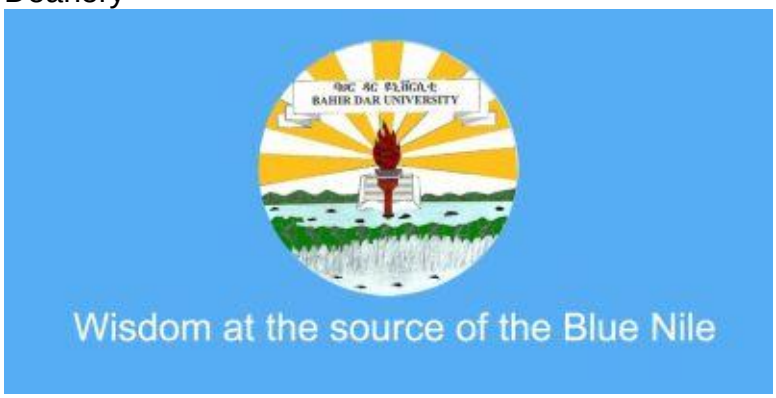
BONES - Bahir Dar Orthopaedic Network and Exchange with Severn Deanery



The COVID-19 pandemic has undoubtedly had a devastating effect on global surgical efforts. Two trips were planned as part of the BONES initiative in spring of this year. The second trip, planned for the end of March 2020, would have seen Mr Andrew Kelly (Musgrove Park Hospital), Mr Daniel Engelke (Gloucestershire Royal Hospital), Cez Kocialkowski and James Berwin as invited faculty for an AO trauma course in Addis Ababa, teaching orthopaedic residents from around the country including Bahir Dar. Sadly, this has been postponed until further notice.

I'm delighted to report however, that one team made it there and back again before the pandemic took hold. The trip was paediatric themed and led by Mr Simon Thomas (Paediatric Orthopaedic Consultant and TPD for Severn Deanery), joined by Thomas Knapper, Alex Aquilina and his colleague Nils Hellberg from the Virti 360 virtual reality videoing team which sparked much interest amongst the local trainees.

I would also like to take the opportunity to thank Mr David Woods (Great Western Hospital) for so generously donating a C-arm, including maintenance package and lead jackets, to the cause. My understanding is that it is waiting in a container and is ready to be shipped. This will undoubtedly make a huge difference to their capacity to deal with the complex injuries they see on a daily basis.

Whilst trips to Bahir Dar are currently on hold, we are still accepting notices of interest from registrars and consultants around the region with the idea of lining up a number of trips for when it becomes safer to travel. For this years BONES report, I have asked Thomas Knapper and Alex Aquilina to write about their experiences.

Sincerely,

James Berwin (ST7, Severn Deanery and co-founder of BONES)

Trip report by Thomas Knapper (ST7, Severn Deanery):

The partnership with Bahir Dar focuses on education and fostering a supportive network. With each trip we aim to take some basic equipment and teaching aids out with us for the hospital and trainees. Therefore with bags packed with saw bones,

nails, hammers and the critical customs forms we flew from Heathrow to Bahir dar via Addis Abba. Upon arrival on a nice sunny day we received the usual warm welcome from Bini, Bini and Bekalu at the airport before a short transfer to our hotel.

The following day we visited the University hospital site to deliver equipment and take a tour of hospital. A large complex on the outskirts of town, Tibebe Ghion is the University hospital of Bahir Dar. Externally the main hospital building is complete and internally the hospital is up and running with busy outpatients, filled wards and enough trauma on a daily take to cover most of the Orthobullets trauma section in a single trip. The site is constantly developing and evolving with a library, medical school and accommodation all near completion. Despite having access to nearly all the investigations that we are accustomed to back home (bloods, radiographs, CT, MRI) the contrast to our university hospitals is stark. Procurement of new equipment appears to be a logistic nightmare therefore any spare kit or resources are extremely well received.

Although the trip was short the experience and exposure was abundant. The week consisted of the daily trauma meetings of the preceding 24 hour take, a paediatric trauma ward round, clinics, theatre and teaching. Trauma is plentiful in Bahir Dar and most is complex owing either to the mechanism of injury; falls from scaffolding, RTC, snake bites rural shootings or stick beatings or to delayed presentation following visits to the local bone setter. Management is familiar but adapted to the local resources available.

Clinics were especially useful as an insight into the differences in pace, patient-doctor interactions and the pathology seen. In a single morning we saw synostoses, skeletal dysplasias, congenital patella dislocations, numerous chronic osteomyelitis, pathological fractures and post traumatic growth disturbances. I think the variety, although not unexpected, had a lot to do with the effort the attending and residents had gone to organise a list of patients with either interesting pathology or complex cases for second opinions.

As part of the alliance the key focus is on education and supporting healthcare development. The practical focus on this trip was paediatric TENS nailing. For this we ran a sawbone workshop for all the residents covering both upper limb and lower limb fracture patterns, The main challenge was remembering to adapt the technique to performing without image intensifier guidance. This however was very well received and we hope that this will be a practice adopted locally in the not too distant future.

And finally the highlight of the trip was the socialising with the Doctors and sightseeing. We were treated to an evening in the local cultural hall where we were encouraged to dance and rehydrate on the local

drink; Tej - a honey wine home-brew of unknown strength. On the final day we took time to visit the Blue Nile falls. Accompanied by Wubshat and David two of the senior residents. After a bumpy journey down a dirt road we arrived at a bustling village and the start of the hike to the Blue Nile falls. This is the key 'must see' in the vicinity of Bahir Dar and despite David telling us that we had come in the "wrong season and they are usually more impressive" they were still a highlight and highly recommended day out.

I would recommend a visit to any trainee and trainer it gives you a valuable insight into different training, healthcare systems and challenges and there is as much that they can teach us as we can teach them.

Bahir Dar Virtual Reality Feasibility Project Report

Alex Aquilina (ST4, Severn Deanery) and Nils Hellberg (Virti)

Background

The World Health Organisation (WHO) recognises a global health workforce crisis with a need for a scale-up of health professional education. The WHO 'Safe Surgery Saves Lives' campaign highlights a continuing need to improve education in resource-poor healthcare systems.

Simulation training is a staple part of medical training in the NHS with well-recognised patient safety benefits. Simulation facilities are expensive and difficult to access in resource-poor healthcare systems. Smartphone ownership and internet access are growing in Africa.

Recent technological advances make it possible to deliver immersive Virtual Reality (VR) simulation educational experiences directly to users' smartphones requiring only an internet connection. VR-simulation training delivered via smartphones in resource-poor healthcare systems provides a novel and exciting opportunity to provide simulation in a cost-effective and scalable way over large geographical healthcare networks.

For this visit to Barhir Dar, I have partnered with Virti, a company that specialises in making experiential education affordable and accessible for everyone. Virti has created an online platform that delivers virtual and augmented reality coupled with state-of-the-art artificial intelligence programming via an app to transport users into difficult to access environments. Virti have agreed to collaborate on this project. The links already established by BONES provided the perfect opportunity to test the feasibility of using the Virti platform in a resource-poor healthcare system.

During an Ethiopia to the UK visit in November 2019 facilitated by James and the BONES team we were able to demonstrate the Virti platform and a 360-degree camera to Dr Biniyam Biresaw and Bekalu Wubshet from Bahirdar University Tibebe Ghion Specialised Hospital. Bini and Bekalu were impressed by the technology and felt that it has the potential to improve resident and medical student training in Ethiopia. A joint application to the University of Oxford Africa Oxford Initiative was successful in providing funding for the trip and equipment.

Trip Aims

1. Assess the feasibility of delivering and developing VR-simulation training via smartphones in Bahir Dar
2. Demonstrate the Virti platform, creation, editing and upload of 360-degree videos to Orthopaedic Residents
3. Collect feedback from residents on their experience using and accessing demo VR-simulation training videos and ideas for future work

The Trip

Nils Hellberg, Chief Technical Officer for Virti and I joined Mr Simon Thomas (Severn TPD) and Mr Thomas Knapper (Severn Trainee) for a three-day visit to Bahirdar University Tibebe Ghion Specialised Hospital. We wanted to assess the feasibility of both using the Virti platform to deliver VR based simulation teaching to orthopaedic residents on their smartphones, and also the creation of 360-degree video content on the ground; including video editing using local IT infrastructure and upload of edited content to the Virti platform.

On the morning of the first day, Nils and I partnered with Dawit, an intern and Wubshet, a senior resident. Dawit and Wubshet were assigned to look after us throughout our visit and partner in the project. Throughout our stay, we demonstrated how to use the camera and equipment, undertake video editing, stitching of 360-degree video content and upload of stitched material to the Virti platform; in the hope that they could continue to develop and deliver VR teaching content in the future. With Dawit and Wubshet's help, we created a University and Hospital tour in VR by capturing a series of concise 360-degree videos (5-30 seconds long) of the key areas of the site using an Insta360 One X camera on a Tripod. Following video editing, we were successful in uploading the video files (5-40 MB in size) to the Virti platform. The fastest and most reliable internet connection we

could find was off of the hotel WIFI. The Jacaranda hotel has an excellent reputation for its internet connection which makes it popular among locals and visitors. To complete the cycle, we were able to download the newly uploaded hospital tour to a pair of Oculus Go VR headsets and demonstrate the tour back to the department later in the week. In the afternoon we filmed Tom and Simon's sawbone teaching sessions with the intention of being able to use the video footage to pilot delivering sawbone teaching in VR at Barhir Dar in the future using the Virti platform.

On the second day, we filmed Bini in the operating theatre undertaking a debridement of sequestrum on a child in 360-degrees using a head mount in the morning and Mr Thomas running a teaching clinic in the afternoon. The clinic provided a suburb opportunity to film a series of unusual short teaching cases and document the discussion over the management plan between the local and Bristol team.

Throughout our visit, Dawit and Wubshet posted instructions on the resident Telegram messaging app group on how to download the Virti app and access the demo VR content. We asked the residents to download three simulation videos; an introduction to the c-arm image intensifier, a demonstration of a WHO checklist and application of a VAC dressing. On our last day in the hospital following resident teaching, Nils and I demonstrated the Virti platform to 14 of the residents. We showed simulation videos of a hip examination and an application of a VAC dressing using two Oculus Go headsets and the resident's smartphones placed in VR headset glasses. We then collected feedback and undertook a focus group with a small group of five residents.

Findings

We found that it is feasible to deliver and create VR teaching content in Barhir Dar, Ethiopia, where access to the internet is possible. All 14 residents at Barhir Dar surveyed owned a smartphone device capable of downloading the Virti app and running the simulation videos in VR when using the VR headset glasses. The one caveat was that consistent downloading and uploading of video and app content was challenging due to poor internet connection speeds, dropouts and reliability on both cable and mobile internet. Of the 14 residents surveyed the average reported download and upload speed from either a wired internet connection provided via WIFI or from the local 3G network was less than 2MB/s. Only one resident was able to download all three demonstration simulation videos, and an additional two residents were able to download one or more of the videos during our visit. We believe that the main issue with downloading of VR videos from the Virti app was firstly due to the relatively large size of the video files and a combination of slow and unreliable internet connections. However, all 14 residents watched the hip examination and VAC application demonstration videos on the final day. Feedback was very positive; all residents enjoyed using the Virti app, felt they would benefit from further training using the app and would like VR simulation to become a core part of training in the future.

Future work

The Af-Ox Travel Grant enabled us to leave a 360-degree camera and equipment in the care of the Barhir Dar orthopaedic department. Dawit and Wubshet will continue to work with us to develop and share VR content in the future. We also purchased two Oculus Go headsets that will be loaded up with VR teaching content and sent to Barhir Dar enabling the department to continue to deliver VR simulations both to residents and medical students in the short term. During our visit, we could see that the necessary infrastructure was being built and installed to provide a high-speed internet connection within the university building. When this is in operation, it will enable us to overcome many of the issues encountered when downloading and uploading video files.

Declarations

I would like to thank BONES for making the necessary introductions and for facilitating our trip. This project would not have been possible without the kind support provided by the Barhir Dar Orthopaedic department and for Dawit and Wubshet for looking after us during our visit. Finally, I would like to acknowledge and thank the University of Oxford Africa Oxford Initiative for providing the funding to make this trip possible and to allow us to gift 360-degree video equipment to the team on our departure.