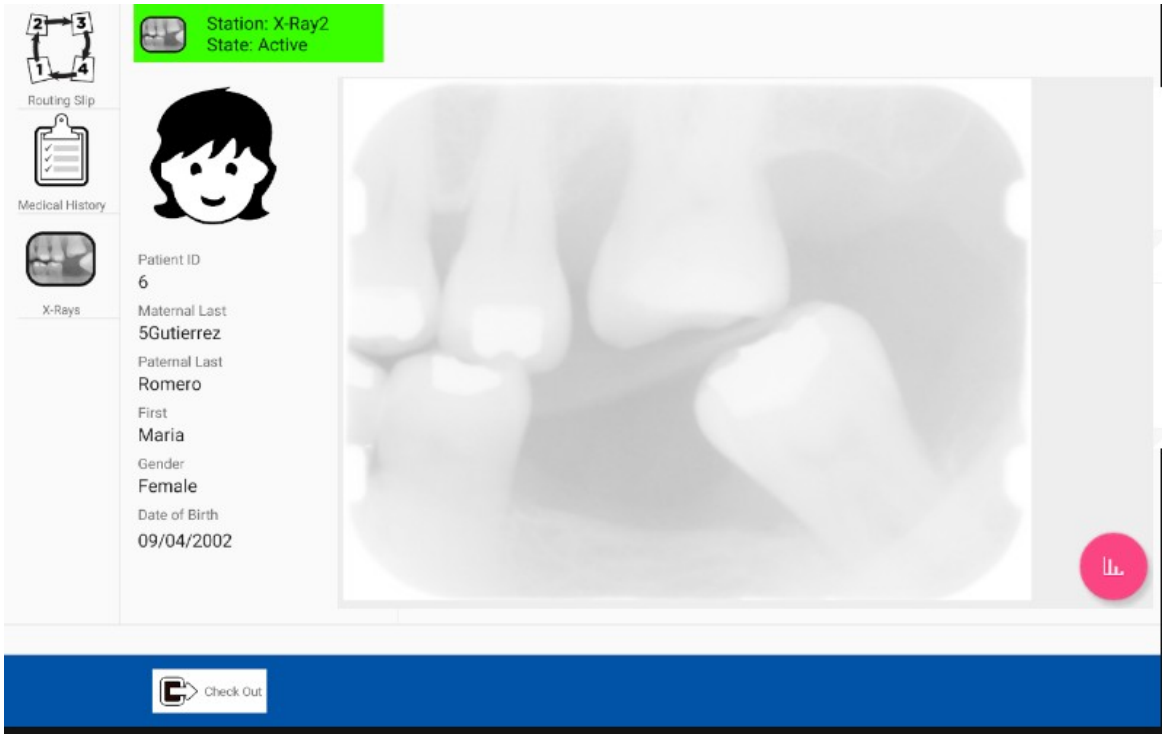

Figure 2.3.3 Viewing an X-Ray

The pink button on the lower right corner, if pressed, will perform a histogram equalization enhancement on the image in order to improve its contrast. This is shown in Figure 2.3.4.

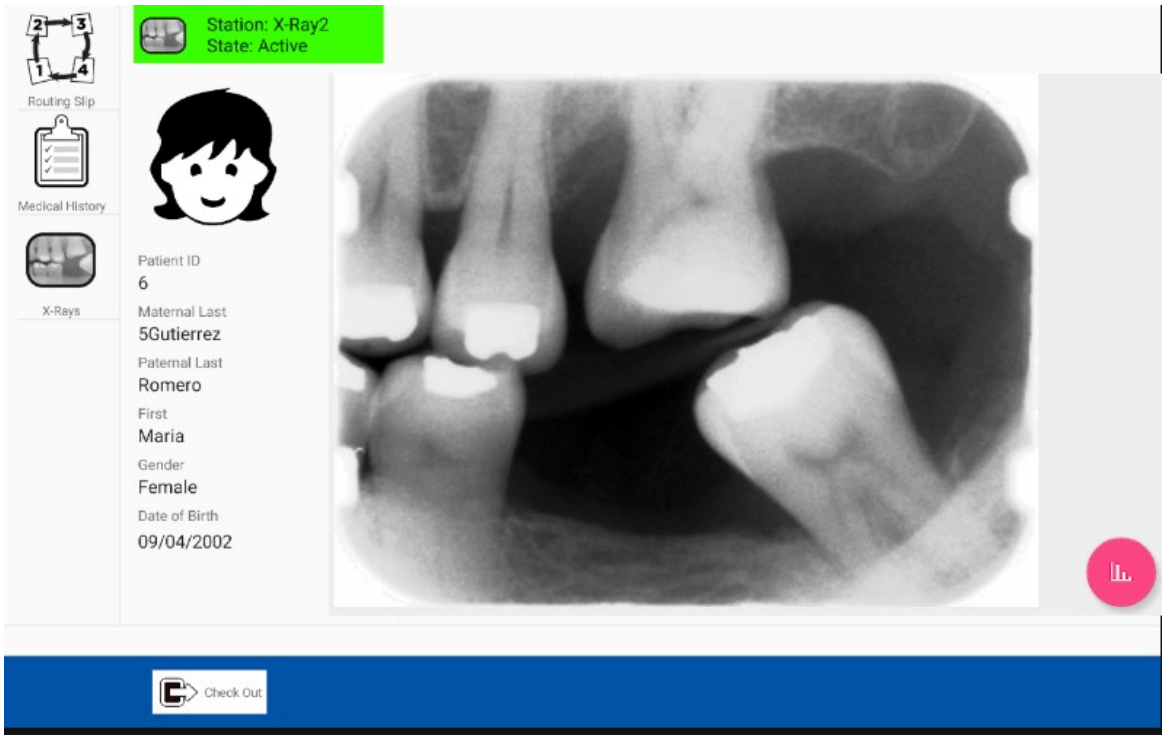

Figure 2.3.4 Contrast Enhancement via Histogram Equalization

Finally, the user can “pinch-zoom” with his or her fingers to zoom in, zoom out, and scroll the X-Ray image. This is depicted in Figure 2.3.5

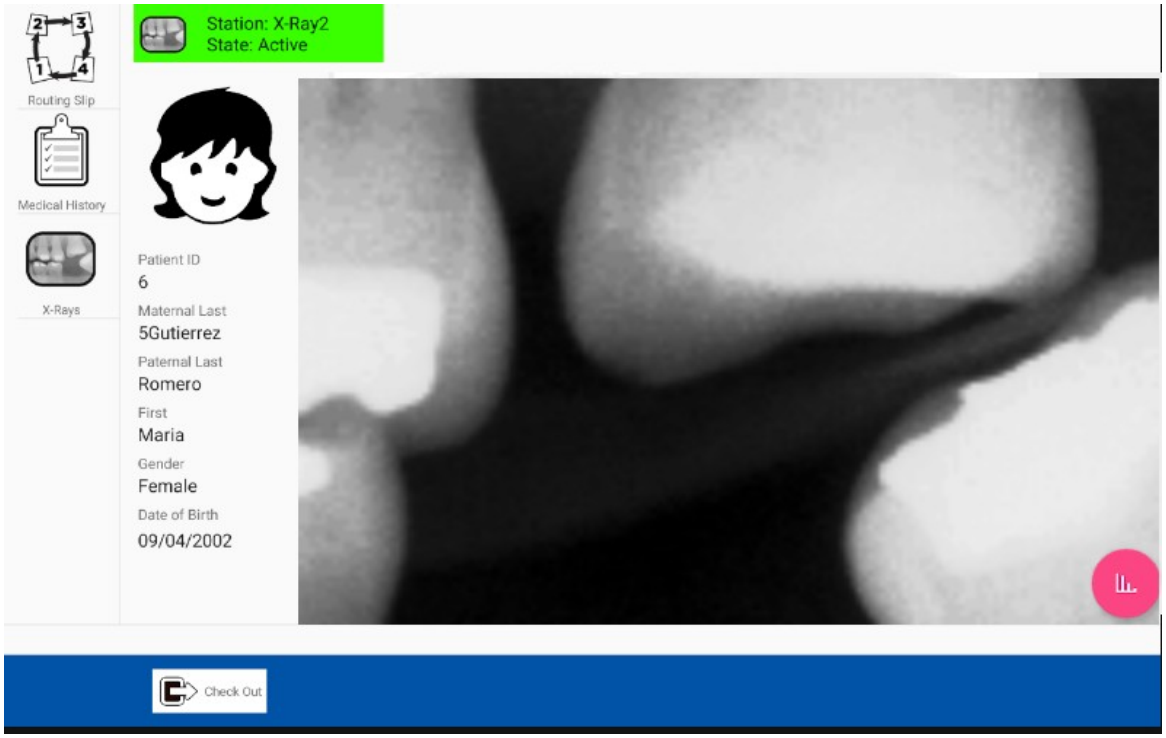

Figure 2.3.5 Pinch-Zoom of the Displayed X-Ray

2.4 Free Form Notes

The chart for a patient should provide a single "free form" text area where notes may be added by the dentist.

The intent of this requirement is to provide the dentist or hygienist a place to record data which might not be directly attributable to the sections described earlier in this section.

The dentists and hygienists should be able to edit text previously entered in the free form area during the current examination.

The name of the person entering or editing a note, and the date, should be recorded along with the note.

Past free form notes should be available for review at subsequent clinics. Each free form note will be identified by the date it was initially created. Clicking on a listed free form note will cause it to be displayed on the screen. A previously edited free form note can be modified, but in doing so the free form note will retain the date of its first creation. Once created and saved, it is not expected that the free form note will be modified except to correct errors.

3. Printing

The application should allow for the printing of relevant patient data on a per-screen basis for all items described above.

All printed copies should be watermarked, or at best notated, on a per-page basis, to indicate the following

- this document contains sensitive, patient medical data
- disclosure of the content of this document is in violation of **Standard Official Mexicana NOM-024-SSA3-2010**
- this document should not be photocopied or duplicated in any form
- if found, please notify Thousand Smiles (include e-mail address and phone number)
- this document should be shredded immediately after use

The above disclaimer must be provided on each page of the document, in both Spanish and English language.

4. Other Nonfunctional Requirements

4.1 Performance Requirements

- The system should provide 99.9999% uptime during the clinic
- Search and access to the database should occur with a latency of no more than 5 seconds.

4.2 Safety Requirements

There are no specific safety requirements associated with this subsystem.

4.3 Security Requirements

We assume that the patient digital chart, and the surgery screening sub-system in particular, does not need to adhere to HIPAA requirements, and does not require HIPAA certification. **Standard Official Mexicana NOM-024-SSA3-2010, which establishes the functional objectives and functions, must observe the products of Systems of Electronic Filing to ensure the interoperability, processing, interpretation, confidentiality, safety and use of standards and catalogues of the electronic records health information. An English translation of this standard is available, see References, above, for a link.**

The system communication on the day of the clinic will occur locally and not leave the local network.

Users of the system will have accounts and must authenticate prior to using the digital chart. The user names and their passwords are unique to this system and are not the same used by the volunteer system; only a subset of our volunteers should be granted access to patient data. The database itself is physically and administratively separate from the volunteer database. Passwords will be encrypted on the system, and logging will be used to track account creation, login, and logoff activity.

4.4 Software Quality Attributes

There are no specific SQA attributes associated with this subsystem.

4.5 Business Rules

Access to the system during the clinic will be limited to authenticated users. There are no specific rules associated with who can authenticate.

Between clinics, database access will be restricted to the administrator of the system for purposes of backup and maintenance only. The patient data, and user account information, will not be accessible on the Internet except for purposes of backup and maintenance.

5. Other Requirements

No additional requirements have been identified for this subsystem as of now.

Appendix A: To Be Determined List

<Collect a numbered list of the TBD (to be determined) references that remain in the SRS so they can be tracked to closure.>