Evolution of a Humanitarian Dental Mission to Madagascar from 1999 to 2008


Abstract: In this article, we report on the evolution of a series of dental outreach missions sponsored by Stony Brook University to remote areas of Madagascar over a nine-year period. The project evolved from one dental resident performing only dental extractions in 1999 to a team comprised of two dentists, six third-year dental students, and two dental assistants performing dental restorations, extractions, and endodontic procedures using digital radiographic equipment in 2008. The ability during the latest mission to utilize digital radiography in remote areas lacking running water, electricity, and dental facilities significantly enhanced the range and efficacy of dental procedures. This long-term project offered senior dental students and residents from Stony Brook University’s School of Dental Medicine an educationally valuable opportunity to engage in international dental outreach and to make a significant contribution to the improvement of oral health in the underserved rural communities of Madagascar.

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The island republic of Madagascar is located some 250 miles off the southeast coast of Africa and is separated from the African continent by the Mozambique Channel. It is the world’s fourth largest island and has a population of approximately 20 million people.1 Infant mortality in Madagascar is eleven times greater than in the United States, and mortality for children under five years old is more than fifteen times greater. Approximately 50 percent of the children there are severely stunted in their growth. Malnutrition, diarrhea, respiratory infections, and malaria are the leading causes of death in Malagasy children. Various other diseases cause serious health problems. The status of oral health care is desperate, with only two dentists (the vast majority of whom are located in major cities) for every 100,000 people. Many of the villages in the rural areas are too isolated for the government to build schools, so many of the people can never get an education that will help them break free of crippling poverty. In addition, the lack of access to health care, including dental care, and suitable clinical facilities adds significantly to the burden. The aims of Stony Brook University’s dental missions to Madagascar were to provide dental care to communities in remote villages, gather data on oral hygiene, and educate the villagers on public health via dietary and nutritional counseling by a student from the School of Public Health.

Six dental outreach missions to the island were sponsored by the Madagascar Ankizy Fund (www.ankizy.org) and Stony Brook University School of Dental Medicine. “Ankizy” means “children” in the Malagasy language. This fund was established in 1998 by Stony Brook University paleontologists studying fossils in remote areas of northwestern Madagascar.2 They were struck by the abject poverty...
of the rural inhabitants of the island and especially by
the fact that children there receive no formal educa-
tion and have no access to health care. The fund was
set up with the explicit purpose of building schools
and establishing temporary health care clinics in rural
areas to improve the education and physical well-
being of Malagasy children. To date, the Madagascar
Ankizy Fund has built four schools, two in the south-
ern villages of Mahatsinjo and Manombo and two in
the northwestern villages of Berivotra and Mitsinjo.
Two of these schools, in Mahatsinjo and Berivotra,
have been used as temporary dental clinics despite
the fact that there is no electricity, running water,
or any semblance of dental facilities. In addition to
these missions to remote villages, the Madagascar
Ankizy Fund has provided much needed curricular
materials, training, equipment, and supplies to the
Institut d’Odontologie-Stomatologie Tropicale de
Madagascar (IOSTM), the only dental school on the
island, located in the city of Mahajanga. The IOSTM
was established in 1977 and trains forty students per
year. Students from the IOSTM have rotated through
one of the remote clinics beginning with the 2005
mission.

Organization of the Missions

The first dental mission to Madagascar, in
1999, was minimal in that only a few oral surgical
instruments and supplies were available. In the most
recent mission in 2008, twenty-two large crates (Rub-
bermaid twenty-four-gallon “Action Packers” with
Tamperseal Search/Alert Transportation Security
Administration locks, with ¼ inch shackle) of sup-
plies were shipped with the dental team. Among the
supplies sent were 8,000 pairs of gloves, 1,500 masks,
1,000 gut sutures, 5,000 anesthesia needles, and all of
the surgical instruments and local anesthesia needed
for the surgical procedures. Three Aseptico portable
dental units (Aseptico Corp., Woodinville, WA)
were sent, allowing for restorative as well as surgical
procedures. Electricity for the dental units, as well as
for the radiographic equipment, was supplied from
a 220V generator (Honda Corp., Alpharetta, GA).
In the absence of room lighting, battery-operated
camping headlamps were used in the first five dental
(Ronkonkoma, NY) headlamps were used, and these
vastly improved vision for all dental procedures.
The dental chairs were canvas beach chairs, and the
empty packing crates were used as bracket tables. In
the absence of running water and cuspidors, bottled
water was used by the patients for rinsing, and the
bottom halves of plastic soda and water bottles were
placed in the cup holders of the beach chairs to al-
low patients to expel blood, saliva, etc. Sterilization
of instruments was achieved by thorough boiling of
instruments on a propane gas heater. Figures 1 and 2
provide views of the clinical sites and set-ups.

All radiographic images, beginning in 2006,
were obtained using a Nomad portable hand-held
x-ray machine (Aribex, Orem, UT) and, beginning
in 2007, with Schick digital sensors Size 1 and Size
2 (Schick Technologies, Long Island City, NY). A
Compaq laptop computer (Hewlett-Packard Co., Palo
Alto, CA) was loaded with Schick CDR software.
The primary uses of the radiographic system were for
endodontic and oral surgery procedures. All resultant
images were stored for viewing both during and after
the mission. The exposure factors were 60 kVp, 2.3
mA, and 0.14 seconds (Figure 2).

Communication with patients was facilitated by
translators who spoke both Malagasy and English and
were supplied by the Madagascar Ankizy Fund. The
fund also supplied four-wheel drive vehicles, driv-
ers, and mechanics and, where necessary, camping
supplies to access and live in remote areas.

History of the Missions

In 1999, only the small, dispersed village of
Berivotra in northwestern Madagascar was visited by
an orthodontic dental resident on a reconnaissance
mission from Stony Brook University School of
Dental Medicine. The same resident plus a third-year
dental student visited Berivotra again in 2001. Only
extractions were possible in these two missions. In
2005, the same village was served, but this time by
a team of two dentists and four third-year students.
The 2005 team was equipped with two portable dental
units, thus allowing restorative procedures for the
first time. No dental records were kept during any
of these first three dental missions.

In 2006, the mission expanded in scope by
serving Berivotra and two other villages, Antanambo
and Ampijaroa, both in northwestern Madagascar. Al-
though the number of dentists and third-year students
was the same as in 2005, a first-year dental student was
added to the team to record the number of patients,
extractions, fillings, and anterior root canals for each
of the three villages and to obtain other data relevant to oral health care. Over 1,900 procedures were performed (Table 1). The 2006 mission was also the first in which the Nomad x-ray unit was used. X-ray film was used to record images. In the absence of running water and electricity, this proved to be a challenge, as the exposed film had to be processed in a black bag with containers of developer, wash, and fixer inside the bag. The quality of the exposed film was frequently very poor due to incomplete fixation and chemical staining and inadvertent exposure to light.

The 2007 mission included only one dentist and four third-year dental students, but the efficacy of the team was vastly improved by using Schick sensors to obtain digital radiographs with the Nomad unit. The digital images obtained were a vast improvement over those previously obtained with film and black bag processing: better resolution, no chemical staining, and virtually instant viewing. The images allowed the mission to provide much better service and see more patients (Figure 3). For the first time, the dental mission expanded beyond northwestern Madagascar.
into the high-altitude rainforest environment in the south-central part of the island, where the village of Mahatsinjo was serviced. Table 1 shows the results of our 2007 mission to three sites. This mission increased the number of procedures performed to over 2,100.

The 2008 dental mission expanded to include two dentists, six third-year dental students, and, for the first time, two dental assistants. The number of villages served increased to five (Figure 4), and the number of procedures to over 2,700 (Table 1). As a result of the previous missions, many patients who had been treated in previously served villages arrived to be reexamined. For the most part, they were in good oral health, thus demonstrating that previous procedures coupled with oral hygiene lectures and the distribution of toothbrushes and toothpaste had been effective.

The dental missions have provided other opportunities such as seminars presented by Stony Brook University dental faculty at the IOSTM and dental students and dental educators from IOSTM working side-by-side with members of the Stony Brook dental teams in the remote clinics. The Stony Brook team members have benefitted immensely from their Malagasy colleagues and students in learning about the local standards of oral health care based on available treatments and medications, as well as

### Figure 2. Technologies used in the dental clinics in Madagascar

*Note:* The four photographs are as follows: portable Aseptico dental unit used in the field clinics (A); operatory setup in the school building, with canvas beach chairs used to seat patients (B); and Nomad portable radiographic unit in carrying case and demonstration of its use, for which the lead acrylic shield was removed so that the sensor placement could be depicted (C, D).
about Malagasy culture in general. This reciprocal relationship has allowed the improvement of oral health, both directly and indirectly in Madagascar.

Over the nine years and six expeditions to remote areas of Madagascar, our dental missions have grown from one dental resident doing only extractions in one location to a large team of dentists, dental students, and dental assistants performing more than 2,700 procedures, including restorations and endodontics, in five locations. Even with the challenge of working in adverse conditions (lack of dental facilities, lack of housing, extreme cold in the southern highland locations, extreme heat in the northern lowland locations) and using battery-operated headlamps for light, bottled water for the water supply, and a gasoline generator for power, each year the mission increased the numbers of patients seen and procedures performed. The capacity to provide a variety of procedures was vastly enhanced through the use of digital radiography in an area devoid of normal everyday conveniences.

Lessons Learned

We learned that it is necessary to have a coordinator in the country where a team will volunteer so that individual can set up all the advanced logistics such as housing, meals, laundry, transportation, interpreting, and someone to talk with the village elders to urge patients to come to the clinic for treatment. We had a project coordinator working in Madagascar for the Ankizy Fund who obtained permission from the local government to allow Stony Brook University to take a team to Madagascar. Thus, the team visited the country at the invitation of the Madagascan government and the Board of Governors of the Institut d’Odontologie-Stomatologie Tropicale de Madagascar.

We also learned that we had to send a sustained outreach mission to the area served in order to reinforce the hygiene and sanitary lessons with the patients who had been seen. Their purpose was not only dentistry but public health, sanitation, and above all education. In addition, we learned as a result of the first missions to alter the amount of supplies taken with the team. At times we almost ran out of anesthesia and had to limit treatment to children and patients who had traveled a great distance to the clinic. The use of the Nomad portable x-ray unit and Schick digital sensors enabled the team to expand its ability to carry out endodontic treatments and to assess whether it was prudent to remove lower third molars depending on the proximity to the alveolar canal. The Nomad also allowed us to see if root tips were left behind from fractured roots.

Other lessons had to do with the composition of the team. Two important requirements in the selection of participating students were their good academic standing and completion of their clinical requirements, thus ensuring that participation in the mission would not interfere with their graduation schedule. All students who participated in the missions gained experience and more confidence in their clinical ability as well as increased their speed in performing procedures under the most adverse yet

Table 1. Villages served and procedures performed during the 2006–08 dental missions in Madagascar

<table>
<thead>
<tr>
<th>Site</th>
<th>Patients</th>
<th>Extractions</th>
<th>Fillings</th>
<th>Endodontics</th>
<th>No Work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2006</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berivotra</td>
<td>60</td>
<td>245</td>
<td>108</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Antanambao</td>
<td>207</td>
<td>779</td>
<td>154</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ampijaroa</td>
<td>148</td>
<td>538</td>
<td>105</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>415</td>
<td>1562</td>
<td>367</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td><strong>2007</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berivotra</td>
<td>66</td>
<td>125</td>
<td>50</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Antanambao</td>
<td>154</td>
<td>612</td>
<td>125</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Mahatsinjo</td>
<td>216</td>
<td>1,085</td>
<td>150</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>436</td>
<td>1,822</td>
<td>325</td>
<td>8</td>
<td>34</td>
</tr>
<tr>
<td><strong>2008</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berivotra</td>
<td>48</td>
<td>121</td>
<td>38</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Antanambao</td>
<td>41</td>
<td>156</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ampijaroa</td>
<td>81</td>
<td>347</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mahatsinjo</td>
<td>230</td>
<td>1,399</td>
<td>66</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Katespy</td>
<td>158</td>
<td>521</td>
<td>28</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>558</td>
<td>2,544</td>
<td>132</td>
<td>25</td>
<td>0</td>
</tr>
</tbody>
</table>
rewarding conditions. Their absence from school did not affect school operations, and all received honors in OMF surgery and endodontics.

We did face challenges in the missions. The living arrangements were tents and sleeping bags, showers were a bucket and a ladle, and food was rice and beans with a local root called manioc, which looks like a sweet potato and is a staple of the Malagasy villagers’ diet. In spite of this, all the students were enthusiastic about the mission.

Seeing the extensive need for medical and dental care in the areas served by these missions, we would have liked to have the possibility of expanding our oral health outreach to larger populations. Unfortunately, funds of approximately $50,000 are required for the organization of a mission of this size. Budget and time constraints have so far required us to limit our oral health outreach missions to the regions described here.

We hope that our experiences will encourage other academic and nonacademic organizations to explore international dental outreach missions. We also hope that our students’ experiences will stimulate other dental schools to undertake similar foreign outreach missions and to work in cooperation with foreign dental schools. In fact, our faculty members

Figure 3. X-ray images taken using the Schick/Nomad systems for extractions, evaluation, and endodontic treatments during the Madagascar mission
Figure 4. Villages in Madagascar served by the dental outreach teams: 1) Katsepy, Berivotra, and Ampijaroa (clockwise); 2) Antanambao; 3) Mahatsinjo
gave lectures at the IOSTM, and each year any dental equipment and supplies that were not utilized were donated to the school. Finally, we have noted the enthusiasm of applicants to our dental school when the Madagascar dental outreach project is described during the interviewing process, suggesting a potential role for outreach programs as recruitment tools for highly qualified applicants.

Plans for the Future

As we consider the safety of the dental outreach team paramount, we did not send a mission to Madagascar in 2009, due to the political unrest occurring at that time. However, we hope to restart the dental missions to the island once the political climate changes.

Acknowledgments

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REFERENCES