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1st Global Consensus for Clinical Guidelines for the Rehabilitation of the Edentulous Maxilla: A Single-Round Survey on the Number of Implants, Timing of Implant Placement, and Loading for Fixed Restorations

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ABSTRACT

Objectives: To gather the opinions and preferences of experts regarding the number of implants used to support a fixed prosthesis in the edentulous maxilla, timing of implant placement, and timing of implant loading. This was performed using a single-round survey methodology. The primary objective was to support the development of a consensus and contribute to the formulation of clinical practice guidelines for the management of the edentulous maxilla.

Materials and Methods: A custom survey instrument was created by a steering committee and team of experts for the 1st Global Consensus for Clinical Guidelines. The anonymous survey was conducted using a single-round survey method. Consensus was defined as > 75% and ≤ 95% agreement or disagreement, and strong consensus as > 95% agreement or disagreement.

Results: A total of 202 experts from 42 different countries were identified and invited to participate. 117 provided consent and completed the questionnaire, resulting in a response rate of 57.9%. Strong consensus (> 95%) reached on no items. Consensus (> 75% and ≤ 95%) reached on four items: always using CBCT for planning, first molar as distal-most implant site for full-arch fixed prosthesis, use of a lab-fabricated acrylic provisional for full-arch fixed prosthesis, and the use of 4 implants to retain a removable maxillary denture.

Conclusion: This survey synthesized the preferences and opinions of experts regarding implant number, timing, and loading for the fixed rehabilitation of the edentulous maxilla to inform a consensus development process and contribute to the formulation of clinical practice guidelines for the management of the edentulous maxilla.

[Correction added on 5 March, 2026 after first online publication: The copyright line was changed.]

1 | Introduction

A fully edentulous patient often experiences reduced masticatory ability (Müller et al. 2012), which can negatively impact systemic, oral, and mental health (Gennai et al. 2022). Replacing an entire set of missing (or hopeless) teeth with dental implants and prostheses has been shown to significantly improve quality of life (Ellis et al. 2007; Martins et al. 2021; Reissmann et al. 2017).

However, treating the edentulous maxilla with an implant-retained or implant-supported prosthesis requires the clinician to make several critical clinical decisions to best serve the patient's needs. As implants, abutments, augmentation techniques/materials, and prosthetic designs/materials have evolved, so too has the diversity of workflows. There remains a wide breadth of treatment approaches, particularly regarding implant number, positioning, and timing. This clinical variability is influenced by differences in clinical training, implant designs, augmentation materials, lab technician capabilities, comprehension of existing science, patient preferences and expectations, and regional variations in costs and reimbursements. While the body of scientific evidence in this field continues to grow, global consensus on many of these key variables remains elusive.

Consequently, a single-round survey was conducted with an international, interdisciplinary panel of experts as part of the 1st Global Consensus for Clinical Guidelines (GCCG) 2025. This initiative, titled "Patient-Centered Clinical Workflow in Implant Dentistry", focused on developing consensus regarding the rehabilitation of the edentulous maxilla. Four distinct surveys were developed to explore expert opinions on various aspects of full-arch maxillary rehabilitation. This summary focuses on the responses collected from Survey No. 1, which specifically addressed the number of implants, the timing of implant placement, and the timing of implant loading in edentulous maxilla rehabilitation.

2 | Materials and Methods

The Ethical Committee of the University of Düsseldorf granted approval for this single-round survey (Protocol no. 2024-2973). The study adhered to the standards outlined in "Good practice in the conduct and reporting of survey research" (Kelley et al. 2003).

2.1 | Study Design

This study was executed as a single-round survey method, designed in preparation for the GCCG Workshop hosted in Boston in June 2025. The primary objective was to investigate emerging trends and advancements in the rehabilitation of the edentulous maxilla, aiming to align clinical practices with existing scientific evidence. By gathering expert insights, the study sought to accurately represent real-world implant treatment strategies, identify gaps in the literature, and highlight discrepancies between expert opinion and current evidence.

The results from the survey were used to formulate key questions for further systematic reviews or direct discussion during the GCCG Workshop by Group 1. The Scientific Chairs of the GCCG (Frank Schwarz, Hom-Lay Wang), with the help of the Survey Panel (Todd Schoenbaum, Giulia Brunello) and the Cross-disciplinary Expert and Patient Panel (Guo-Hao Lin, Franz-Josef Strauss), finalized the questionnaire and managed the selection and invitation of experts.

2.2 | Questionnaire

Questions for experts were developed based on the current literature, covering the area of the number of implants (fixed), the timing of implant placement, and the timing of implant loading in edentulous maxilla rehabilitation. The initial draft of the questionnaire was prepared through the joint efforts of the Scientific Chairs, the Survey Panel, and members of the working groups.

To ensure clarity and relevance, the questionnaire underwent an iterative validation process, involving multiple rounds of feedback and revisions. In addition to the Scientific Chairs, contributors included the Survey Panel and the Cross-disciplinary Expert and Patient Panel. On the basis of their input, the questionnaire was refined before obtaining ethical approval.

The final questionnaire, created in English and designed to be completed in 20–30 min, consisted of 25 items (Appendix S1) organized as follows:

a. declaration of consent (item 1);
b. professional specialization and working environment (items 2–3);
c. implant treatment planning for edentulous maxilla (items 4–5);
d. surgical phase for fixed prostheses (item 6–8);
e. restorative phase (items 9–11, 21);
f. surgical phase for removable prostheses (item 12–14);
g. timing of implant placement and loading (items 15–20);
h. occlusal scheme (items 22–23);
i. fundamental outcomes to be included in future studies (items 24–25).

2.3 | Sample Size, Expert Selection, and Data Collection

There is no universally accepted formula for determining the number of respondents in a single-round survey. However, it was set based on the COMET Initiative guidelines (Williamson et al. 2017) and on previous Delphi studies in the field (Alarcon et al. 2021; Madianos et al. 2016).

A total of 202 experts from 42 different countries were identified and contacted for the study. Given their expertise across multiple areas addressed by the consensus, 14% of these experts

TABLE 1 | Details and distribution by country of the contacted experts.

Country	No.	%
Argentina	3	1.5
Australia	4	2.0
Austria	6	3.0
Belgium	3	1.5
Brazil	12	6.0
Chile	4	2.0
China	6	3.0
Denmark	4	2.0
France	7	3.5
Germany	3	1.5
Greece	4	2.0
Guatemala	1	0.5
Iceland	1	0.5
India	5	2.5
Ireland	1	0.5
Israel	3	1.5
Italy	16	8.0
Japan	7	3.5
Republic of Korea	3	1.5
Lebanon	1	0.5
Malaysia	2	1.0
Malta	1	0.5
Netherlands	2	1.0
New Zealand	1	0.5
Peru	5	2.5
Poland	2	1.0
Portugal	7	3.5
Russia	1	0.5
Saudi Arabia	1	0.5
Serbia	2	1.0
Singapore	2	1.0
South Africa	1	0.5
Spain	9	4.5
Sweden	5	2.5
Switzerland	8	4.0
Taiwan	2	1.0
Türkiye	4	2.0
United Arab Emirates	1	0.5
United Kingdom	9	4.5
Uruguay	1	0.5
United States of America	41	19.5
Zimbabwe	1	0.5

were additionally invited to participate in one of the other three surveys. The detailed distribution of these experts by country is shown in Table 1 and Figure 1. Due to the anonymous nature of the data collection, it was not possible to distinguish between respondents and nonrespondents. The survey link was disseminated via email by the European Association for Osseointegration (EAO) Office to experts who were selected and approved by the Scientific Task Force. Each organization had discretion over the expert selection process, which included members from leading international implant dentistry organizations, such as the Academy of Osseointegration (AO), the EAO, the International Team for Implantology (ITI), and the Osteology Foundation (OF).

The single-round survey commenced on October 3, 2024, and was open for responses until October 25, 2024, a period of 3 weeks. A reminder was sent on October 19, 2024. Participation in the survey was entirely voluntary and without any incentives. The survey was conducted electronically using Microsoft FORMS (Redmond, WA, US). Informed consent was obtained from all participants at the beginning of the survey; if consent was not given, the survey was automatically terminated. All data were collected, stored, and processed anonymously.

2.4 | Agreement Definition

While no universally accepted method exists for defining consensus in single-round surveys (von der Gracht 2012), this study applied the following thresholds for 7-point Likert scale questions:

- **Strong consensus**: achieved when > 95% of the experts "somewhat agreed", "agreed" or "strongly agreed" with the statement made, or alternatively when > 95% "somewhat disagreed", "disagreed" and "strongly disagreed";
- **Consensus**: defined when either agreement or disagreement was greater than 75% and no more than 95%;
- **No consensus**: defined when either agreement or disagreement was 75% or less.

For multiple-choice questions allowing multiple responses, strong consensus for any single option was defined as selection by more than 95% of respondents, consensus as selection by more than 75% and no more than 95%, and no consensus as 75% or less (Diamond et al. 2014).

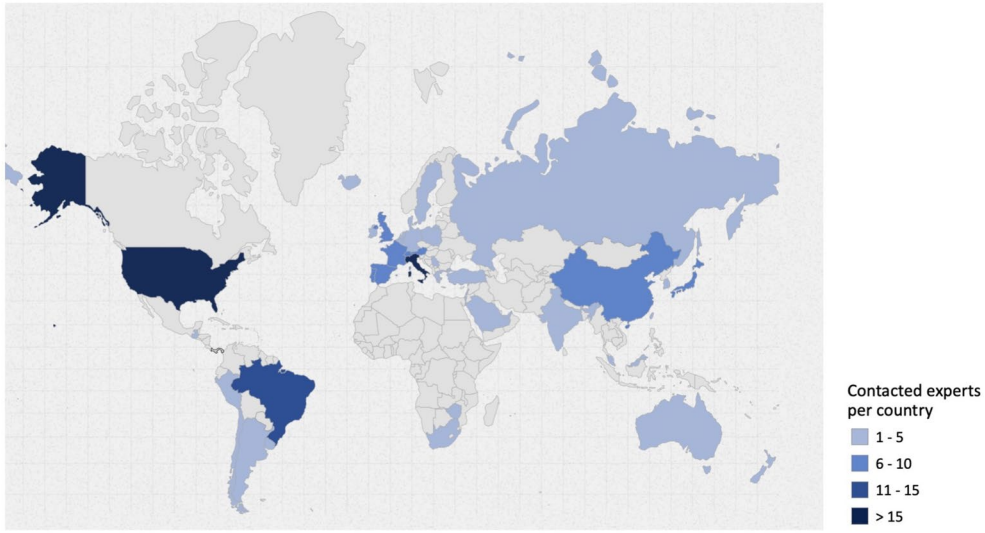

FIGURE 1 | Distribution by country of the contacted experts. Map created using the open source online tool available at https://www.amcharts.com/ (amCharts, Neringa, Lithuania).

2.5 | Statistical Analysis

Each question response was analyzed individually using descriptive statistics, with results presented as percentages. Additionally, the degree of agreement or disagreement for each question was reported as the median score and interquartile range (IQR) (see Figure S1 and S2), following the RAND guidelines (Khodyakov et al. 2023).

In the graphs, the percentage of agreement (%) was calculated by summing the responses "somewhat agree," "agree," and "strongly agree." If the sum of "somewhat disagree," "disagree," and "strongly disagree" was higher, that percentage was reported instead, with clarification provided in the figure footnotes. Summary graphs displaying the median and IQR were created following the RAND guidelines and presented in the supplement (Khodyakov et al. 2023).

All analyses were performed using Microsoft Forms, STATA v18, and GraphPad Prism v10.

3 | Results

Out of 202 contacted experts, 118 accessed the survey. Of these, 117 provided consent and completed the questionnaire, resulting in a response rate of 57.9%. Due to anonymity concerns, information about the respondents' countries was not retrieved, as inviting only one expert from certain countries could compromise confidentiality.

3.1 | Professional Specialization and Working Environment

The majority of experts reported having either one (76.9%) or multiple (15.4%) specialization degrees, while only nine respondents (7.7%) identified themselves as general practitioners. The most frequently reported specialty was Periodontology (43%), followed by Oral Surgery (32%), Prosthodontics (18%), and none (7%). Regarding the working environment, the most commonly selected option was "private clinic" (81.2%), followed by "university" (49.6%), and "public hospital" (3.4%). More than half of the experts (65.0%) worked in only one setting: 57 in private clinics, 18 at university, and 1 in a public hospital.

3.2 | Implant Treatment Planning for Edentulous Maxilla

For the utilization of cone beam computed tomography (CBCT), 83.8% of experts reported always having an indication for its use, while 8.5% reported usually, and 7.7% reported sometimes. None of the respondents selected "never" as an indication for using CBCT.

We asked experts their preferred surgical approach for implant placement in the edentulous maxilla for full-arch fixed treatment; 39.3% of them reported fully guided, 31.6% of them reported traditional prosthesis guided, 18.8% of them reported pilot guided, 9.4% of them preferred completely freehand, and 0.9% of them preferred real time navigation.

3.3 | Surgical Phase for Fixed Prostheses

For a fixed rehabilitation of the edentulous maxilla (opposing a fixed full-arch implant-supported mandibular prosthesis), 72.6% of experts reported 6 implants as a preferred number of implants, 14.5% of them preferred 8 implants, 8.5% of them preferred 4 implants, 3.4% of them preferred 5 implants, and 1.0% of them preferred more than 8 implants. None of the respondents preferred 3 or fewer implants.

Regarding the ideal anterior implant sites for fixed rehabilitation of the edentulous maxilla opposing a fixed full-arch implant-supported mandibular prosthesis, 47.0% preferred lateral incisor

sites, 23.1% favored canine sites, and 17.9% of experts preferred central incisor sites. However, 12.0% of respondents expressed no strong preference for specific anterior implant sites.

For a fixed rehabilitation of the edentulous maxilla (opposing a fixed full-arch implant supported mandibular prosthesis), 80.3%, 12.0%, and 6.8% of experts preferred to have the first molar, second molar, and second premolar as the most distal implant site, respectively. However, 0.9% of the respondents reported having distal to the second molars as the most distal implant site.

3.4 | Restorative Phase

For a fixed rehabilitation of the edentulous maxilla, 66.7% of the respondents preferred a fixed provisional prosthesis, while 32.5% of them preferred a removable provisional prosthesis. The rest of the experts reported not using a provisional prosthesis at all (0.8%).

For the preferred material/design/fabrication for a fixed provisional prosthesis, 83.8% of the respondents reported acrylic provisionals fabricated and completed in a laboratory, while the rest 16.2% of them preferred acrylic converted intraorally for provisionalization.

For the preferred material/design/fabrication for a fixed definitive prosthesis, 30.0% of the respondents reported one-piece full zirconia with titanium abutments or bases, followed by segmented full zirconia with titanium abutments or bases (23.9%), segmented ceramo-metal (12.0%), one-piece ceramo-metal (11.1%), one-piece acrylic with titanium bar or framework (5.1%), one-piece acrylic (Polymethyl methacrylate, PMMA) with titanium abutments or bases (4.3%), one-piece full zirconia with no titanium abutments or bases (4.3%), segmented full zirconia with no titanium abutments or bases (1.7%), segmented acrylic with titanium bar or framework (0.9%), and segmented acrylic with titanium abutments or bases (0.9%). However, 0.9% of the respondents reported none of the above, and 4.9% of the respondents reported other.

For a patient with an edentulous maxilla seeking full-arch fixed implant treatment, assuming the edentulous ridge is visible at full smile, 70.9% of experts preferred an FP1 (a prosthesis with no prosthetic replacement of gingiva) prosthesis with minimal alveoloplasty over an FP3 prosthesis (a prosthesis with prosthetic replacement of gingiva and alveolar ridge) requiring alveoloplasty to conceal the transition. However, 23.9% favored an FP3 over an FP1, while the remaining 5.2% selected other options.

3.5 | Surgical Phase for Removable Prostheses

For a removable rehabilitation of the edentulous maxilla, 81.2% of experts reported four implants as a preferred number of implants, 11.1% of them preferred six implants, 6.0% of them preferred three implants or less, 0.85% of them preferred five implants, and 0.85% of them preferred eight implants. None of the respondents preferred more than eight implants.

For an implant-retained, tissue-supported maxillary removable denture, 28.2% of experts reported needing to replace the retention after 1 year, 25.6% after 2 years, 35.0% within 2–5 years, and 11.2% after more than 5 years. Additionally, 1.6% of respondents indicated other timeframes for retention replacement.

For the utilization of a definitive removable, implant retained (i.e., locators or bar), tissue supported maxillary denture, 17.1%, 72.6%, and 10.3% of experts reported always, sometimes, and never offered this option, respectively.

3.6 | Timing of Implant Placement and Loading

Following immediate implant placements into extraction sockets in the maxilla (in otherwise "normal" sites without the need for extensive hard tissue augmentation), 62.3%, 14.5%, and 23.2% of experts reported provisional delivery whenever possible on the day of implant placement, the day after implant placement, and following osseointegration of the implants, respectively.

We asked experts their minimum value of acceptable RFA (Resonance Frequency Analysis) for immediate, implant-supported, fixed provisionalization for the entire maxilla. Among the respondents, 40.2% of them reported all implants attached to the provisional must have ISQ (Implant Stability Quotient) above 65, 12.8% of them reported all implants attached to the provisional must have ISQ above 50, and 4.3% of them reported all implants attached to the provisional must have ISQ above 35. However, 1.7% of them reported other, and 41.0% of the experts did not use RFA.

Following implant placements into a healed ridge edentulous maxilla (in a "normal" and sufficiently robust jaw), 4.3% of experts preferred to make a definitive impression or scan within a week after implant placements, while 20.5% of them waited for 1–2 months, 47.0% of them waited for 3 months, 23.1% of them waited for 4 months, and 5.1% of them waited for 6 months before making a definitive impression or scan.

In terms of immediate implant placements into extraction sockets in the maxilla (in otherwise "normal" sites without the need for extensive hard tissue augmentation), 3.4% of experts preferred to make a definitive impression or scan within a week after implant placements, while 8.5% of them waited for 1–2 months, 36.8% of them waited for 3 months, 32.5% of them waited for 4 months, and 18.8% of them waited for 6 months before making a definitive impression or scan.

Following modification of the emergence area of a FP1 full-arch provisional in the maxilla (in an otherwise "normal" and healthy patient), 4.3% of experts preferred to make a definitive impression or scan within a week, while 17.9% of them waited for 4 weeks, 11.1% of them waited for 6 weeks, 29.1% of them waited for 8 weeks, and another 29.1% of them waited for 12 or more weeks. However, 6.0% of the respondents did not do FP1, and the rest of them reported other (2.5%).

Following extraction of a maxillary molar, if there is sufficient interseptal bone, 31.6% of experts reported always placing an

immediate molar implant, 38.5% reported doing it sometimes, 19.7% of them reported doing it rarely, and 10.2% of them reported never performing immediate molar implant placement.

3.7 | Occlusal Scheme

For the definitive full-arch maxillary, implant supported, fixed prosthesis opposing a 2 implant retained, removable mandibular acrylic denture, 70.0% of experts preferred having an occlusal scheme of bilaterally balanced group function, 22.2% of them preferred an occlusal scheme of mutually protective occlusion with anterior guidance, while 7.8% of them preferred an occlusal scheme of unilateral group function.

When the scenario involves an opposing full-arch, implant-supported fixed mandibular prosthesis, 33.3% of experts preferred a bilaterally balanced group function occlusal scheme, 47.9% favored a mutually protective occlusion with anterior guidance, and 18.8% preferred a unilateral group function occlusal scheme.

3.8 | Fundamental Outcomes to be Included in Future Studies

When asked about the patient-reported outcome measures (PROMs) to be considered for future studies on maxillary full-arch rehabilitation with dental implants (Figure 2, Figure S1), none of the listed PROMs reached a strong consensus. However, consensus was achieved on seven PROMs, including the quality of masticatory function questionnaire (QMFQ), oral health impact profile for edentulous people (OHIP-EDENT), visual analogue scale (VAS) for satisfaction, numerical rating scale (NRS) for satisfaction, chewing ability questionnaire, denture satisfaction questionnaire, and macro aesthetics questionnaire. In contrast, the micro aesthetics questionnaire did not reach the consensus threshold (66.6%) (median: 5; IQR: 4–6).

When asked about the clinician-reported outcomes (ClinROs) to be considered for future studies on maxillary full-arch rehabilitation with dental implants (Figure 3, Figure S2), strong consensus (97.5%) was achieved on marginal bone loss (median: 6; IQR: 6–7). Consensus was achieved on 13 listed ClinROs: implant survival, vertical bone height assessed on CBCT, surgical complications, prosthetic complications, implant primary stability, peri-implant mucositis and peri-implantitis, ridge width measurement, ridge height measurement, keratinized tissue width, clinician's assessment of treatment success, recommendations for future procedures, surgery difficulty, and plaque score. However, two ClinROs, resonance frequency analysis (median: 5; IQR: 4–6) and duration of the surgery (median: 5; IQR: 4–6), did not reach the consensus threshold, with 50.5% and 62.4%, respectively.

4 | Discussion

This study was designed to gather expert opinions using a single-round survey methodology on the number of implants, the timing of placement, and the timing of implant loading in edentulous maxilla rehabilitation. The results of this single-round survey will be compared with published evidence to inform a consensus development process, identify research gaps, and areas for future investigations. Notable findings from the survey are as follows.

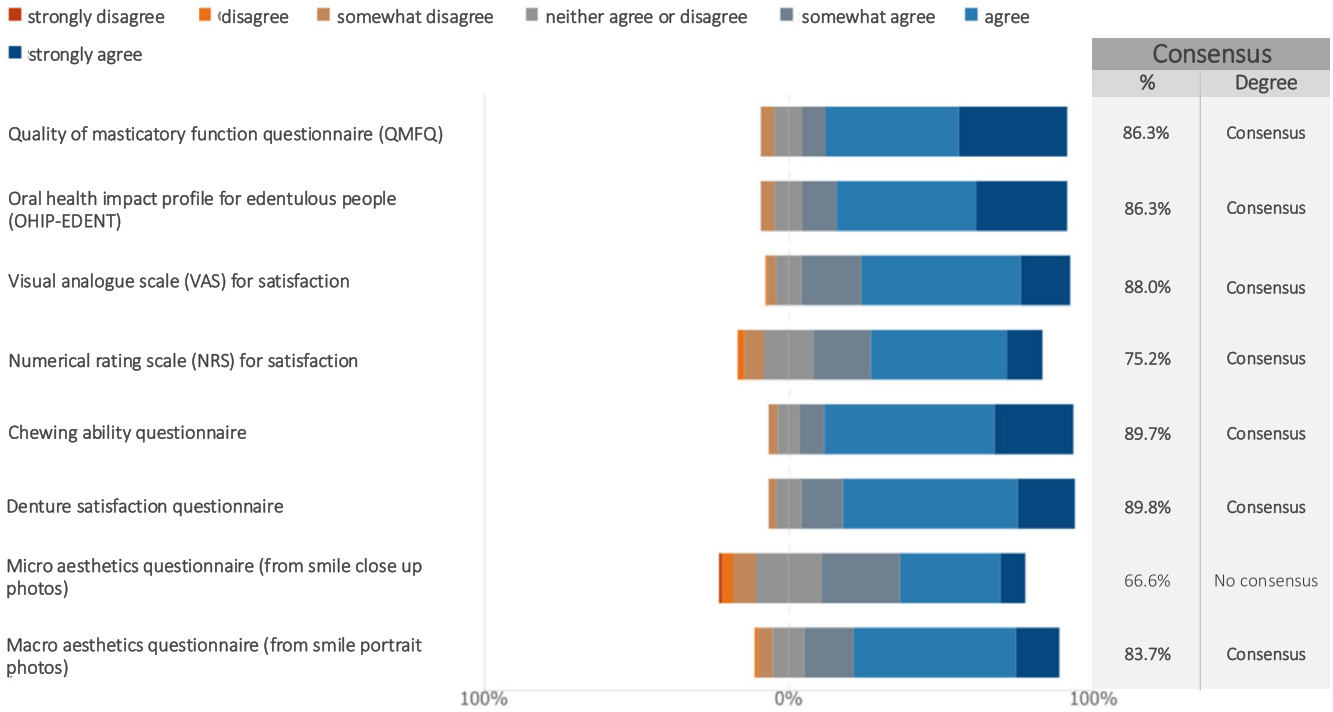

FIGURE 2 | In future studies on maxillary full-arch rehabilitation with dental implants, do you consider relevant the following patient-reported outcome measures (PROMs)?

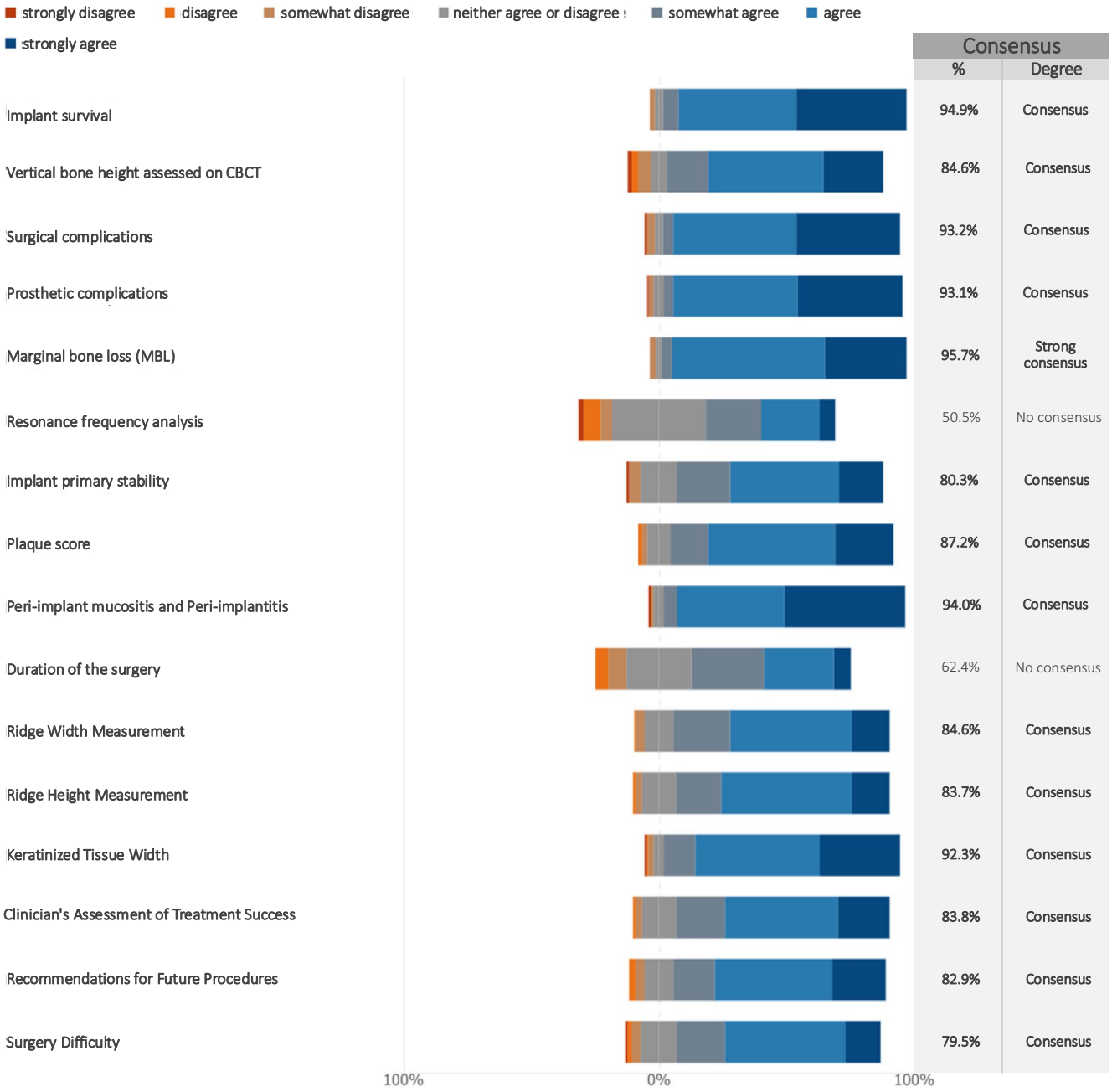

FIGURE 3 | In future studies on maxillary full-arch rehabilitation with dental implants, do you consider relevant the following clinician-reported outcomes (ClinROs)?

4.1 | Implant Treatment Planning for Edentulous Maxilla

There was strong agreement (83.8%) that cone beam computed tomography (CBCT) was always indicated for use in maxillary full-arch implant treatment. This is consistent with longstanding and repeated published guidance on the importance of CBCT use in identifying bone volume, morphology, and relevant anatomical landmarks in implant planning.

Regarding the surgical guidance for implant placement in the edentulous maxilla, the preferences were varied. The most preferred option was to utilize a fully guided approach (39.3%), followed by the use of a traditional prosthesis-guided approach (31.6%). This variation may be reflective of the respondents training background, comfort or experience with the use of a fully guided approach, surgical experience, or preferred prosthetic approach (i.e., the use of multi-unit abutments vs. prostheses directly affixed to the implants).

4.2 | Surgical Phase for Fixed Prostheses

A consensus was reached for the placement of six implants to support a maxillary full-arch fixed prosthesis (72.6%). While 14.5% preferred eight implants, 8.5% preferred four implants.

The preponderance of preference for six implants to support a fixed maxillary full-arch prosthesis is generally consistent with systematic reviews and a recent survey of clinicians. However, the methodology used in one of the systematic reviews included grouping four and six implants as a single variable (Heydecke et al. 2012), and as less than five versus more than five in two others (Daudt Polido et al. 2018; de Luna Gomes et al. 2019). The recent survey of a prosthodontic organization found a similar preference for six implants in the maxilla amongst prosthodontists (Schoenbaum et al. 2020). It is worth noting that the number of implants preferred may also be in part affected by economic and insurance factors in the geographic area.

Regarding the preferred location of the anterior most implants, the preferences were varied. The most preferred option was the lateral incisor sites (47.0%), followed by canine sites (23.1%). This variation may be reflective of the experts proficiency with bone augmentation, preferences of their restorative or technician colleagues, or the use of FP1 vs. FP3 prosthesis designs. 12% indicated "no preference" and it may be that while most respondents did have a preference, that anatomical limitations of the specific patient might dictate alternative, and less desired though still acceptable, sites.

For a fixed rehabilitation of the edentulous maxilla (opposing a fixed full-arch implant-supported mandibular prosthesis), strong agreement was found for the location of the distal most implant site, with 80.3% preferring the first molar position. While 12.0% preferred the second molar position, 6.8% preferred the second premolar position. There are no known published trials demonstrating the superiority of any option for this variable. The preferences noted here are likely to be affected by the prosthesis design/materials used by the clinician and the intended or tolerated distal cantilevers. The preferred distal most implant site may also be affected by the clinician's proficiency level with maxillary sinus augmentation.

4.3 | Restorative Phase

Regarding the preferred provisional design, the preferences were varied. The most preferred option was the use of a fixed provisional prosthesis (66.7%), followed by removable prosthesis (32.5%). This variation is perhaps due to the surgeon's experience and proficiency with performing a denture conversion, having a restorative colleague available to perform the conversion, or having technician support to rapidly fabricate a provisional prosthesis. It may also have been affected by the clinician's patient population preferences or tolerance for a removable prosthesis.

A strong consensus (83.8%) was found for the use of a laboratory fabricated acrylic resin (PMMA) provisional prosthesis. 16.2% preferred the use of an intraorally converted acrylic denture. There are no known published trials demonstrating the superiority of any option for this variable. The preference for a lab fabricated prosthesis vs. intraoral conversion is likely due primarily to clinician workflow, clinician proficiency with conversion, financial considerations, time required to convert, and potentially the durability of the provisional prosthesis. While no known quantification of fracture toughness exists between these two options, it may be that a provisional fabricated as a solid unit would be more durable than a converted prosthesis.

Regarding the preferred material/design/fabrication method for a fixed definitive prosthesis, the preferences were varied. The most preferred option was the use of a one-piece full zirconia with titanium bases or abutments (30.0%), followed by segmented piece full zirconia with titanium bases or abutments (23.9%), segmented ceramo-metal (12.0%), one-piece ceramo-metal (11.1%), one-piece acrylic (PMMA) with titanium bar or framework (5.1%), and all other options below 5% preference. This variation is likely due to the wide variety of viable options available and the individual experts' preferences and tolerances for the limitations of each. It may also be related to the preferred number of implants used, as the segmented approach generally necessitates having at least 6 implants, while the one-piece prosthesis generally requires at least 4. The variation in material selection may be related to the proficiency of the experts' technicians in the satisfactory execution with each.

Regarding the preferred prosthesis design in a patient where the edentulous ridge is visible at full smile, the preferences were varied. The most preferred option was the FP1 (70.9%) (a prosthesis with no prosthetic replacement of gingiva) prosthesis with minimal alveoloplasty over an FP3 prosthesis (23.9%) (a prosthesis with prosthetic replacement of gingiva and alveolar ridge) requiring alveoloplasty to conceal the transition. This variation is perhaps due to the clinician's proficiency with extensive alveolar reduction and a preference to preserve native bone. It may also be affected by the clinician's (or their restorative colleague's) comfort and proficiency with shaping and refining the soft tissues around the prosthesis.

4.4 | Surgical Phase for Removable Prostheses

For a removable rehabilitation of the edentulous maxilla, 81.2% of experts reported four implants as a preferred number of implants. A systematic review (Kern et al. 2016) found that implant loss rates for maxillary overdentures on less than four implants were significantly higher than for four implants (7% vs. 2%; $p < 0.0001$). Similar results were found in a subsequent systematic review (Di Francesco et al. 2019) with 4% implant failure with four or more implants and 7% implant failure with less than four implants.

Regarding the anticipated longevity of the retentive component in a tissue-supported, implant-retained removable denture, the expectations were varied. The highest reported expectation was "2–5 years" (35.0%), followed by "after 1 year" (28.2%). This variation may be due to the preferred number of implants used, the retention device's design (i.e., bars vs. locators), the strength of the retentive inserts commonly used, and the oral hygiene and maintenance instructions provided.

Regarding the practice of offering patients a definitive removable, implant retained, tissue-supported denture, the results were mixed. Most experts did offer it "sometimes" to patients (72.6% of respondents), while 10.3% "never" offer it as an option. This variation may be due to the specific marketing or practice orientation, where some practices may position themselves on only providing fixed implant treatments.

4.5 | Timing of Implant Placement and Loading

Regarding the timing preferences for delivery of a fixed, implant-supported provisional on implants placed into extraction sockets, the responses varied. The most popular approach was "whenever possible on the day of implant placement" (62.3%), followed by "after osseointegration" (23.2%). This variation may be due to the clinician's proficiency with immediate denture conversion, training and experience, the design and expected stability of the implants used, and patient population tolerance for a removable prosthesis.

Regarding clinician preferences for implant stability (ISQ using RFA) for immediate, implant-supported, fixed provisionalization for the entire maxilla, the responses varied. The most common answer was "I do not use RFA" (41.0%). The next most common answer was "ISQ > 65" (40.2%). Other answers were "> 50%" (12.8%), and "ISQ > 35" (4.3%). Amongst RFA users, the strong majority was using ISQ > 65 as their threshold. The variation in the use of RFA may be due to clinician training, exposure, or cost.

Regarding the timing for making a definitive impression or scan, the results were varied. For implants placed in a healed maxillary ridge, the most common answer was "at least 3 months" (47.0%). For implants placed in extraction sockets in the maxilla, the most common answer was also "at least 3 months" (36.8%). The variation including other answers of "at least 4 months", "within a week", and "1–2 months" is perhaps due to variations in the targeted values of initial implant stability, the implant design or surface, implant manufacturer advertising, the number of implants used, and the type of prosthesis (i.e., FP1 vs. FP3).

Regarding the time allowed for soft tissue maturation following modification of the emergence area of a FP1 full-arch provisional in the maxilla, the responses were mixed. The two most common answers were to allow "at least 8 weeks" and "allow at least 12 weeks" (both at 29.1%). The variation in answer for this question are likely due to variations in clinician tolerance for further tissue movement and the pressures or expectations of their individual patient populations.

Regarding the immediate placement of implants into the sockets of extracted molars, the responses were varied. The most common answer was to perform it "sometimes" (38.5%), followed by "always" (31.6%). This variation may be due to differences in the osteotomy protocol, augmentation techniques/materials, and implant designs.

4.6 | Occlusal Scheme

Regarding the preferred occlusal scheme when restoring a definitive full-arch maxillary, implant-supported, fixed prosthesis opposing a two implant-retained, removable mandibular acrylic denture, the results were mixed. The most preferred scheme was "bilaterally balanced group function" (70.0%), followed by "mutually protective occlusion with anterior guidance" (22.2%). This variation may be due to differences in training and experience or the occlusal design of the denture teeth used (i.e., monoplane vs. lingualized vs. anatomic).

Regarding the preferred occlusal scheme when restoring a definitive full-arch maxillary, implant-supported, fixed prosthesis opposing full-arch, implant-supported fixed mandibular prosthesis, the results were varied. The most common answer was to use mutually protective occlusion with anterior guidance (47.9%), followed by bilaterally balanced group function occlusal scheme (33.3%). This variation may be due to differences in training and experience, the prosthetic materials used (i.e., acrylic vs. zirconia), or the occlusal design of the prostheses (i.e., monoplane vs. lingualized vs. anatomic).

4.7 | Fundamental Outcomes to be Included in Future Studies

Experts agreed (> 75%) on the relevance of several PROMs to be used in future studies assessing maxillary implant-supported full-arch rehabilitations, including:

- Quality of Masticatory Function Questionnaire (QMFQ)
- Oral Health Impact Profile for Edentulous people (OHIP-EDENT)
- Visual Analogue Scale (VAS) for patient satisfaction
- Numerical Rating Scale (NRS) for patient satisfaction
- Chewing Ability Questionnaire
- Denture Satisfaction Questionnaire
- Macro-aesthetics questionnaire evaluated through smile portrait photos

There has been an increasing emphasis on quantifying patient experiences through patient-reported outcomes (PROs) using patient-reported outcome measures (PROMs). These are standardized questionnaires designed to assess patient perspectives (Weinfurt and Reeve 2022). PROMs can offer insights into treatment challenges and outcomes in implant therapy (Cosyn et al. 2024; Thoma et al. 2024). This aligns with previous systematic reviews that have highlighted increased interest in PROMs within implant dentistry (De Bruyn et al. 2015; Feine et al. 2018; Yao et al. 2018). It has been suggested that PROM data can enhance patient-clinician communication, thus improving treatment outcomes (Nelson et al. 2015; Sutherland and Till 1993). PROMs may help patients express their goals and concerns more effectively than traditional outcome measures and engage more actively in their treatment discussions (Feldman-Stewart and Brundage 2009; Santana and Feeny 2014).

The survey indicated consensus among experts regarding important clinician-reported outcomes for future research in maxillary implant-supported full-arch rehabilitations. These include:

- Implant survival rates
- Vertical bone height assessments using CBCT
- Surgical complication rates
- Prosthetic complication rates
- Marginal bone loss (MBL) around implants

- Primary implant stability measures
- Plaque accumulation (Plaque score)
- Peri-implant mucositis and peri-implantitis occurrences
- Measurements of ridge width and ridge height
- Keratinized tissue width
- Clinician's overall assessment of treatment success
- Recommendations for future procedures based on clinician experience
- Assessment of the difficulty level of surgical procedures performed

There was consensus among the responding experts for inclusion of most of the PROMs listed. This emphasizes clinician understanding of the importance of a patient-centered approach to implant therapy. Additionally, there was consensus for inclusion of 13 of the proposed ClinROs. These outcomes are aligned with the implant dentistry core outcome set and measurement identified in the ID-COSM initiative (Tonetti et al. 2023).

4.8 | Limitations

This study has several limitations. First, the expert sample was not randomly selected. Although experts from different countries were involved, the sample is not representative (Akins et al. 2005). Moreover, this survey used a single-round survey technique, involving only one round to improve brevity and efficiency.

5 | Conclusions

This survey synthesized the preferences and opinions of experts regarding implant number, timing, and loading for the fixed rehabilitation of the edentulous maxilla in support of creating global practice guidelines.

Author Contributions

Todd R. Schoenbaum: investigation, data curation, writing – original draft, supervision, project administration. **Guo-Hao Lin:** conceptualization, methodology, writing – original draft, writing – review and editing. **Giulia Brunello:** methodology, software, validation, formal analysis, writing – review and editing, visualization. **Franz J. Strauss:** methodology, software, validation, formal analysis, writing – review and editing, visualization. **Frank Schwarz:** conceptualization, methodology, investigation, resources, supervision, project administration. **Ronald E. Jung:** conceptualization, methodology, investigation, resources, supervision, project administration. **Hom-Lay Wang:** conceptualization, methodology, investigation, resources, writing – original draft, writing – review and editing, supervision, project administration.

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Ethics Statement

The protocol was notified to and approved by the Ethical Committee of the University of Düsseldorf (Protocol no. 2024-2973).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Appendix S1:** clr70016-sup-0001-AppendixS1.pdf. **Figures S1–S2:** clr70016-sup-0002-FiguresS1-S2.docx.