Patients can suffer from differing degrees of edentulism depending on the number of teeth they have lost. Generally, the more teeth lost, the more they suffer.

An epidemiological study conducted in Japan found that 70% of people aged 65–70 have bilateral occlusion, and over 60% aged 80–90 have no posterior occlusal support (Figure 1). Especially among older populations, missing teeth can critically damage people's Oral Health Related Quality of Life (OHRQoL) and their general health.

Worldwide, implant therapy is an established method for treating edentulism and implant survival rates are high. Implant-supported prostheses are reliable solutions for cases involving multiple missing teeth, such as those presented in this paper. In cases 1 and 2, neither patient was satisfied with their original removable dentures because of poor functionality and/or aesthetic problems.

**Case 1**

The patient was a 64 year-old female who worked in an office (Figure 2). Her chief complaint was that she did not want to wear removable dentures any more.

Several treatment options were considered:

1. Implant-supported full-arch bridge from tooth 16 to tooth 26; immediate placement and loading
2. Implant-supported full-arch bridge from tooth 16 to tooth 26; delayed placement following extraction of teeth 22–24; and immediate or delayed loading
3. Implant-supported bridges on teeth 16–21 and teeth 25–26; natural tooth-supported prostheses on teeth 22–24

After discussing the patient's preferences, it was determined that she wanted to complete treatment as soon as possible as she was moving abroad. The patient selected option 1. There were several advantages associated with this treatment course:

- it matched the patient's preferences
- the prosthesis would be relatively easy to maintain while the patient lived in another country
- it meant that there would be no further concerns about her remaining natural teeth (22–24)

**Treatment**

The patient's occlusal condition was good; a radiographic guide (fitted with an assembly type for immediate placement) was made following her first visit; CT images were taken; and the treatment plan was consulted (Figure 3). Guided surgery with immediate placement and function was then performed (Figure 4).
Two months after surgery, periapical intraoral x-rays were carried out using the bisecting angle technique to confirm there were no complications.

Four months after surgery, an impression was made for the second provisional restoration. At that time, while retightening the abutment screw to the manufacturer's recommended torque, the implant at 24 began to move and the patient felt pain (Figure 5). After a few weeks of observation, the situation remained unchanged and a plan was finalised for another operation. The implant at 24 was removed and a new tilted implant was simultaneously placed; a second provisional was delivered (Figure 6).

After four months, the final prosthesis was delivered (Figure 7).
Figure 5: Four months after first operation. Disintegrated implant is indicated by red circle.
Figure 6: Re-operation, removing implant number 24 and immediately replacing with a new tilted implant.
Figure 7: Eight months after treatment.
Case 2

The patient was a 79 year-old female who was a housewife (Figure 8). Her chief concerns were that she wanted to have a stable complete mandibular denture and increased functionality while chewing food.

Medical history

The patient suffered from Hashimoto’s disease (Hashimoto’s thyroiditis); osteoporosis; and lumbar spinal stenosis. The patient’s medical history also revealed that she had been prescribed: Thyradin; Pravastatin; Alendronate sodium hydrate; Methylcobalamin; and Limaprost alfadex.

Treatment options

1. Complete denture with implants (overdenture)
2. All-on-4 fixed implant-supported full-arch bridge

The patient had expressed a desire for minimally invasive treatment options and could not afford to cover the full cost of a fixed prosthesis herself. Because of this and her pre-existing medical conditions, option 1 was selected: implant overdenture with immediate function.

Treatment

A temporary denture (to be used as a radiographic guide too) was made during a preoperative drug interruption period for Alendronate sodium hydrate (Figure 9). CT images were obtained using the double scan technique; the treatment plan was finalised (Figure 10).

During the first implant surgery an approach using guided surgery with a mini-flap was selected in order to preserve non-mobile mucosa. A magnetic abutment-retained denture with immediate function was placed (Figure 11). After making a Conus crowned telescopic denture of the maxilla, a flame-treated zirconia denture (Figure 12) was finalised in the mandible.

During the one-year maintenance visit the patient reported that she had removed a small, hard substance from the left side of peri-implant area. Initially, she had thought it was a fish-bone. She reported no pain and no other symptoms. Ultimately, it was deemed to be a sharp piece of bone which had not been recontoured during implant placement. Slight bone resorption in the area was observed on an x-ray. No further complications have been reported up to three years after prosthesis insertion. In retrospect, it would have been prudent to trim away the sharp bone edge at the time of implant placement to avoid concentration of stress and fracture.
Removable options can often be more technically challenging than fixed alternatives. The differential degree of support which is provided by implants, natural teeth and soft tissue must be harmonised and reconciled by the removable prosthesis itself. It is strongly recommended that a careful examination, including 3D CBCT scanning and digital treatment planning, is conducted.

Both patients in cases 1 and 2 were satisfied with their functional and aesthetic results. Their Japanese Oral Health Impact Profile (OHIP-J) summary scores before treatment were 121 in Case 1 and 58 in Case 2; after treatment they were 32 and 4 respectively.

Various criteria for measuring the success of clinical treatment have been defined\(^3\)\(^-\)\(^5\); however these generally represent outcomes which are valued by the clinician. It is necessary for us to keep our focus on patient-based outcomes and the aspects of treatment which most affect the patient (for example how surgically invasive a procedure is; how long treatment lasts; and how high the economic burden may be\(^6\)). To do so, an assessment oriented towards the patient's subjective evaluation of treatment outcomes must be carried out.

OHRQoL is an important patient-reported outcome which captures the impact of oral diseases and dental treatments. Oral Health Impact Profile (OHIP) is the most widely used and reliable tool for measuring OHRQoL. OHIP consists of a multi-dimensional questionnaire, and lower OHIP summary scores indicate a better OHRQoL. A previous study reported OHIP summary scores in the general population group at 19.7 ± 24.3\(^7\). The OHIP summary scores of the patients described in this study were significantly lower after treatment; both had improved quality of life, regardless of that fact that different therapies had been provided.

Recently, severe cases involving multiple missing teeth – such as those with an Eichner index of B3, B4, C1, C2 or C3 – have been researched at Showa University Dental Hospital. Initial results have suggested that, where appropriate case selection and thoughtful analysis of how best to meet patient expectations and preferences have been applied, there may be little or no significant improvement of OHIP summary scores where fixed implant-supported bridges were used instead of removable implant-supported dentures (Figure 13). In this study a total of 30 patients participated; 12 received fixed implant bridges and 18 received removable implant overdentures (IOD) or implant-assisted removable partial dentures (IARPD). Patients each completed an OHIP questionnaire before receiving treatment – to provide baseline results – and after. The number of subjects participating is currently limited, and we will continue with patient recruitment and enrolment to increase sample size.

In general, clinicians (using their perception of objective criteria) view fixed prostheses as being superior to removable prostheses, both functionally and aesthetically. However, treatment outcomes are multidimensional and should be evaluated while incorporating the patient's subjective assessment. Ideally, a treatment plan should be created using patient information (like age; economic status; and general health) gathered at the time of pre-treatment examination and counselling.

Patients' needs are multifaceted, and often present a constellation of individual desires. Clinicians are obligated to seek treatments which best fit each patient. To borrow a phrase from our medical colleagues, we are seeking to practise ‘individualised dentistry’ which should be grounded in patient-based outcomes, not clinician-based outcomes.

The treatments described in cases 1 and 2 had similar treatment periods (both involved immediate function) and both improved the patient's OHRQoL, but the economic burden of case 1 was almost four times higher than that of case 2. Implant overdentures and implant-assisted RPDs can therefore be considered as promising and effective solutions, especially in an aging society.

References
Baseline Follow-up ΔT
Average (SD) Average (SD) Average (SD)

Fixed (n=12) 74.5 (31.6) 28.3 (22.7) 46.3 (31.7)
Removable (n=18) 72.3 (41.0) 39.7 (24.6) 32.6 (38.5)
P 0.6 0.1 0.2

Figure 11: First Surgery, guided surgery and immediate loading.
Figure 12: Final prosthesis two years after treatment.
Figure 13: OHIP summary score at baseline and follow-up, and volume of improvement (ΔT).

*Fixed: Female 42%, ave. age 57.0±8.4y, missing teeth #16.4±5.1, implant #7.9±2.3. Removable: Female 89%, ave. age 72.9±7.2y, missing teeth #22.3±5.0, implant #3.3±2.0. P-values obtained from paired t-test *P<0.05. ΔT: Follow-up scores – Baseline scores.