The following case illustrates some of the innovations in implant design that have been crucial in making implant therapy easier to produce and as accessible to as many patients as possible.

Innovations in implant design have streamlined and simplified treatment, making it easier to produce ideal outcomes. Key advancements, such as the screw-shaped implant body, the internal prosthetic connection and the tapered body design, have been crucial in making implantology the essential mode of tooth replacement today.

The case illustrates more than three decades of implant evolution.

By Jack A. Hahn, DDS

Since placing my first dental implant 45 years ago, many implant systems have come and gone, several of which I designed myself. If there’s one thing I’ve learned from the thousands of implant cases I’ve completed during the course of my career, it’s that regardless of the implant system chosen, long-term success depends on following the basic principles of treatment planning, surgery and prosthetic design.

Innovations in implant design have streamlined and simplified treatment, making it easier to produce ideal outcomes. Key advancements, such as the screw-shaped implant body, the internal prosthetic connection and the tapered body design, have been crucial in making implantology the essential mode of tooth replacement today.

The following case illustrates more than three decades of implant evolution.

The patient, whom I’ve been treating for more than 30 years, has received implant therapy several times to treat tooth loss from fracture or decay. Because this treatment occurred episodically throughout many years, I’ve utilized several different implant systems to replace the patient’s teeth. As a result, the patient has implants with internal as well as external hex connections, ranging from an outdated bladeform design to the very latest tapered implant. The experience I’ve had both designing and placing these implants for this patient and thousands of others has given me the unique opportunity to observe my results and determine what designs and protocols work and what can be improved; as I’ve strived to advance implant design throughout the years.

The implants

• JAH 2000 Blade Implant (Fig. 3): I first placed an implant for this patient in 1988. It was the JAH 2000, which I designed as a flat, two-piece implant with wings. The blade implant was indicated for thin ridges where a root-form implant could not be placed without bone grafting. Blade implants were typically connected to other implants or teeth, and could be cut, shortened and shaped to align with the anatomy of the bone, which was commonly required when placing blade-form implants at the time. For this patient, two teeth anterior to the implant were prepared, an incision was made, a trough was drilled in the patient’s very narrow ridge, the implant was placed and a five-unit bridge was delivered to replace three teeth in the posterior mandible. Notice that I adjusted the distal inferior portion of the implant so as not to impinge on the mandibular nerve.

• JAH 2000 Select Blade Implant (Glidewell Direct; Irvine, Calif.), which I designed in order to make treatment simpler, more predictable and as accessible to as many patients as possible.

The JAH 2000 was a significant improvement over what was on the market at that time. I designed the neck to extend lower than the tops of the wings, allowing more bone to integrate around the neck of the implant. Decades after implant placement, this blade design continues to serve many of my patients well.

• Steri-Oss HL (Fig. 4): The Steri-Oss HL implant in the area of tooth 426 is HA-coated and was placed immediately into an extraction site of a tooth that was lost to caries. Beginning in 1986, my practice was one of multiple centers conducting a 12-year study on nearly 3,000 Steri-Oss implants. We gained provisional ADA approval for extraction with immediate implant placement and loading.

• Replace Select Tapered (Fig. 5): I placed several Replace Select implants (Glidewell, Tustin, Calif.) for this patient throughout the years, and the tapered shape simplified positioning within the available bone, especially in the area of the premaxilla. Prior to the Replace Select, most implants were parallel-walled, and in 1991 I came up with the concept of a tapered design, although it didn’t come to market until 1997. The idea arose from my experience with single-tooth replacements in the anterior maxilla, where I’d often need to tilt parallel-walled implants to the facial to avoid perforating the subnasal fossa. The roots of natural teeth are tapered, so it occurred to me that implants should be tapered as well. The bone is not square; it’s a series of triangles that is best accommodated by a tapered shape.

A flat top with an internal connection offered anesthetic advantage because the implant could be placed at or slightly below the crest of the bone, without an external component causing metal to show through the crown. This led to the design of the tri-lobe internal connection of the Replace Select, which was first introduced by Steri-Oss and became the most popular design in the Nobel Biocare implant portfolio after the company acquired the brand in 1998.

The thread pattern of the Replace Select was similar to that of the parallel-walled Steri-Oss implant, but I wanted to have a variant of aggressiveness in the pitch of the threads as it came up to the apex. I knew that another company was coming out with four different implants for the different qualities of bone, and I wanted to beat them to the punch. So I said, “Let’s put four different thread patterns in one implant,” which really helped with the degree of taper and cutting into denser bone.

The tapered shape of the Replace Select was ideal for two-stage treatment, but the thread design wasn’t aggressive enough to provide the stability I needed for single-stage surgery. This led me wanting a thread design that was more sharp-edged — but not too aggressive — which was one of the formative ideas behind the Hahn Tapered Implant.

• Hahn Tapered Implant (Fig. 6): Like several of the implants I’ve placed for this patient, the two Hahn Tapered Implants shown in the panoramic radiograph (Fig. 2) were placed immediately following tooth extractions. The patient is active socially and has always wanted an immediate temporary after having a tooth extracted. In both cases, I extracted the tooth, prepared the site and placed the implant.
The patient’s root-canal-treated mandibular canine needed to be separated from the posterior bridge connected to the patient’s JAH 2000 blade implant. Because both of the Hahn Tapered Implants achieved excellent initial stability, immediate provisional crowns were delivered. The patient’s other implants have performed well, but required more work to get the outcome I wanted. With the Hahn Tapered Implant, there are fewer steps.

The Hahn Tapered Implant’s ability to remain engaged with the palatal bone around the implant-abutment interface and the thread pattern just right. We ended up with an implant that can be directed against the palatal bone, avoids the facial plate and fits within tight anatomical spaces. The Hahn Tapered Implant includes a 1 mm-machined collar. Because both hard and soft tissue is stable around a machined collar, this design affords doctors the flexibility in crestal positioning they need to meet the esthetic demands of each case. We designed the implant with a conical connection to ensure a strong, stable seal.

The prosthetic connection also facilitates platform switching, which has been shown in numerous studies to preserve bone and gingival tissue around the implant-abutment interface. To ensure an optimal restorative outcome, the Hahn Tapered Implant System features contoured healing abutments and matching transfer copings. Since we launched the Hahn Tapered Implant in 2015 and began working with experienced practitioners, we’ve received nothing but positive feedback. The comment that I hear repeatedly is: “Jack, I love your implant.” Looking back at this patient’s radiograph, I know that we’ve come a long way with implant design.

Conclusion

The various implants I’ve designed and placed in this patient throughout the years demonstrate that success is highly predictable as long as we adhere to the proper diagnostic, surgical and restorative principles. At the same time, advancements in implant design have simplified surgery and made it easier to establish the implant positioning and stability needed to achieve the best outcome possible. I’m proud to have contributed to this evolution and look forward to the innovations to come.

References available upon request from the publisher.
Dubai, covering 1500 students aged 4-6 years old. The implementation of the program required cooperation between the Ministry of Health and Prevention, the Knowledge and Human Development Authority, School health and Educational Institute Unit, the private companies and Dental Services Department, Dubai Health Authority.

- School children were provided with free toothbrushes appropriate for their age, fluoridated toothpaste and customized tooth brushing charts to record their daily tooth brushing.
- A training workshop was conducted for the oral health coordinators (school nurses) that were assigned to supervise the daily tooth brushing after meals and provide guidance and support to the students.
- Guidelines for tooth brushing in schools and infection control measures were adapted from the MyS-mile program (Scotland) and copies provided to the oral health coordinators.
- The program involved two forms of tooth brushing based on the facilities in school.

**Wet tooth brushing**

Schools that had enough washrooms that accommodated the students were requested to take their tooth brushes with the proper amount of tooth paste and brush their teeth on the sink, rinse their tooth brushes and replace them back in the storage.

**Dry tooth brushing**

Schools that did not have the facility for children to go to washrooms to brush their teeth and spit excess toothpaste were given instructions to brush in their classrooms using appropriate amount of toothpaste and spit in cups or paper towels and were disposed of appropriately.

Toothpaste was placed on paper plates to help in infection control and enables the use of one toothpaste tube to be used for more than one student.

A dental team of two dentists and two dental hygienists visited each school and conducted dental check-ups using the visible plaque index (VPI) in a mobile dental van. Main concentration was to measure the plaque accumulation on the teeth surfaces for the students aged 4-6 years, as they were the age group with the highest caries prevalence based on the previous screening conducted in Dubai.

Results were recorded for each student on oral hygiene forms and were placed in the student’s medical file in the school with the supervision of the school nurse.

A visit to each classroom participating in the tooth brushing scheme was done with the presence of the oral health coordinator to check on the charts and tooth brushing storage facility.

Parents were involved on the same day to have an introduction on the tooth brushing scheme and information given on healthy diet and good oral hygiene habits and tooth brushing charts were distributed to help them follow up on the brushing at home.

Follow up from the dental team with oral health coordinator was done on a weekly and monthly basis.

At the end of the three-month activity, a second dental checkup conducted on the students to record the dental plaque accumulation and compared with the previous results. An extensive interview was done with the oral health coordinator (school nurse) and the feedback questionnaire from the parents were collected.

An additional activity that encouraged children to be more involved with oral health was a drawing contest of healthy smiles, winners were given one year supply of tooth brushes and tooth paste to take home.

**ANNUAL DENTAL HYGIENIST SYMPOSIUM**

19th January 2018

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08.45 – 09.00</td>
<td>Coffee and registration</td>
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<tr>
<td>09.00 – 09.15</td>
<td>Welcome remarks – Introduction to the EDHC Board</td>
</tr>
<tr>
<td>09.15 – 09.45</td>
<td>Rachael England – Public Health in a dental context</td>
</tr>
<tr>
<td>09.45 – 10.15</td>
<td>Mary Rose Pincelli Boglione – When is the best time to brush, and why?</td>
</tr>
<tr>
<td>10.15 – 10.30</td>
<td>Refreshments</td>
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<tr>
<td>10.30 – 11.30</td>
<td>Dr. Eleftherios Kaklamanos</td>
</tr>
<tr>
<td>11.30 – 12.00</td>
<td>Dr. Shiamaa Shihab Ahmed Al Mashhadani – (Dubai Health Authority)</td>
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<tr>
<td>12.00 – 13.00</td>
<td>Beverley Watson – Prophylaxis Masterclass – Theory</td>
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<tr>
<td>13.00 – 14.00</td>
<td>Lunch</td>
</tr>
<tr>
<td>14.00 – 15.00</td>
<td>Beverley Watson – Prophylaxis Masterclass – Practical</td>
</tr>
<tr>
<td>15.00 – 16.00</td>
<td>Dr. Hamzeh Awad – The Role of Tele-Health in Diabetes Management: Does the Cloud Based Smart Electronic Health Application (SEHA) provide the comprehensive approach for Diabetes Prevention and Management? “The Perspective of Oral Health in Diabetes”</td>
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<tr>
<td>16.00 – 17.00</td>
<td>Dr. Jaco Smith - The introduction to oral probiotics and the implication in dentistry</td>
</tr>
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**Interviews with the school nurses** (oral health coordinators) involved a half-hour interview with open-ended questionnaires related to:
- Commitment and support of the school administration in allowing students to do the tooth brushing at the assigned time on a daily basis.
- If the activity had fulfilled the learning objectives of the training they had completed before the activity took place.

Another question was about their professional opinion if this activity contributed to children's acceptance for daily brushing and interest in oral health.

A set of questions were asked about the mechanism of the activity and the reactions of school staff in having students brush their teeth daily in the school.

Any barriers that effect implementation of the tooth brushing activity, in regards to the commitment of schools, 71% of the oral health coordinators responded that if the school administration enforced the activity the compliance was high both from the teachers and students, others informed that allowing students to take a minute break to brush their teeth and return back to the class was considered as a disruption to the students daily schedule.

A high response was to the questions about students' reaction to brushing in school and how they considered it as an enjoyable task and made the students interested in brushing their teeth more often, even in schools that did not enforce daily tooth brushing, students requested from their teachers to be given permission to brush their teeth.

Many of the Oral health coordinators (56%) agreed that the main barrier for students brushing as a daily activity in the schools was:
- Storage facility of the toothbrushes in the classrooms and maintaining infection control standards.
- Allowing students to leave the class to brush their teeth.
- The cooperation of the class teachers and the head administration to continue with the tooth brushing activity for a long period.

**Parents Questionnaires**

Parents received a questionnaire to give feedback on their children experience with the tooth-brushing scheme. The questions asked about:
- Did you receive information on the tooth brushing challenge from the school?
- Would you consider tooth brushing in school for your child as a good way for her/him to establish good oral hygiene habits?
- Have you noticed any positive behavior change from your child towards tooth brushing at home?
- How can the oral health team support you to enhance and encourage your children to maintain their good oral health habits?

- Parents oral health lectures in school
- Continue tooth brushing for children in school
- Any other suggestions

**Parent’s feedback**

Response rates for the feedback questionnaire was 95%. There was a high response rate for the positive behavior change towards tooth brushing (86%). Many parents answered that the idea of their children brushing daily in school would help to establish a good oral hygiene routine (83%). They had increased interest to have more parents’ oral health sessions (72%). Most of the parents wanted their children to continue to brush at school (73%). There were 21% of parents who were concerned with infection control issues in regards to the storage of toothbrushes in schools.

**Conclusion**

The school-based oral disease prevention intervention comprised of oral hygiene instructions and supervised tooth brushing education was effective in imparting oral health knowledge and establishing good oral hygiene habits in school children and in improving their oral hygiene status and the attitudes of their parents. With these positive findings, it is recommended that similar programs be supported and implemented with a larger sample size to determine the long-term effect of such programs and to improve the poor oral health situation among school children. Furthermore, policies for such preventive measures should be placed to emphasize the importance of its effect and govern their implementation.

**Acknowledgements**

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**References**