In November 2017, QAdental, a new dental consultation portal, won the Innovation Award at the Finnish Dental Congress and Exhibition in Helsinki. Developed by Dr Mikko Nyman and Teddy Grenman, Chief Dentist and Chief Engineer at NUOVO NORDIC Healthcare Services, respectively, the platform offers dental professionals the opportunity to e-consult with dental specialists, serves as a database for learning material and patient cases, and enables forum discussions. Dental Tribune International spoke with Nyman about this pioneering solution and the expertise it brings to remote areas and developing countries.

Congratulations on winning the award. How did this come about?
This has been quite a year. We piloted QAdental in Namibia this spring. It wasn’t easy to obtain permission from the local ministry of health and it wasn’t easy to get people excited about something totally new. We visited the country twice. However, we managed to conduct the pilot successfully. In summary, this win feels very good and motivates us all to continue developing QAdental.

Did you have a team to support you in the development process?
QAdental was developed by a team. Teddy Grenman and I were the main architects, but without the rest of the team—CEO Jani Korpela, Chief Medical Officer Jarkko Saramäki and Project Coordinator Teemu Tanninen—we wouldn’t have been able to conduct the pilot successfully in Namibia. Steve Jobs’s famous quote applies to QAdental also: “Great things in business are never done by one person. They’re done by a team of people.”

With the success of the platform, will something change for you personally?
My focus will be completely on QAdental and I’ll pass over most of my other duties in the company [NUOVO NORDIC Healthcare Services] to my colleagues. This applies to Teddy also.

How do the features of QAdental help practitioners in particular?
In Finland and many other countries, specialist services are not available in remote areas. This means dental professionals located there are obliged to work beyond their scope. QAdental brings to them advanced knowledge and a supporting community via the Internet. This way, clinicians can perform more challenging procedures more safely and discuss patient cases with their peers. The growing international database of questions and answers and learning material is available for all members. With the help of the advanced search function—or maybe artificial intelligence in the near future—clinicians may find answers to their questions from previous questions and answers.

What sets QAdental apart from other dental community platforms?
This kind of consultation or support service might be very significant in enhancing patient safety and healthcare quality. Our plan was to export Finnish or Western expertise to developing countries. One challenge was that these countries cannot afford to pay for Western dental specialist consultation. That’s why we wanted to develop a way to share the knowledge. The solution was quite obvious: we had to create a place where all consultations, answers and learning material are available for all members so that the learning experience wouldn’t be limited to one person.

During the pilot project, we learnt that there’s a need for specialist e-consultations also in Finland, especially in remote areas. In Finland, there’s no tele-consulting platform where information and learning experiences are shared with several practitioners at the same time, so QAdental serves as a kind of reverse innovation when it comes to Western countries. Compared with other dental forums, QAdental focuses solely on consultation and learning material. There’s always a dentist on duty taking care of maintenance, and to make sure that the appropriate QAdental professional answers to the corresponding consultations. The officer on duty is also the quality controller when it comes to official answers.

Will your product be globally available or only for the Finnish market?
QAdental is open to all dental professionals globally and membership is free. Dentists can register at www.qadental.com.

Thank you very much for the interview.
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Dynamic navigation in fully edentulous maxilla

Preoperative planning is the most important part of a successful implant rehabilitation and requires multiple parameters to be considered for the precise placement of implants. The implants should be placed not only within anatomical boundaries but also be strategically located to support a prosthesis that will fulfil both functional and aesthetic requirements.

3-D virtual images are being used through computer software, which transforms CBCT scans into 3-D virtual models. However, after a precise planning or virtual realisation of the treatment, the osteotomy should also be executed precisely according to the plan and would likely require guidance of the drills and the implant.

For years, stereolithographic static guides have been used successfully for implant osteotomies, using detailed information implemented through 3-D virtual images. Static guides on the other hand present several disadvantages. The loss of tactile feeling during osteotomy and the fact of being limited to the predesigned drilling trajectory are considered to be their major drawbacks.

Real-time navigation

A recent technology, which provides dynamic guidance through a real-time navigation for implant osteotomy, offers not only accuracy, but also additional valuable advantages during an operation. With this technology, the
location and diameter of implants can be modified and a flap can be incised intraoperatively whenever needed.

Furthermore, dynamic navigation enables the surgeon to adjust the surgical plan during surgery. In case of an unexpected low bone quality, an additional implant could be planned with the software and placed additionally. Moreover, one of the most significant benefits of dynamic navigation is the ability to use it also for alveoloplasty and reshape the alveolar crest’s topography during the same surgery, together with the implant placement.

The precise location of implants is case-specific and determined by different factors. If an edentulous case is to be restored with an implant-supported screw-retained fixed prosthesis, implant locations should be critically examined whether they can provide screw access holes within occlusal or palatal/lingual parts of the restoration. Frequently, alveoloplasty is required for the recontouring of the ridge in order to obtain sufficient bone thickness at the level of the implant’s collar.

This crestal trimming of bone may also be necessary in order to increase the inter-arch space and provide a sufficient volume for the restorative material, since dento-gingival prostheses are frequently required to enhance aesthetics. In such cases, dynamic guidance can be used to level the alveolar crests as planned on virtual images, followed by precise multiple osteotomies.

Case report

The following case report describes the treatment of a 65-year-old male with an one-year history of maxillary partial edentulism (Fig. 1). He was discontent with the stability of his prosthesis and expressed that through the unstable prosthesis situation he has lost social self-confidence. In the initial appointment he thus stresses his need for a “fixed solution”.

His medical history did not reveal any specific systemic disease or condition that contraindicates oral surgery. The patient’s soft tissues on the edentulous ridges were healthy and panoramic X-rays showed expanded sinuses at both sides and irregular alveolar ridges. The treatment plan, carried out for a maxillary screw-retained fixed prosthesis, included two implants at the pre-maxillary region and two tilted in the posterior maxilla to avoid a sinus lift surgery.

Stent placement

In order to acquire both anatomical and prosthetic information prior to the surgery, a scan prosthesis was manufactured by duplicating the maxillary denture (Fig. 2). It is important that the scan prosthesis has the same aesthetic and functional information as the complete denture or set-up. Thus, the scan prosthesis was checked for its fit, aesthetics and maxilla mandibular relation (Fig. 3). The scan prosthesis was then used together with a Navident Edentulous Kit for CBCT imaging.

The Navident edentulous protocol consists of a SDI (Small Diameter Implant of 2.2 mm or 2.5 mm diameter), which is inserted into the alveolar ridge of the arch to be operated, prior to the acquisition of the CT scan. This temporary SDI serves as a mount for the CT marker and Jaw Tag used for the registration of the CT scan to the patient and for tracking the patient’s jaw during surgery.

The SDI can be placed either in a vertical position or in a horizontal position in relation to the alveolar crest. A special plastic arm with a proprietary aluminium bracket is then used for the connection of the CT marker and Jaw Tag to the SDI. Two types of arms are available: one for a
vertically placed and another for a horizontally placed SDI (Figs. 4a & b). In the presented case, the SDI has been placed vertically to achieve the required stability (Fig. 5).

The CT marker, containing the fiducial marker used for the registration of the CT scan to the patient, was attached to the V-type arm on the fix-plate at one end. At the other end, the assembly was placed over the SDI's square head and secured to it using a setscrew which was embedded in the aluminium bracket, with this creating a complete “NaviStent” (Fig. 6).

The scan prosthesis was then modified to accommodate the aluminium bracket before it was placed over the maxillary edentulous ridge (Figs. 7 & 8). For accuracy purpose, it is imperative that the scan prosthesis is stable, while at the same time it should not interfere with the NaviStent.

**CT scan**

The following CBCT imaging protocol for Navident dynamic navigation was applied during CT imaging. Before the scanning procedures, both the modified scanning prosthesis and the NaviStent had been placed into the patient’s upper jaw (Figs. 9 & 10).

A CT marker was then connected to the NaviStent. A scout view had been acquired prior to the actual scan to verify the presence of the CT marker in the CT scan. In order to allow for accurate registration, at least three corners of the fiducial marker must be present in the scan. In order to maintain a high level of accuracy during navigation, it is mandatory that the slice thickness must not exceed a maximum of 0.4 mm. In this case, the slice thickness had been set to 0.3 mm. Afterwards, the scan was exported in DICOM format, then imported into Navident.
Osteotomy planning

When the CT scan is imported into Navident, a proprietary algorithm detects the fiducial’s image in the scan, then registers it with a mathematical model of the fiducial that is stored in the computer memory. This enables Navident to map the Jaw Tag, which is the tag mounted onto the patient, to the CT image during navigation.

For this case, Ankylos dental implants had been selected. The implants with a diameter of 3.5 mm and a length of 11 mm were planned on the locations 15, 12, 22 and 25 using the Navident planning software (Fig. 11). The following parameters were considered when osteotomies were planned:

1. Alveolar ridges, though they had a sufficient bone height, were narrowing at the crestal 1/3. Without waiving or compromising the restorative information, the implant locations were planned to be deeper where at least 2 mm of buccal plate thickness could be achieved.
2. Straight implants were placed at 12 and 22 and tilted ones at 15 and 25.
3. Angulated distal implants were planned 1 mm mesially to the sinus wall.
4. The angle of distal abutments was planned to be 30 degrees to the occlusal plane to have the retaining screws access holes placed in the denture’s occlusal aspect since screw-retained abutments have 30 degree joints.
5. The plane of the implant collars was planned to be parallel to the occlusal plane.

Surgery

Before surgery, the CT marker was disconnected from the NaviStent Arm and replaced by the Jaw Tag, which is detected by the Navident camera. A Drill Tag was installed onto the handpiece (Fig. 12). Together with the Jaw Tag, they provide real-time feedback during surgery, enable the surgeon to communicate with the software and place the implant as planned.

A crestal incision was made at either side. Pilot drills were used to start osteotomy followed by the Ankylos dental implant drilling protocol. All drills were navigated according to the planned trajectory, until real-time feedback confirmed that its tip has reached the apical end of the planned osteotomy. The alveolar crests were levelled by a rongeur (Fig. 13). Between each trimming attempt, the pilot drill was touched to the trimmed surface of the crestal bone and its level was checked on the virtual image.

The trimming of the bone was completed under the guidance of dynamic navigation and the pilot drill was again touched to the newly formed alveolar crest. Implants were inserted in the osteotomies as planned (Figs. 14–16), the gingival tissue placed back and sutured with coated poly-glyactin 910 sutures. The patient was medicated with antibiotics and chlorhexidine mouth rinse and was released with NSAID’s.

Conclusion

The Navident navigation surgery system achieves a successful guidance both in alveoloplasty and implant osteotomies in the edentulous maxilla (Figs. 17–19). In the presented case, the proposed protocol was highly efficient in gathering 3-D prosthetic and anatomical information for the planning. Dynamic navigation provided a precise guidance in the execution of the planned osteotomies through a flexible surgical operation.

Editorial note: A list of references is available from the publisher.

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