

To See or Not to See: How to Measure Patient Satisfaction About Medical Imaging

A Qualitative Investigation into the Applicability of a Patient Satisfaction Questionnaire

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PSY-202000384: M12 BSc Thesis PSY

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June 26, 2023

Abstract

Bearing in mind the significant presence of different 2D and 3D medical imaging techniques in the field of orthognathic surgery (OGS), some of the modalities might be considered by patients to be more informative about their abnormalities and treatment plans, than others. This asks for the establishment of a measure to examine OGS patients' preferences in doctor-patient communication, since OGS patients' requests for treatment accompany significant changes in their facial appearance. Well-informed, shared decision-making concerning the choice to undergo surgery is especially important for these patients, as their psychosocial well-being is at play as well. A patient satisfaction questionnaire aimed at the utilisation of 2D and 3D medical imaging, can shed light on OGS patients' preferences regarding comprehensible imaging techniques. This study, therefore, examined the feasibility of such a questionnaire for a population of Dutch OGS patients, namely the Vragenlijst Inventarisatie Patiënttevredenheid Afbeeldingen (VIPA). In order to pretest the questionnaire, OGS patients were recruited from the University Medical Centre Groningen, based on availability. Medical specialists were approached as well, due to their expertise in informing patients and thus their ability to assess the questionnaire's inclusion of all aspects of the topic. The patients were either assigned to a 2D condition, being informed by regular medical imaging techniques, or they saw 3D holographic images. The qualitative Three-Step Test-Interview method was applied on a sample of nine OGS patients and six medical specialists. This approach provided data on the participants' response behaviour and opinions on the questionnaire were gathered. Thematic analysis was performed to analyse the interview data. Data of both groups contained information relating to the subjects' overall impressions of the questionnaire, formulation, content, format, and attitudes towards medical imaging. Yet, they only seemed to agree on multiple issues in language and VIPA's clearness, but to vary with respect to the questionnaire's applicability. It was found that the VIPA is partially feasible for OGS patients in measuring their satisfaction with medical images. This was due to the preliminary VIPA's focus on a different patient unit, time of implementation, and imaging techniques. Viewing the opinions in light of existing data made the adaptation of the questionnaire possible. Though the final version of the VIPA needs to be validated before implementation, the OGS domain draws nearer to the possibility to employ the most effective, evidence-based medical imaging techniques for their patients. Future research can examine the role of the adjusted VIPA as a uniform patient satisfaction measure with medical imaging for a wider patient population, e.g., different hospitals or similar patients to the OGS domain.

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To See or Not to See: How to Measure Patient Satisfaction About Medical Imaging

The healthcare domain is an ever changing sector, with currently a high need for the provision of healthcare services in the Netherlands (Zeilstra et al., 2019). The growth and popularity of orthognathic surgery (OGS) is, among others, one of the factors that has led to the demand (Kolokitha & Topouzelis, 2011). The average age of the OGS patient population is lowering due to the fact that many patients become conscious of their dentofacial deformities during their early adolescence (Meade & Inglehart, 2010). Furthermore, increased importance is attached to the shared decision-making process between healthcare professionals and patients to reach substantiated decisions in accordance with patients' preferences and their enhanced autonomy (Elwyn et al., 2012; Frosch et al., 2012; Sandman et al., 2011). OGS modifies dentofacial deformities, which denotes maxillary and mandibular irregularities and jaw incongruities, following from for instance dental malocclusion (Khechoyan, 2013; Lin et al., 2018). The OGS unit is part of the broader oral and maxillofacial surgery (OMFS) field that includes serious abnormalities concerned with the mouth, head, and the neck (Ifeacho et al., 2005). Aesthetic improvement has often been found to be the primary motivation of OGS patients to undergo treatment, though they frequently seek treatment because of functional impairments as well (Øland et al., 2011; Vargo et al., 2003; Williams et al., 2005). Considering this main aim, patients are commonly in the position to make requests for undergoing surgery instead of being obligated due to medical necessity (Williams et al., 2005).

Since the anomalies in this field generally affect the appearance of individuals, treatment and surgery can lead to significant changes in their way of looking and consequently to related concerns (Athanasίου et al., 1989; Øland et al., 2011). It has been discovered that successful treatment in the field of OGS can lead to an enhanced self-concept and self-esteem of the patient, as well as improved well-being and overall quality of life (Ghorbani et al., 2018; Lee & Samman, 2008; Øland et al., 2011; Ostler & Kiyak, 1991). However, absence of information before the treatment among this group has led to an impaired psychosocial well-being after the treatment (Athanasίου et al., 1989). Consequently, understanding what the impact is of treatment on their physiognomy stresses the critical role of well-informed patients before making their decision about surgery (Williams et al., 2005). Medical education has even been discovered to be necessary in order to achieve and enhance patient satisfaction (Marcus, 2014).

Linder-Pelz (1982) describes patient satisfaction as “the individual’s positive

evaluations of distinct dimensions of health care” (p. 580). Explicitly, the expectancy disconfirmation theory states that there is a comparison among patients, between expectations (the core standard) and the actual perception of a healthcare service (the experience) (Batbaatar et al., 2015; Serrano et al., 2018). Subsequently, negative expectations followed by positive perceptions lead to positive disconfirmation and thus satisfaction. Negative disconfirmation is the result of the actual experience not surpassing the prior expectations and will realise dissatisfaction (Batbaatar et al., 2015; Serrano et al., 2018). Accordingly, positive perceptions should be aimed for in healthcare service, as these have the potential to rule out negative expectations and to confirm patients’ positive expectations. In particular, patients who were in the position to see their medical image have been found to be more content with the treatment they received than those who were not provided with the medical image (Kendrick et al., 2001). Image-based education can thus lead to the creation of positive perceptions for patients (Marcus, 2014).

Medical imaging is being applied in the healthcare domain and refers to the techniques being used to visualise bodily tissues and organs and thereby their function and structures (Hussain et al., 2022). In order to get insights into OGS patients’ wide range of complicated anomalies and given the demand for accuracy in this domain, medical specialists make use of several medical imaging techniques (Ameerally et al., 1994; Ifeacho et al., 2005; Wang & Ford, 2021). For instance, X-ray photography, such as periapical radiography, is put into practice to detect single-teeth implications (caries) (Wang & Ford, 2021). Furthermore, computed tomography (CT) has the ability to visualise the earlier mentioned dentoalveolar injuries and maxillofacial traumas (Wang & Ford, 2021). In addition, three-dimensional (3D) models, generated from the above mentioned two-dimensional (2D) imaging modalities, have the potential to visualise human anatomy in a manner easily explainable to patients. Different features of the graphical models can be highlighted through rotation on a computer monitor (Caligiana et al., 2020; Erolin, 2019; Phelps et al., 2017).

Moreover, although not fully applied yet in the communication between physician and patient, the addition of newer forms of disclosing medical information to patients, for instance by means of Mixed Reality (MR), seem to have promising effects (Hu et al., 2019; Yusoff et al., 2011). MR moves beyond the limitations of Augmented Reality and Virtual Reality, merging the virtual, computer-generated world with the world of reality, leading to a new space where interaction of digital and physical elements is conceivable in real time (Kitagawa et al., 2022; Milgram & Kishino, 1994; Morimoto et al., 2022; Park et al., 2020; Yusoff et al., 2011). An example of MR technology which is currently being applied in the healthcare

domain is the Microsoft HoloLens (Gsaxner et al., 2023; Stromberga et al., 2021; Tepper et al., 2017). The HoloLens is a head-worn computer, comprising a pair of smart glasses (Gsaxner et al., 2023; Karthika et al., 2017; Stromberga et al., 2021). Hence, the user becomes part of the virtual world through spatial effects, by hearing and seeing its content, along with the original physical world (Karthika et al., 2017; Stromberga et al., 2021). Following its interactive nature, the Lens can support patients in comprehending their health status and treatment possibilities, and create more direct and simple risk communication, given that communication between the physician and patient can be difficult due to a gap in knowledge (Antel et al., 2022; Blanchard et al., 2022; Gsaxner et al., 2023; Pandrangi et al., 2019; J. Zhang et al., 2020).

Presenting 3D visualisations and MR technologies can enhance patients' comprehension with respect to medical information and their diagnosis, in turn leading to a boost in patient satisfaction (Hu et al., 2019; Phelps et al., 2017). This goes along with the fact that 3D prediction planning has the ability to enhance surgical expectations and motivation, to increase the patient's confidence and preparedness, and reduce pretreatment anxiety among OMFS patients (Antel et al., 2020; Hertanto et al., 2021; Mahajan et al., 2021). The wide range of visualisation techniques that are available to inform patients about their medical conditions, highlights the value of investigating patients' preferences and establishing a measure of patient satisfaction with respect to the application of different medical imaging techniques.

As a result of the role that patient satisfaction plays in the healthcare domain, multiple surveys have been designed to measure patient satisfaction in relation to the quality of and experience with healthcare organisations (Al-Abri & Al-Balushi, 2014; Anil et al., 2018; Pusic et al., 2013). However, when focussing specifically on patient satisfaction with regard to medical imaging techniques, only one questionnaire was found. Pinkster et al. (2022) have designed a measure of patient satisfaction with respect to viewing 2D and 3D medical images of patients' damages. They identified two factors which are necessary in comprehending patient satisfaction with regard to medical images, namely: the clearness of the image and the importance of seeing it. Together these scales make up the Questionnaire for Patient Satisfaction with Imaging (QPSI) (see Appendix A for the full list of items of the QPSI). The Vragenlijst Inventarisatie Patiënttevredenheid Afbeeldingen (VIPA), is the Dutch version of the QPSI. The questionnaire has originally been designed to examine patient satisfaction among trauma patients with the aim of determining the extent to which they are satisfied with being informed about their medical conditions utilising 2D and 3D computer imaging

modalities.

The VIPA can operate as a tool to examine the levels of satisfaction among Dutch OGS patients, since it has been found to be the only qualified measure of patient satisfaction regarding medical imaging techniques (Pinkster et al., 2022). Considering the time and resources inefficiency of creating a new measure and the extensive testing that has been employed regarding this survey, the VIPA makes a reliable, preferred fit. However, it is not known yet whether the designed questionnaire is appropriate for OGS patients in the same manner as it fits trauma patients. While, as stated, OGS patients frequently seek care out of aesthetic improvement, this motivation is not necessarily found among trauma patients, who are predominantly in urgent need of treatment (Berben et al., 2008; Øland et al., 2011). Moreover, differences in interactiveness between the 3D computer imaging modality used for the creation of the preliminary VIPA and the new focus on MR holographic images, is an additional reason for the necessary reassessment of the fittingness of VIPA for OGS patients.

Aim Study

Bearing in mind the significant presence of different medical imaging techniques in the field of OGS, the patients might consider some to be more informative about their anomalies and treatment plans, than others. Gaining insights into the patients' (group specific: age, diagnosis, level of education) preferences is of great importance as this can secure their satisfaction by having their expectations met by the actual experience (Batbaatar et al., 2015; Serrano et al., 2018). This study, therefore, aims to arrive at a tool to measure these preferences, by investigating the suitability of the VIPA, as a satisfaction measure with 2D and 3D medical images, for OGS patients.

The essentiality of involving respondents in the process of examining the reliability of questionnaires, as well as its pretesting to prove their validity, stresses the importance of including OGS patients in this study (Hilton, 2015). Medical specialists' (e.g., radiologists, doctors, technical physicians, and surgeons) experiences can add to the optimisation of the questionnaire as well, as they have a crucial role in providing the patient with knowledge regarding their medical situation (Brock, 1991; Emanuel & Emanuel, 1992). Moreover, involvement of experts is essential to reach content validity, by assuring that only vital questions are incorporated (Hilton, 2015; Taherdoost, 2016). Including both groups can also identify whether these two groups are on the same line with respect to their opinions, following their gap in knowledge (Antel et al., 2022). By including both perspectives, an important goal within the speciality of OMFS, which is ascertaining well-organised service,

by tailoring treatment and hospital policies, can be achieved (Ifeacho et al., 2005). This improvement of doctor-patient communication can enhance patients' feelings of empowerment and their involvement in the decision-making process (Urlings et al., 2022; Ware et al., 1983; Williams et al., 2005).

Hence, in order to examine whether the VIPA can be applied to OGS patients, the following main research question has been defined: *To what extent is the VIPA feasible for the population of OGS patients?* For this examination, various (sub) questions are posed:

- What needs to be adjusted to make the VIPA suitable for OGS patients?
- What are the perceptions of OGS patients and medical specialists on the VIPA?
 - What are the similarities between the perspectives of OGS patients and medical specialists on the usability of the VIPA?
 - To what extent are all questions of the VIPA applicable for OGS patients?
 - What topics needed to measure patient satisfaction among OGS patients are missing?
- What refinements have to be made to bring about a final VIPA product employable for OGS patients?

Method

Design

The current study aimed to test a questionnaire of patient satisfaction about 2D and 3D medical imaging among OGS patients and medical specialists in order to adjust the questionnaire to make it feasible for future utilisation. Hence, a qualitative design, more specifically, semi-structured interviews as part of the Three-Step Test-Interview (TSTI) method have been performed. The obtained observational data and first-hand insights regarding their perspectives on both the questionnaire and image-based education were used to investigate the suitability of the questionnaire.

Participants

The present research population contained OGS patients from the UMCG as well as medical specialists. Beforehand it has been decided upon to exclude patients who were not able to sufficiently speak and understand Dutch, as the goal of the study was to test a questionnaire written in Dutch. Furthermore, only participants with an age of 16 or higher were able to take part in the study. With respect to the medical specialists, exclusively those who were familiar with the OGS department and therefore in the position to judge whether the

questions would be relevant for this target group could test the VIPA. All medical specialists needed to have experience with the application of medical imaging in the healthcare domain. Both OGS patients who already received treatment and patients who only had their first consultation in the UMCG were accepted to take part in the study.

This research established a sample size in accordance with the research goal and the specificity of the sample to reach sufficient information power (Malterud et al., 2016). Specifically, the present study contained a narrow aim, considering the wish to tailor the VIPA to OGS patients. Since the actual target group was involved in the study as well, it was determined that a rather small sample size of approximately 15 to 20 participants would suffice for this qualitative study (Boddy, 2016; Malterud et al., 2016).

Participants have been selected based on convenience sampling. A total of 15 individuals participated in the study (see Table 1). Six medical specialists shared their insights. Among the specialists were four OMFS surgeons, a technical physician specialist, and a dental technician. They had an age range from 33 to 58 ($M_{age} = 43.0$, $SD_{age} = 8.9$). All six medical specialists identified themselves as male. Nine patients took part in the current study. The age of the patients ranged from 16 to 43 ($M_{age} = 24.2$, $SD_{age} = 9.7$). Of these nine patients, five identified as female and four as male. Four OGS patients were part of the condition in which the regular medical imaging technique was being shown. Five OGS patients were informed by means of an MR technology, the HoloLens II (Microsoft, Redmond, Washington, United States). Prior to the study, all participants were asked to give consent for their participation. The Ethics Committee of the University of Twente approved the bachelor's thesis project (request number: 230195).

Table 1
Sociodemographic Characteristics of the Participants

Sample Characteristics	<i>Medical Specialists</i>		<i>Patients</i>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
Gender				
Female			5	56
Male	6	100	4	44
Education				
Primary education			1	11
Pre-vocational secondary education				
Secondary vocational education			5	56
Senior general secondary education			1	11
Pre-university education				
Higher professional education	1	17	1	11
University education	5	83	1	11
Hospital				
Martini hospital	1	17		
Ommelander hospital Groningen	1	17		
University Medical Centre Groningen (UMCG)	2	33	9	100
University Medical Centre Utrecht (UMCU)	2	33		
Function				
OMFS surgeon	4	66		
Technical physician specialist	1	17		
Dental technician	1	17		
Abnormality				
Mandibular Retrognathia (class II malocclusion)			6	67
Maxillary Hypoplasia (class III malocclusion)			3	33
Type of medical imaging technique				
2D images			4	44
3D images			5	56

Proposed treatment		
BIMAX	3	33
BSSO	6	67

Note. This table demonstrates the sociodemographic characteristics of the participants who were subject to the research study. n = number of cases, % = percentage.

Materials

The Vragenlijst Inventarisatie Patiënttevredenheid Afbeeldingen (VIPA), designed by Pinkster et al. (2022), was applied as a medical imaging satisfaction measure among the participants (see Appendix B for the VIPA). The survey comprises two subscales, namely the level of clearness of the image and the level of importance of seeing the image (Pinkster et al., 2022). A total of 13 items make up for the complete questionnaire. Respondents can indicate their answers on a 5-point Likert scale, varying from ‘Strongly disagree’ (1) to ‘Strongly agree’ (5). Measuring the clearness is done by using items such as: ‘The image provided clear information about my injury’. Asking patients about their view on the importance of seeing medical images is possible using items like: ‘The image made the explanation of my injury more understandable’ (Pinkster et al., 2022). The two subscales were found by Pinkster et al. (2022) to be weakly correlated ($\rho = .34$), indicating two rather distinct characteristics of patient satisfaction. Next to that, the clearness and importance items demonstrated to be highly relevant based on reliability analyses ($\alpha = .75$ and $\alpha = .84$) (Pinkster et al., 2022). The initial items have been slightly adjusted based on a literature review on OGS patients’ satisfaction with medical imaging in order to account for differences in terminology applicable to the altered patient group.

The Three-Step Test-Interview (TSTI) was applied to test the usefulness of the VIPA for OGS patients. The TSTI is a method of pretesting self-completion questionnaires, by means of both observations and interviews, which comprises three rounds (Di Malta et al., 2020; Hak et al., 2004; Paap et al., 2015). The goal of the technique is to identify potential issues and gain insights into the subject’s responding process, which thus enabled the examination of the suitability of this measure (Di Malta et al., 2020). The qualitative method was also selected as a manner of investigation, as in order to apply the TSTI, researchers are generally not required to have expert knowledge about the questionnaire (Beatty & Willis, 2007). Given the questionnaire’s medical nature, researchers from other scientific departments were still considered to be able to lead the pretesting. Other than that, the TSTI gave the opportunity to collect data from two different groups (patients and medical specialists), which facilitated a comparison in similarities between their perspectives.

The first step of the TSTI serves the purpose of having the participants verbalise their thoughts while completing the questionnaire. This provides the researcher with observational data on the participants’ thoughts with respect to the survey and on their response behaviour. Thereafter, during the second round, the researcher asks clarifying questions on these thoughts and behaviours by means of a focused interview, if applicable. After completion of

the questionnaire by employing the TSTI, the subjects are asked additional questions pertaining to the questionnaire that is being tested.

In the present study, open-ended questions were asked to the participants by means of a semi-structured interview (see Appendix C for the interview scheme). These questions related to the questionnaire itself, such as its items. These insights were gained by asking questions such as: “What is your opinion about the questionnaire?”. Besides that, all participants were questioned about whether they perceived the survey as representative and complete. Patients were given the opportunity to speak about their views on being informed through medical images about their anomaly and/or treatment options during consultations as well. The medical specialists were asked different questions regarding this latter topic, due to their role as healthcare provider rather than receiver.

Procedure

The first phase of the study consisted of a literature search with the aim of adjusting the VIPA to make it suitable for administering to OGS patients (and specialists). As stated, the VIPA was designed with a focus on trauma patients and 3D computer images. Pretesting of the questionnaire was thus facilitated by examining existing literature on commonly applied terminology concerning OMFS/OGS patients and their medical conditions. Furthermore, completeness of the VIPA was investigated by viewing the existing items in light of research on patient satisfaction of OGS patients. Finally, a focal point in the study design on holographic images, rather than 3D computer models, asked for a review on language use relating to 2D images and 3D holographic images. The findings were compared to the original VIPA, and necessary adjustments were made.

During the second phase, the participants recruited by a technical physician based on availability were involved in the research. The medical specialists were contacted in time by the technical physician regarding their interest to participate. In the case of the patient participants, they first had their consultation in which they were either shown 2D or 3D medical images. The images shown in the 2D condition were dependent on their diagnosis. These patients were provided with an illustrative YouTube video on the treatment planning or an information folder as well. The 3D images that were provided by the HoloLens were two holograms of a male Maxillary Hypoplasia (class III malocclusion) patient, before and after undergoing surgery. The technical physician demonstrated the manner in which the patients had to wear the headset and how they could interact with the two holograms, by zooming in and out and by twisting and turning the projections. Walking around the projections was

possible for them as well due to the projections' stationary nature in the room. After the OGS patients finished their consultations, they were asked to participate in the study and were forwarded when they were willing to do so. Pretesting of the VIPA took place in a separate consultation room.

At the start of the study, all participants were handed a consent form on which the aim of the research was stated and instructions were given (see Appendix D for the informed consent form). Details were also given on the option to record the interview, the manner in which the data would be handled, maintenance of anonymity and confidentiality, voluntary participation, and the possibility to withdraw. Ultimately, the research candidates were asked to give consent for their participation. Thereafter, the respondents were offered oral instructions regarding the process of the TSTI. This included an exercise to practise with thinking aloud. As a result, the participants could practise saying their thoughts out loud and they knew what was expected from them.

Following, when the procedure was clear for the subjects, the recording of the procedure started and the participants were handed the VIPA and asked to complete it. Besides the 13 items, all participants had to disclose their demographics before completing the items. The questionnaire ended with a question on the general satisfaction about the usage of images and whether they would recommend other patients the utilisation of medical images during consultations. Additionally, the technical physician had to elaborate information on the medical conditions of the patients. Throughout this first round, the subjects were asked to think aloud, while going through the questionnaire. This way, the researcher could gain observational data as the respondents made their thoughts regarding completion of the test noticeable and their responding behaviour could be viewed.

Throughout completion, the participants were encouraged to express their thoughts by saying, for instance, "Please say aloud what you are thinking." Indications of confusion, skipping a question, or other striking behaviour were all written down by the observer. Notes on unclear and/or incomplete thoughts were made as well. To ensure that their thought process was fully captured, during the second step a focused interview took place where the participants were asked more in detail about some of these unclear thoughts and behaviours while completing the survey. This was accomplished by asking "Did I hear you say...?" or "When you read/wanted to score item X, you stopped for a moment, what were you thinking at that moment?"

The final round served the purpose of obtaining knowledge about the respondent's thoughts on the questionnaire. Based on semi-structured interviews with open-ended

questions, the researcher asked the participants about their opinions on the questionnaire and the items, as well as the subjects' thoughts on its representativeness in measuring OGS patients' satisfaction. Additional probes were utilised in order to encourage the participants to continue expressing their feelings and opinions. Going through all the steps of the TSTI took approximately 20 to 60 minutes.

The semi-structured interviews took place immediately after the focused interviews were completed. An interview scheme was applied during the interview and depending on the extent to which the participants answered questions extensively, various questions were posed. The technical physician actively joined some of the conversations, especially those with the medical specialists, as they were often interested in technical aspects of the HoloLens or UMCG's future application of the questionnaire. One of the patients did not give consent for an audio recording, therefore notes of this subject's answers were made during all TSTI steps. Three of the interviews with medical specialists took place via Microsoft Teams meetings. These participants were sent both the informed consent form and VIPA beforehand. The filled in documents were sent back to the researcher after the procedure was completed. All subjects were visible to the researcher while filling in the survey by having turned on their cameras. This ensured that the TSTI procedure could still be practised.

Analysis

The recordings of the interviews formed the basis of the analysis. Orthographic transcription had been applied to account for the experiences of the participants. Thematic analysis was employed as a method of analysing the interviews, considering the interest in what the participants said. This form of analysis supported the identification of commonalities in the views of OGS patients and medical specialists on the VIPA, since its aim is to shed light on meaningful patterns within data (Braun & Clarke, 2006, 2012). The data sets from the patients and the medical specialists were analysed separately, due to differences in their roles. This allowed the examination whether the actual target group, and the specialists who have wide knowledge on the topic of the questionnaire, shared the same opinions regarding the questionnaire. In the case of contradictory views and their frequency, it could thus be examined in what manner great importance should be attached to these perspectives, which opinions had to be adopted, and to what extent the questionnaire was suitable for OGS patients.

Braun and Clarke's (2006) "six-phase approach to thematic analysis" was applied to conduct the thematic analysis. During the first phase, the data corpus (i.e., collection of all the

data) was scanned. Thereafter, the individual interviews were repeatedly read and notes were made relating to important verbal information. This facilitated generation of initial codes, which were labelled in Microsoft Word. According to Boyatzis (1998) a code can be defined as “the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon” (p. 63). In creating these codes, the researcher was constantly on the lookout for specificity, relevance, as well as clarity, and consistency. These labelled aspects in the data set were then utilised to group the codes together to identify prospective (sub-)themes. As part of the fourth phase, the initially constructed themes were examined more extensively, leading to combined, split up or even excluded themes. At last, the resulting themes were named and explanations on what information the theme captures (in relation to the research questions) was denoted. Constant comparison was utilised as a method to facilitate the identification of commonalities. The thematic analysis eventually led to a number of themes in relation to the participant’s opinions on the questionnaire and their perception on medical imaging. After extensive revision of the codes and corresponding themes, the finalised coding scheme was used to code the interviews and the frequency of the codes was determined.

Throughout the analysis, an inductive approach was practised as the codes and themes resulted from the interview data (Braun & Clarke, 2006). The codes were designed after an extensive, iterative process of revision. This method shed light on the content of the verbal data of the participants, rather than taking into account fixed theories on how the codes should look like, as the exploration was data-driven (Braun & Clarke, 2006; Linneberg & Korsgaard, 2019). This was crucial as in order to test the questionnaire among the participants and to include their opinions in an unbiased manner, being influenced by knowledge about how the participants would perceive the questionnaire, would not allow for a complete extraction of their most important views. Hence, the inductive approach enabled to accurately act for the participant base.

In order to establish inter-rater reliability, a third year bachelor’s student studying psychology was asked to analyse the coding structure of a by chance-selected transcript from a medical specialist and an OGS patient, utilising the finalised coding scheme. The student had prior knowledge and experience in the process of qualitative coding, but was not aware of the specifics of the study itself. By having an independent party analysing the data items, the quality of the codes was improved by aiming for intercoder agreement.

After the reliability was established, the systematic overview of the data that was created allowed for the discovered themes of both groups, as well as its contents, to be

compared to each other. After the similarities between the two subject groups were established, this result was evaluated in light of related literature. By considering both views, answers have been found in relation to the applicability of the questions, missing topics, and the opinions on the use of medical imaging. Reviewing these, by examining literature on patient satisfaction, OGS patients, and image-based education, led to the adjustments for the questionnaire, reaching a final version of the VIPA.

Results

The goal of this research study was to tailor the VIPA to a population of Dutch OGS patients. Examining literature on the language use that applies to the OGS domain and pretesting the questionnaire among a group of OGS patients and medical specialists shed light on the applicability of the VIPA in measuring the satisfaction of these patients with image-based education.

Phase 1

During the first phase of the study, literature has been gathered on the wording and medical terms that the OGS patients seem to be familiar with, to examine whether this was in accordance with how the original VIPA was written. Based on the literature search, it has been found that in terms of correct terminology for the medical conditions of OMFS patients, they are frequently referred to as abnormalities, discrepancies, deformities, and asymmetries instead of injuries (Ifeacho et al., 2005; Khechoyan, 2013; Lee & Samman, 2008; Lin et al., 2018). Hence, the term injury (letsel) was replaced with abnormality (afwijking) (see Appendix E for the adjusted questionnaire after phase 1). Furthermore, the questionnaire was in need of an umbrella term covering the rather different 2D images and 3D holographic images. Subsequently, the image (afbeelding) construct has been changed into image (beeld). Note here that only an adjustment was necessary to the Dutch term used in the VIPA as the verb 'image' applies to both meanings. Moreover, the completeness of the questionnaire was examined. Table 2 provides an overview of the items' coverage of potential relevant topics relating to both trauma and OGS patients' satisfaction with medical imaging, to account for their (dis)confirmation.

Table 2

Overview of the Inclusion of Potential Aspects Relating to Trauma and Orthognathic Surgery Patients' Satisfaction with Medical Imaging in VIPA

Original questionnaire item	Topics relating to trauma patients' satisfaction with medical imaging	Topics relating to OGS patients' satisfaction with medical imaging
Item 1. The image provided clear information about my injury	Comprehension of information provided by images Information offering Clearness of the information obtained by the patients	Understanding of disclosed information Quality of doctor-patient risk communication
Item 2. The image was necessary to understand the doctor's explanation of my injury	Comprehension of information provided by images	Understanding of disclosed information Quality of doctor-patient risk communication
Item 3. Seeing the image allowed me to make a well-considered choice about my follow-up treatment together with my doctor	Role of information provision in the decision-making process	Quality of doctor-patient risk communication
Item 4. I understood the doctor's explanation of the image	Comprehension of information provided by images Clearness of the information obtained by the patients	Understanding of disclosed information
Item 5. The image motivated me to adhere to the doctor's recommendations	Role of images in complying to the treatment	
Item 6. I am confident that an image contributes to a correct diagnosis of my injury	Patients' anxieties Clearness of the information obtained by the patients	Presurgical anxiety Degree of pretreatment trust
Item 7. Prior to my treatment, I expected to see images during a consultation	Information offering Patients' treatment prospects	Prior expectations

Item 8. Seeing the image of my injury was very important to me	Patients' anxieties	Presurgical anxiety
Item 9. When I got home, I could remember the information about my injury because I had seen an image during my consultation	Role of images in remembering information	
Item 10. The image made the explanation of my injury more understandable	Comprehension of information provided by images	Understanding of disclosed information Quality of doctor-patient risk communication
Item 11. I think the image provided me with a reliable impression of my injury	Information offering Clearness of the information obtained by the patients	Degree of pretreatment trust
Item 12. Seeing the image during consultations was reassuring for me	Patients' anxieties	Presurgical anxiety
Item 13. The image motivated me to work on my recovery	Role of images in complying to the treatment Role of images in the course of recovery	

Note. This table demonstrates potential, important topics that relate to patient satisfaction with medical imaging for trauma patients (original target group of VIPA) and orthognathic surgery patients (new target group of VIPA). The facets are shown in relation to the questionnaire's items.

Facets of trauma patients' satisfaction with medical imaging that were included in the original VIPA related to, for instance, the comprehension of information provided by the images, the role of images in remembering information and complying to treatment, and patients' anxieties (Pinkster et al., 2022). With respect to the relevant factors to reach patient satisfaction with medical imaging among OGS patients, presurgical anxiety, prior expectations, understanding of disclosed information, degree of pretreatment trust, and the quality of doctor-patient risk communication were identified as potential contributors (Al-Hadi et al., 2019; Hertanto et al., 2021). Taking into account that the original list of items already included questions related to these topics, no extra items were added to measure patient satisfaction. In addition, the original VIPA included a statement about the moment of filling in the survey, which had to indicate the number of weeks since the accident of the patient happened. Because OGS patients generally do not owe their abnormality to an accident, this was changed into 'number of weeks since first consultation', to get a feeling of how far the patients are in their process. The modified VIPA was utilised during the second phase of the study.

Phase 2

As for the second phase, results were collected on the opinions of the participants regarding the VIPA and its suitability to be applied in practice. Due to their differing roles, coding schemes were separately created for patients and medical specialists. An overview of the identified themes and codes relating to the patients, following the pretesting and interviews, is shown in Table 3. The table shows that overall five themes have been identified, that is, *overall impression of the questionnaire, formulation (and language), content, format, and attitudes towards medical imaging*, with ten corresponding codes in total. Definitions of the codes and the frequency of occurrence of the codes have been notified as well. In addition to the ten codes that were designed, a code to label chunks of information which was not relevant in order to answer the research questions, namely 'Other (uncodable)', was selected.

Table 3

Thematic Analysis: the Identification of Codes and Themes for Orthognathic Surgery Patients

Theme	Code	Definition	Quote	Frequency, <i>n</i>
Overall impression of the questionnaire	(1) General views on the VIPA	The opinions of OGS patients on the VIPA in general and its representativeness for them as a group of patients	“I think the questionnaire is fairly well composed. I also find the questions logical, and as I think about it, I understand the purpose. So yeah, I don’t really have any doubts about it.”	22
	Formulation (and language)	(2) Type of language used	General perception on the type of language that is applied in the questionnaire	“I thought the language used was clear and understandable, without too much jargon or technical terms. It was suitable for everyone. Although I have a higher education, I believe someone without formal education could easily comprehend it. So, I think that was well done.”
Content		(3) Perceived issues in language	Expressed confusion about or issues with the manner in which the instructions, respondent characteristics, and the questions are phrased	“What does ‘abnormality’ mean?”
	(4) Question is not applicable	The relevance of the questions that are being asked to measure specifically OGS patients’ satisfaction with medical imaging	“I haven’t been home yet, so do I have to fill it out?”	14
	(5) Wrong interpretation	Wrongful and incongruent understanding by the participant of the questions in relation to the items’ intended meaning	“Yes, I have been thoroughly examined and I think what is meant by advice is that we have discussed together what the best course of action is now, that’s basically what it comes down to.”	10
Format	(6) Length of the	The suitability of the number of questions and the length of the items	“[...] I think that 13, 13 questions is really enough.”	6

	questionnaire			
	(7) Lay-out and formatting	The contentment with the visual representation of the questionnaire	“I think the lay-out is neat. It’s clear, organised and straightforward. Not too cluttered.”	7
	(8) Suggestions for structure/layout changes	Suggestions to make changes to the structure and lay-out of the VIPA with the aim of improving the questionnaire	“I would have completely [...] made the answer compartments a bit smaller myself and the reading compartments slightly bigger.”	5
	(9) Answering options	Thoughts on the 5-point Likert scale that is utilised to score the items	“I also liked that there is not so much [...], when I see those first 13 questions, for example, that you can choose between strongly agree, strongly disagree, so to speak. I really like the fact that there aren’t that many choices.”	4
Attitudes towards medical imaging	(10) Perceived effectiveness of medical imaging in patient education	Views of OGS patients on the benefits, and drawbacks of the utilisation of medical imaging techniques to be educated about their abnormalities and/or treatment options leading to patient satisfaction	“But I also think that by showing images and using images, the brain stores the image more easily. I can say 20 words to you and you don’t quite know them. But I can show you one picture, with those 20 words in it, and I think you’ll remember it all.”	22
	(11) Other (uncodable)	Feedback and/or information that is not relevant for this research		

Note. This table demonstrates the results of a performed thematic analysis on the data of OGS patients. Included are the identified themes and their matching codes, definitions of the codes, example quotes and the frequency of the occurrence of the code; n = number of cases.

Overall Impression of the Questionnaire

(Dis)satisfaction in relation to the questionnaire was a common aspect that OGS patients expressed while completing the VIPA and/or when being questioned about their perspective on the questionnaire. The theme ‘Overall impression of the questionnaire’ highlights patients’ opinions with respect to the survey. By focussing on various aspects of the VIPA, many participants could voice their opinions on the extent to which the questions accurately capture their experiences. The theme therefore specifically describes their general views on the VIPA and its representativeness. On the whole, OGS patients have been found to be rather positive with regard to the utilisation of the VIPA. Overall, they describe the questionnaire as orderly and clear.

Patient 1 called the survey to be focused by stating: *“It really gives me the impression that the research was really about the images. So, what do those images do during my consultation? So that was [...], I found it very targeted. It doesn’t go all over the place.”* Patient 3, stated that the questions are too focused on images, missing the role of the doctor and its advice. However, this latter view is not in line with the aim of the questionnaire itself. Various interviewees claim that the VIPA is a complete, representative questionnaire for them, and did not have suggestions to add questions in order to truly measure their satisfaction with medical imaging techniques.

Formulation (and Language)

The manner in which the respondent characteristics (clinical characteristics and demographics), the instructions, and questions were phrased and the general type of language applied in the questionnaire, made up the theme ‘Formulation (and language)’. With regard to the type of language being used in the questionnaire and the extent to which this was comprehensible for the patients, one patient stated: *“I thought the language used was clear and understandable, without too much jargon or technical terms. It was suitable for everyone.”* Other participants agreed by saying that the wording was fine and understandable. Patient 2, however, said that she perceived some words to be a bit difficult, as Dutch was not her first language. Patient 6 argued the same when he mentioned that for some people challenging words are used. Stating their thoughts out loud and/or asking during the interview which words they were referring to, identified the second code relating to this theme, namely ‘perceived issues in language’.

Focussing on the perceived issues patient 2 and 6 were talking about, patient 2 stated that concepts such as: recommendation, abnormality, consultation, and impression, were

complex and she asked twice what was meant with ‘images’. In addition to the term ‘consultation’, patient number 6 said that ‘diagnosis’ and ‘well-considered’ were hard to understand for him. Moreover, ‘highest level of education’ (hoogst genoten) and ‘recommendation’ were identified as issues. Subject 5 revealed that she was not sure whether the recommendation concerned a pretreatment or post treatment situation. Besides, one of the respondents experienced issues in the formulation of the third statement ‘Seeing the image allowed me to make a well-considered choice about my follow-up treatment together with my doctor’, asking: “*That I knew what I wanted to do? Or? I don’t really quite get it.*”

Content

The next theme ‘Content’ deals with the suitability of the questions being asked as well as the patients’ meaning-making of the content of the questionnaire. Information on this theme was gathered by analysing the thoughts that the participants mentioned while reading and answering questions. Although their general views on the VIPA showed that they were pleased with the questions’ representativeness, the think aloud procedure identified questions that were not applicable in measuring their satisfaction. For instance, patients stressed regarding the item ‘The image motivated me to adhere to the doctor’s recommendations’, that they did not receive recommendations yet, except that they had to think about it (the treatment options). Patient 8 questioned the relevance of the question itself. Additionally, with respect to the patients’ ability to make a well-considered choice about their follow-up treatment, one of the interviewees indicated that she is not that far in her process yet. Similarly, one patient was struggling to give an answer to the final statement about the motivation to work on their recovery after having seen the image, stating that she did not receive treatment. Patient 4 highlighted the unrepresentativeness of question 9: “*I haven’t been home yet, so do I have to fill it out?*”

Furthermore, as a consequence of the think aloud method, patients felt the need to explain the extent to which they agreed with the questions themselves. Though this was not the instruction, this revealed various indices in which they interpreted the statement in a wrong manner. The fifth item has been interpreted incorrectly multiple times. The aim of the question is to focus on the role of the image in following the postoperative instructions given by the doctor. However, patients viewed the question in light of being motivated to take on the advice of the doctor and to agree with the suggested treatment plan or the motivation to undergo treatment knowing what they would look like after the treatment. The goal of the final item is to examine the level of motivation in relation to working on side-effects of the

surgery. This question was subject to wrongful interpretations by the patients, since patients agreed with the statement, while they did not receive any form of treatment yet. Patients interpreted the item as being motivated to undergo the treatment, thereby identifying recovery as changing their current state of abnormalities.

Format

Besides, the TSTI procedure offered data on the satisfaction of the OGS patients with reference to the lay-out and answering options of the VIPA, as well as its length, and suggestions for structure changes, leading to the theme 'Format'. One patient signalled that the questions were quite long for her as a dyslexic. Two participants agreed that the questionnaire contained several lengthy questions. Other patients' opinions conveyed pleasure with respect to the number of questions, stating that the amount was doable. In general, all participants communicated contentment by calling it a clear document, making it easy to understand what is expected from them, as well as well-structured and neat. Suggestions for lay-out changes related to adjusting the sizes of reading and answering compartments or adding comment boxes. Next to this, patients specifically mentioned the answering options. These views were contradictory as one stated the presence of too many options, while others were content.

Attitudes Towards Medical Imaging

The standpoints of the patients towards the role of medical imaging in patient education delivered insights into benefits and drawbacks of image-based education, making up the final theme 'Attitudes towards medical imaging'. Taking a comprehensive view, OGS patients signalled the effectiveness for the doctors as they considered that it would simplify their task to explain the information to the patients. Furthermore, several patients claimed that the images aid them in understanding their medical conditions. On top of that, patient 1 and 2 contended that the images enhance their memory recall. The man also communicated the improved involvement of the patients as they can assess the images themselves. Nonetheless, patient 1 mentioned that not all patients benefit from the medical images, as he imagined that it can be confronting as well. The subjects in the 3D condition perceived the interactiveness of the HoloLens to be insightful. However, patient 5 voiced her opinion on the difficulty in relation to the control of the technique. Still, they were rather positive by arguing that the HoloLens offers clarity and reassurance.

The results of the thematic analysis on the data of the medical specialists are displayed in Table 4. The analysis detected six themes in relation to the perspectives of the specialists on the VIPA, namely *overall impression of the questionnaire, formulation (and language), content, missing topics/elements, format, and attitudes towards medical imaging*, with a total of fourteen matching codes. The table includes definitions of the codes and example codes to illustrate the meaning behind each code. Their count is stated as well to throw light on the importance of the codes. As with the patient participants, the code 'Other (uncodable)' was assigned to irrelevant data.

Table 4

Thematic Analysis: the Identification of Codes and Themes for Medical Specialists

Theme	Code	Definition	Quote	Frequency, <i>n</i>
Overall impression of the questionnaire	(1) General views on the VIPA	The opinions of medical specialists on the VIPA in general and its representativeness for OGS patients as target group	“I think as it is now, it is not representative.”	19
	Formulation (and Language)	(2) Type of language used	General perception on the type of language that is applied in the questionnaire	4
	(3) Perceived issues in language	Expressed confusion about or issues with the manner in which the instructions, respondent characteristics, and the questions are phrased	“Diagnosis that is shown with the image. That’s a very strange sentence. Diagnosis that is shown with the image. How should I read that?”	55
	(4) Suggestions for changes language/formulation	Suggestions to make changes to the phrasing of the questionnaire with the aim of improving the questionnaire	“Yes, indeed I think here abnormality, that could have been a bit more specific. I think we talked earlier about deviating jaw position. Well, that might be a more apt word than abnormality in general.”	33
Content	(5) Question is not applicable	The relevance of the questions that are being asked to measure specifically OGS patients’ satisfaction with medical imaging	“I wonder if that is very applicable. Because we don’t really give instructions to the patient yet at this point. Because that’s actually only after the treatment that you have to perform certain actions.”	29
	(6) Suggestions for adaptation in content	Suggestions to change the intended meaning of a question and thereby	“And maybe you could also [...], for example if you are talking about question	3

		its content	13, then I wouldn't use the word 'motivated', but you can also say, you can also ask a question. That you say; 'by seeing the schedule of the surgery, I can better envision what my operation/facial change will be like'."	
	(7) Repetitiveness of questions	Similarity in questions that are being asked	"The image makes [...]. Yes, again this is so double-edged. The image made about [...], the image made the explanation of my abnormality easier to understand. I, yes, it is again, this again falls into the category of question 1, 2, 4, yes."	7
	(8) Perceived relevance of elements other than questions	The (in)appropriateness of the instructions and respondent characteristics	"And gender, age and highest education. It is good to know indeed. The education [...]. Um, yes it's fine. Maybe maybe you should leave out 'highest'. Otherwise it becomes a bit of a score list. If someone says, 'I've only had primary education', that I think by myself, that is indeed a bit stupid then."	6
Missing topics/elements	(9) Missing concepts	Inadequate coverage of concepts and other elements that are necessary for a questionnaire measuring patient satisfaction of OGS patients	"What I struggle with a bit with this question is that it's about the abnormality. But what I'm missing is the outcome of the treatment."	16
	(10) Suggestions for the addition of topics/elements	Suggestions to add questions to measure patient satisfaction with medical imaging or to include other missing aspects in the VIPA with the aim of improving the questionnaire	"I would expect then something that you can ask about like: 'well, did you find it comfortable?' or 'did the device interfere with the understanding of the abnormality?' or something like 'how much does it distract from the information you want to	23

Format	(11) Length of the questionnaire	The suitability of the number of questions and the length of the items	provide?” “I always think it’s nice to really make sentences as short as possible for patients. Well, I think that’s all in order. Yeah, that looks good.”	5
	(12) Lay-out and formatting	The contentment with the visual representation of the questionnaire	“Yes, that seems fine to me. It’s not a very enjoyable questionnaire, but for the purpose it seems adequate.”	4
	(13) Suggestions for structure/lay-out changes	Suggestions to make changes to the structure and lay-out of the VIPA with the aim of improving the questionnaire	“And and does it make sense to add something, an um one more field for comments of the patients?”	4
Attitudes towards medical imaging	(14) Perceived effectiveness of medical imaging in patient education	Views of medical specialists on the benefits and drawbacks of the utilisation of medical imaging techniques to educate their patients about their abnormalities and/or treatment options leading to patient satisfaction	“Because I think that these kinds of operations are very suitable for it [image-based education], that it is very important for patients that they understand what is happening to them, because they are not acute, those patients can live to be 100 with those abnormalities. So it is interventions that are allowed and not interventions that are required.”	16
	(15) Other (uncodable)	Feedback and/or information that is not relevant for this research		

Note. This table demonstrates the results of a performed thematic analysis on the data of medical specialists. Included are the identified themes and their matching codes, definitions of the codes, example quotes and the frequency of the occurrence of the code; n = number of cases.

Overall Impression of the Questionnaire

The TSTI method revealed the medical specialists' perceptions on the VIPA, leading to the theme 'Overall impression of the questionnaire'. All specialists provided honest insights into their general views on the survey and its representativeness for OGS patients. The specialists predominately argued that the VIPA contained several valuable questions, which, according to the technical physician specialist, are useful in discovering a possible difference in patient satisfaction relating to 2D and 3D medical imaging. However, he also stated that in the VIPA's current state, OGS patients are likely to not feel associated with their personal situation, due to the phrasing of some questions. Specifically, he was referring to the fact that verbs as 'abnormality' are too general, and can apply to a wide range of different patients. An OMFS surgeon argued the same, by mentioning that the questionnaire is clearly targeted to another group. According to him, it takes several adjustments, otherwise one is not going to measure what they would want to measure; *"I think as it is now, it is not representative."* Medical specialist 6, said that some questions are too vague. Nevertheless, medical specialists 2 and 3 highlighted that they perceived the VIPA to be a clearly formulated, good questionnaire.

Formulation (and Language)

Considerable attention of the medical specialists was devoted to the manner in which the different subsections of the VIPA are phrased and the type of language that is being used in the questionnaire. As a result of their discontentment, various suggestions for improvement have been made. These aspects caused the theme 'Formulation (and language)' to develop. Concerning the perceptions on the general type of language applied in the questionnaire, medical specialist 4 fears that OGS patients, especially functional illiteracy, will not comprehend the language practised in the survey, referring to terms such as: image, well-considered, follow-up treatment, diagnosis, and reliable.

Difficulties with the formulation of the content of the instructions, the clinical characteristics, and the questions, were notified by confusing behaviour or spoken accounts on their perceived issues with the formulation. Utilisation of the term 'image' in the clinical characteristics section, the instructions as well as the questions caused some concerns; *"Which images I show to the patient? [...] Type of medical image shown. That is not even a sentence."* Specialist 4 mentioned: *"I think that for patients who see several images during a consultation, it is more difficult to indicate which image you mean."* Suggestions were made for utilisation of: 'planning', 'the imaging' (de beeldvorming), or 'the shown images' (de

getoonde beelden).

The term ‘abnormality’ was mentioned by all six specialists as not being suitable, as the OGS patients are relatively healthy. It was also perceived as an unfriendly term to apply. The technical physician specialist mentioned that it must be made clear in advance what is meant by the word for this patient or that a more general deviating jaw position (afwijkende kaakstand) is implemented. Although the dental physician mentioned that the term abnormality is used in patient files as well, discussion with colleagues shed light on the phrasing of ‘jaw position’ (kaakstand). Similarly, the application of ‘jaw malocclusion’ (standsafwijking van de kaak) was offered.

Further, the specialists noticed other issues in the phrasing of the questions and came up with various suggestions for these perceived problems. This applied, for instance, to the use of ‘follow-up treatment’ and the inability to specifically assess the role of images in the decision-making process. Next to this, specialist 4 argued that as for remembering the information about the abnormality when getting home, it is better that all patients take the same time as reference by describing it as: “*After leaving the consultation room, [...].*”

Content

Regarding the intent of the questions, codes have been formulated that relate to the applicability of the questions and other elements, as well as the specialists’ corresponding suggestions for adaptation, culminating in the theme ‘Content’. The items ‘The image motivated me to adhere to the doctor’s recommendations’ and ‘The image motivated me to work on my recovery’ were not considered to be relevant for this questionnaire, as its content only becomes relevant once the patients receive their treatment. According to specialist 1 and 4, in the preoperative phase, there is no question of instructions and therapy compliance yet. Multiple specialists stated that the only advice these patients receive in this phase is that they have to think about whether they want to undergo the surgery and to make a well-considered choice. It was suggested to shift the focus of the fifth question in the motivation to enter the treatment process. Regarding the final item suggestions for modification were made with respect to improved envisioning of the patients’ operation/facial change or their motivation to cope with side effects.

Different questions were evaluated as not applicable due to their redundancy. Specialists perceived it to be unnecessary to ask patients about their prior expectation to see images, the reassurance of seeing images, confidence in correct diagnosis, and their judgements about the images’ reliable impressions. Concerning the latter point, specialist 4

recommended a statement, as: *“I think the patient’s treatment planning I have seen closely resembles my planning/face.”* Moreover, items 1, 2, 4, and 10 were judged to be asking the same. Hence, specialist 6 suggested to group items together on topic. At last, subjects 4, 5, and 6 questioned the relevance of asking the participants about their highest education and gender.

Missing Topics/Elements

As the goal of the VIPA is to measure patient satisfaction in relation to 2D and 3D medical imaging, testing the survey among experts involved with the target group brought to light topics that they were missing in the questionnaire or other elements perceived to be necessary to make it complete. Consequently, the theme ‘Missing topics/elements’ gives a clear picture of these missing concepts and the related suggestions. Several specialists expected to see various follow-up questions. For instance, relating to the items about the better understanding of the doctor’s explanation or the reliable impression, specialist 1 proposed: *“How do they view their abnormality now? What do they already know about their abnormality?”* Specialist 5 added to this: *“What did they understand?”* Additionally, medical specialist 4 wanted to know: *“What is reassuring?”*, following question 12. Two OMFS surgeons reported, because of the possible distractions the 3D HoloLens entails, they would pose questions to the techniques’ ease of use and its clarity. Nonetheless, this may not be in line with the questionnaire’s goal to adhere to content applicable to both 2D and 3D imaging modalities.

Besides, multiple specialists stressed the importance of an emphasis on pursuing treatment goals and their outcome, understanding of the treatment planning, and inclusion of the ‘operation planning’ rather than solely the abnormality of the patient. In terms of other topics that were missing, the level of detailed information the patients want to receive (soft tissue or bone level), whether they benefit from a 3D image’s interactiveness, and whether they see the necessity for a difference in 2D and 3D simulations, were all mentioned. Specialist 5 wanted to pose a question to the doctor about the patients’ understanding level, which he perceived to be most crucial to ask: *“Did the patient participate in thinking about how an operation should be performed?”* Finally, an OMFS surgeon stated the importance of asking the patients knowledge questions about their abnormality before completing the items. Moreover, he hinted at the possibility to question the patients if they have a clear picture of the facial changes associated with the operation based on the images and whether they can correlate that to their own face.

Format

The visual representation of the VIPA, including the length of the questionnaire and the number of questions, and related suggestions make up the theme 'Format'. Specialists argued that they perceived the questionnaire to be concise, containing a reasonable number of questions, which is beneficial for the patients and for fitting it into the consultations. However, medical specialist 4 viewed the questions themselves to be too lengthy, arguing for briefer questions. By contrast, another OMFS surgeon said: *"I always think it's nice to really make sentences as short as possible for patients. Well, I think that's all in order."*

In general, the participants viewed the lay-out and formatting of the VIPA to be clear and plain. *"Yes, that seems fine to me. It's not a very enjoyable questionnaire, but for the purpose it seems adequate."*, as stated by the dental physician. The second specialist suggested adding a comment field at the end of the questionnaire. Besides, with respect to the clinical characteristics subsection, he recommended to include categories for abnormalities/diagnosis, which the specialist can then select for the corresponding patient.

Attitudes Towards Medical Imaging

The medical specialists were able to provide useful visions on image-based education. This brings about the final theme 'Attitudes towards medical imaging'. What emerged is that according to the experts, the images make the consultations more evident for the patients, by providing new insights. Furthermore, it facilitates the involvement of the patient in the decision-making process. Specialist 6 stated in connection with the patients' understanding: *"Because I think that these kinds of operations are very suitable for it [image-based education], that it is very important for patients that they understand what is happening to them, because they are not acute, those patients can live to be 100 with those abnormalities. So it is interventions that are allowed and not interventions that are required."* Specialists stated that they can assess whether the patients comprehend the images through the extent to which the patients ask (deeper) questions, and by this start to virtually operate with the doctor. However, the fact that it needs to be checked beforehand whether the patients have a wish to see the images, was stressed, arguing that this is not always the case due to its confronting nature. In addition, though they described 3D medical imaging techniques to be advantageous resulting from their ability to eliminate noise and to provide objective understanding, they acknowledged that spatial visualisation can be difficult for OGS patients, and their interpretation is highly dependent on the techniques' user-friendliness.

Phase 2 Comparison

The subjects' issues respecting both the phrasing and relevance of the components of the VIPA, following from the codes of the subject groups relating to these specific aspects have been summarised to account for the received feedback and related suggestions for change (see Table 5). Comparison of the earlier shown code schemes, highlights that with respect to the identified codes and themes, multiple similarities are found. Specifically, data of both groups contained information relating to the subjects' overall impressions of the questionnaire, formulation, content, format, and attitudes towards medical imaging. However, various suggestion codes were created for the specialists, which was not the case for the patients. Furthermore, the medical specialists expressed their opinions on missing topics, which were not found in the patients' data. Besides, though several of the codes have been designed for both subject groups, these codes appeared more frequently in the interview data of the medical specialists.

Focussing specifically on the perceived applicability of the components and issues in language from both participant groups, it was found that overall, the words that were viewed as difficult to understand by/for the patients, were present in the data items of both subject groups, e.g., image and abnormality. It should be noted, however, that the feedback from the patients with respect to the issues in language were identified to a large extent by a subset of the patients, as generally, the patients were rather content with the phrasing. In contrast, a higher proportion of specialists reported on these same issues. Specific differences in the perceived issues in language corresponded to: follow-up treatment, reliable, recommendation, and consultation. Furthermore, the wrongful interpretations by the patients of certain items were not found in the data of the specialists. There were instances when the specialists perceived items to be not applicable for the OGS patients. A number of patients indicated (indirectly) that this was the case for them as well by stating it or asking what they had to do, though not all patients seemed to experience this. The recommended changes for improvement were all taken from the specialists' data, highlighting the presence of these suggestion codes (relating to content and phrasing) for the medical specialists but not the patients. Hence, though at first glance, by looking at the code schemes, the participant groups seem to have similar perspectives on the VIPA as patient satisfaction measure, content wise the groups diverge.

Based on these results, possible adaptations can thus be made to the terminology used in the questionnaire. Constructs such as 'abnormality' can be specified (jaw malocclusion, (deviating) jaw position) and 'image' can be explained more extensively (e.g., meaning:

planning, imaging, shown images). Easier to understand synonyms can be applied for terms like: well-considered, recommendation, diagnosis, consultation, and impression. With respect to the respondent characteristics, abnormality can be specified or replaced by the diagnosis question and patients can be asked about their most recent education rather than their highest. Questions that are perceived to be redundant, due to their similarity or unnecessary, can be left out or their focus could be modified (items 1, 2, 4, 6, 7, 10, 11, 12). Inapplicable items can be left out, or the cause of their inapplicability could be targeted, such as adapting the time frame (items 3, 5, 9, 13). Various questions may be rewritten in a sense that they are briefer. A wide range of questions can be included about, for instance, their presurgical knowledge and patients' involvement. Additional topics that the questionnaire may benefit from are technical/interpretation issues relating to the medical images. Moreover, the VIPA can incorporate a focus on the medical images of operation plannings, rather than solely images of abnormalities. Finally, adjustments to the lay-out can be made, by targeting the answering options, enlarging the reading compartments, adding abnormalities/diagnosis categories, and/or including comment boxes.

Table 5
Overview Perceived Issues with the Questionnaire and Options for Improvement

Questionnaire Components	Feedback Patients	Feedback Medical Specialists	Improvement
Questions			
Item 1. The image provided clear information about my abnormality	Issues in language: abnormality, image	Issues in language: abnormality, image	<ul style="list-style-type: none"> • The planning/imaging/shown image provided clear information about my jaw malocclusion/(deviating) jaw position.
Item 2. The image was necessary to understand the doctor's explanation of my abnormality	Issues in language: abnormality, image	Issues in language: abnormality, image	<ul style="list-style-type: none"> • The planning/imaging/shown image was necessary to understand the doctor's explanation of my jaw malocclusion/(deviating) jaw position.
Item 3. Seeing the image allowed me to make a well-considered choice about my follow-up treatment together with my doctor	Issues in language: image, well-considered Question perceived as not applicable	Issues in language: image, well-considered, follow-up treatment	<ul style="list-style-type: none"> • Seeing the planning/imaging/shown images was an important aspect in making the thoughtful choice about my treatment.
Item 4. I understood the doctor's explanation of the image	Issues in language: image	Issues in language: image	<ul style="list-style-type: none"> • Leaving out the question • I understood the doctor's explanation of the planning/imaging/shown images.
Item 5. The image motivated me to adhere to the doctor's recommendations	Issues in language: recommendation, image Question perceived as not applicable Question was wrongly interpreted	Issues in language: image Question perceived as not applicable	<ul style="list-style-type: none"> • The planning/imaging/shown image motivated me to enter the treatment process. • Leaving out the question
Item 6. I am confident that an image contributes to a correct diagnosis of my abnormality	Issues in language: abnormality, image, diagnosis	Issues in language: abnormality, image, diagnosis Question perceived as not applicable	<ul style="list-style-type: none"> • I am confident that the planning/imaging/shown image contributes to a correct diagnosis of my jaw malocclusion/(deviating) jaw position. • Leaving out the question
Item 7. Prior to my treatment, I	Issues in language:	Issues in language:	<ul style="list-style-type: none"> • Prior to my treatment, I expected to see

expected to see images during a consultation	image, consultation	image Question perceived as not applicable	imaging/shown images during a consultation.
Item 8. Seeing the image of my abnormality was very important to me	Issues in language: abnormality, image	Issues in language: abnormality, image	<ul style="list-style-type: none"> Leaving out the question Seeing the imaging/shown images of my jaw malocclusion/(deviating) jaw position was very important to me.
Item 9. When I got home, I could remember the information about my abnormality because I had seen an image during my consultation	Issues in language: abnormality, image, consultation Question perceived as not applicable and/or too long	Issues in language: abnormality, image, when I got home	<ul style="list-style-type: none"> After leaving the consultation room, I had a good understanding about my jaw malocclusion/(deviating) jaw position because I had seen a planning/imaging/shown images during my consultation.
Item 10. The image made the explanation of my abnormality more understandable	Issues in language: abnormality, image	Issues in language: abnormality, image	<ul style="list-style-type: none"> The planning/imaging/shown images made the explanation of my jaw malocclusion/(deviating) jaw position/treatment more understandable.
Item 11. I think the image provided me with a reliable impression of my abnormality	Issues in language: abnormality, image, impression	Issues in language: abnormality, image, reliable Question perceived as not applicable	<ul style="list-style-type: none"> I think the patient's treatment planning I have seen closely resembles my planning/face.
Item 12. Seeing the image during consultations was reassuring for me	Issues in language: image	Issues in language: image Question perceived as not applicable	<ul style="list-style-type: none"> Seeing the planning/imaging/shown images was reassuring for me.
Item 13. The image motivated me to work on my recovery	Issues in language: image Question was wrongly interpreted	Issues in language: image Question perceived as not applicable	<ul style="list-style-type: none"> By seeing the schedule of the surgery, I can better envision what my operation/facial change will be like.
General question 1. Overall, how satisfied are you with the use of medical		Issues in language: medical images	<ul style="list-style-type: none"> Leaving out the question Overall, how satisfied are you with the use of medical images?

images? General question 2. Do you recommend the use of medical images during consultations with other patients?		Issues in language: medical images	
Respondent characteristics			
Clinical characteristics			
Type of medical image shown during consultation		Issues in language: medical image	<ul style="list-style-type: none"> • What type of medical image was used during the consultation?
Number of abnormalities shown with the image during this consultation		Issues in language: abnormalities	<ul style="list-style-type: none"> • Types of jaw malocclusions shown with the image during the consultation: • Using categories of abnormalities the specialist can select
Diagnosis shown with the image		Issues in language: diagnosis	<ul style="list-style-type: none"> • Treatment planning/simulation shown with the image: • Using categories of diagnoses the specialists can select
Demographics			
Highest level of education	Issues in language: highest level	Issues in language: highest level	<ul style="list-style-type: none"> • What was your most recent education?
Instruction			
'You can answer this question based on your experiences with medical images during a consultation'		Issues in language: medical images	<ul style="list-style-type: none"> • Leave out the instruction sentence

Note. This table demonstrates an overview of the received feedback on the differing components of the VIPA, separated by both participant groups. The last column shows the suggestions of the respondents for improving the element in question.

Discussion

The purpose of this study was to investigate the appropriateness of the VIPA as a 2D and 3D medical imaging patient satisfaction measure for Dutch OGS patients. Hence, the main research question is: *To what extent is the VIPA feasible for the population of OGS patients?* To this end, the first sub question posed is: *What needs to be adjusted to make the VIPA suitable for OGS patients?* Adaptations to the terminology (injury, image) were necessary, as a result of the survey's focus on a different patient group and an alternative 3D imaging modality. With respect to the following sub question: *What are the perceptions of OGS patients and medical specialists on the VIPA?*, OGS patients view the VIPA as well-structured and representative with some difficult to comprehend words. Medical specialists express mixed feelings about the VIPA, varying between a valuable measure and lacking adaptation to OGS patients' situation. Therefore, concerning the question '*What are the similarities between the perspectives of OGS patients and medical specialists on the usability of the VIPA?*', the groups overlap in the structure of the manner in which they expressed their opinions on the VIPA (e.g., length of the questionnaire, completeness, and issues in formulation). Yet, content wise, they only seem to agree on multiple issues in language and its clearness. Regarding the question: *To what extent are all questions of the VIPA applicable for OGS patients?*, not all questions are seen as applicable to them. Additionally, *what topics needed to measure patient satisfaction among OGS patients are missing?* is designed as a research question. The original VIPA is complete in measuring OGS patients' satisfaction with medical imaging. Finally, regarding: *What refinements have to be made to bring about a final VIPA product employable for OGS patients?*, adjustments are made to the phrasing of the questionnaire to closely match with this patient population and a pretreatment situation.

Returning to the main question, it can be stated that the preliminary VIPA is partially feasible for OGS patients as a satisfaction measure with medical imaging. It is clear that the questionnaire is designed with a focus on a different patient group, time of implementation, and imaging modalities. This makes the original terminology not entirely applicable to OGS patients. Therefore, the questionnaire cannot be adopted directly to the OGS domain, hence the refinements.

The findings that led to this conclusion indicate thus a contrast in the views of the two participant groups. Various reasons may account for this. The result is consistent with the fact that patients and specialists are two diametrically opposed groups when it comes to their understanding of the medical domain and its language, their roles as treatment provider or

treatment receiver, and their expectations about healthcare (Antel et al., 2022; Van Dulmen, 2002). Furthermore, practitioners regularly do not have a clear understanding of patients' views on various aspects, such as their need for information, emotional values, or what an illness means to them (Hall et al., 1999; Ishikawa et al., 2013; Kennedy et al., 2017). Imaginably, the power imbalance (relating to expertise and technical knowledge) leads the specialists to believe knowing what is best for the patients and acting as the patients' agents, resulting from feelings of responsibility as well (Charles et al., 1997). Besides, personality differences between physicians and patients, imply patients to be less conscientious and extraverted, which can make the patients not as perfectionistic as specialists or they feel less confident in sharing their opinions (Ammi et al., 2023; Redelmeier et al., 2021). In light of the expectancy disconfirmation theory, in case of high expectations, the experience will most likely not surpass the expectations, which can lead to lower feelings of satisfaction (Batbaatar et al., 2015). Perhaps, the specialists may have had high expectations about the questionnaire beforehand, which were not confirmed, leading to dissatisfaction and expression of suggestions for improvement. This may not have been the case for the patients, since they were only asked at the end of their consultation to participate in the study. Moreover, the VIPA has been validated based on a sample of 106 trauma patients (Pinkster et al., 2022). Medical specialists, however, were not subject to the pretesting of the preliminary VIPA. The testing process has thus resulted in a questionnaire that closely matches patient populations, leading to few similarities between the groups in the current research.

There is not a clearcut answer to the question which group should be followed in their views, now that some conflicting views have been established. Certainly, the aim is to arrive at a questionnaire that the OGS patients can identify with. Therefore, with an eye to future utilisation, the patients' opinions about the questionnaire are leading when examining VIPA's applicability. However, the patients' relative absence of fundamental problems with the questionnaire does not mean that there is no room or need for optimisation. Revision of the VIPA is perceived as possible and even preferred. The perceptions of the specialists can complement the patients' views. Given the wide range of insights and recommendations which lead to contradicting views, particularly their frequency and impact on the VIPA should be considered when deciding upon the importance of these differing results. Moreover, existing literature can shed light on the possibility of the suggested transformations. The regular comments relating to the irrelevance of items resulting from their postoperative nature closely match UMCG's goal to administer the VIPA in the preoperative phase. These associated pain points and suggestions are thus necessary to consider for UMCG's procedure.

Additionally, awareness into the position of the patients' knowledge, their varying (socio-demographic) characteristics, the importance of clear instructions and questions and their perceived issues in language, can lead to the rewording of the instructions, the demographics, and multiple questions, with the aim of optimising the comprehensibility (Jenn, 2006; Van Dulmen, 2002). The same applies to the lay-out of the VIPA. Therefore, in light of the literature, various adaptations seem to be reasonable.

The inclusiveness of 'abnormality' to specifically OGS patients, led to the investigation of the suitability of the suggested verb 'jaw malocclusion' as umbrella-term. This shows to be promising as this explicitly relates to OGS patients rather than OMFS patients (e.g., Khechoyan, 2013; M. Zhang et al., 2006). Additionally, the participants' perceived vagueness of the verb 'image' is in conflict with the VIPA's need of a general term that can refer to either 2D images and videos or 3D holographic images, as both groups will receive the same questionnaire. Hence, 'medical images' can be adopted as a more specific, but still general term.

Concerns in the applicability of various items were raised as these do not fit UMCG's above mentioned time frame. With respect to adjustments to the questions, the two scales (clearness and importance of seeing images) that make up the patient satisfaction survey, should be taken into account, in order to align the adjustment with the questionnaire's aim (Pinkster et al., 2022). Hence, changing the fifth item's focus on the motivation to enter the treatment process, rather than the motivation to adhere to the doctor's recommendations, could be a measure of the importance of seeing the image. Three-D prediction plannings can increase OGS patients' surgical expectations and motivation, which indicates that the images certainly can play a role in increasing the motivation of patients and thus relate to the patients' satisfaction (Hertanto et al., 2021; Mahajan et al., 2021). In contrast, altering the final item into envisioning what the operation will be like, potentially highlights the clearness of an image, as phase 1 identified the importance of OGS patients' understanding of the disclosed information in contributing to their satisfaction with medical imaging (Al-Hadi et al., 2019; Hertanto et al., 2021). This illustrates the possible effectiveness of focussing on the patients' ability to envision what their treatment will be like, as a result from increased understanding of the disclosed information, through medical images. Similarly, UMCG's aim is to provide the survey to OGS patients in the waiting room after the first consultation in the hospital. Patients can no longer be asked about the extent to which they can remember their abnormality when they get home, expectations before their treatment, and their position to make a well-considered choice about their follow-up treatment. Modifications in the timing of

the question can address this issue (e.g., ‘after leaving the consultation room’, asking about prior-consultation expectations, and adopting the future sense).

The UMCG has a desire to involve the role of images in understanding the operation plans and treatment goals as an important part of the examination. Phelps et al. (2017) already stressed the cruciality of providing patients with clinical images to improve their understanding of medical information and thereby boosting patient satisfaction. The role of the interactive nature of MR technology in patients’ comprehension regarding treatment possibilities has also been accentuated (Blanchard et al., 2022; Gsaxner et al., 2023; Pandrangi et al., 2019; J. Zhang et al., 2020). A study by Wake et al. (2019) shows that image-based education, especially by means of 3D models, adds to the patients’ knowledge about surgical procedures and treatment plans, using items such as “I understand why my surgeon chose the treatment plan being offered” (p. 4). This highlights the prospective importance of a focus in this survey on treatment plans as well.

With respect to the items the specialists perceived to be redundant, due to similarity and/or unnecessariness, there is no urgent reason to exclude these items for this motive, as they have been designed based on extensive investigation into the components of patient satisfaction with medical imaging (Pinkster et al., 2022). Furthermore, these questions were not necessarily perceived to be redundant by the patients, whose views are leading. However, the inapplicability of item 11 about the extent to which the patient thinks the image provides a reliable impression of their abnormality, can indeed be questioned, due to their limited knowledge about medical imaging, which has been highlighted earlier. Although the literature does not specifically mention anything about the patient’s inability to make this judgement, errors in interpretation of medical images are not rare (Krupinski, 2010). Focussing on the resemblance between the treatment planning they saw and their own planning/face, might solve this issue. The question may thereby still measure the clearness of the medical image, as decisions of OGS’s patients to undergo surgery may be dependent on their satisfaction with the extent to which the imaging technique (i.e., post treatment hologram, videos in 2D condition) clearly shows overlaps with their personal situation.

The specialists have shown their ideas about the inclusion of various new topics. Several of these seem to deviate to an extent from the actual goal of VIPA. It is especially important to note here, that the patients did not experience any missing topics in measuring their satisfaction. Furthermore, including a question on the uncomfortableness of seeing medical images, which came forward, seems contradicting, as one of the patients even commented on the reassurance of seeing images and this might thus already be captured in the

item relating to feelings of reassurance (Linton et al., 2008). Seeing medical images generally produces more contentment with treatment on the side of the patients and they have even been found to prefer the option to view their images in online patient portals as well (Halaska et al., 2019; Kendrick et al., 2001). Another frequently mentioned topic was the difficulties related to the control of the HoloLens' technique and the distraction this creates. Research demonstrates that MR technologies have the potential to increase patients' understanding of the information presented (Hu et al., 2019). Moreover, it is not certain whether these technical issues apply to the 2D imaging techniques as well. Consequently, the comment boxes can be utilised by the patients to indicate any issues they experience. On the whole, patients stated the positive effects of image-based education on their degree of understanding and recall of medical information. These aspects, however, were already included in the VIPA. Therefore, the interviewing did not lead to the inclusion of new questions to measure patient satisfaction.

The ideas of the specialist to include open, follow-up questions in the survey are not followed. The VIPA is designed to examine the difference in satisfaction between patient groups, rather than individual patient insights (Pinkster et al., 2022). Investigating the patients' understanding of the images and the impact on their satisfaction, as well as asking patients to explain their answers, testing their pre consultation knowledge about their abnormality, and asking what they perceive to be reassuring, are not primary goals of the VIPA. Open-ended questions require more effort from the patients to complete, especially from low-educated individuals (Reja et al., 2003). Furthermore, the questionnaire already provides insights into which imaging techniques lead to better understanding among the patients, following the clearness scale.

Limitations and Strengths

Focussing on potential drawbacks of this study, the think aloud procedure generally caused awkwardness on the side of the participants. Though the subjects all practised with a think aloud exercise, especially the patients found it difficult to state their thoughts. This may have led to insightful opinions being withheld. Adding to this, the patient participants often did not comprehend that it was not the case that they as respondents were tested, but rather their views on the VIPA as a whole. Hence, these subjects often notified their thoughts on the extent to which they agreed with the item, which may have led to crucial perspectives being missed. Nevertheless, this limitation brought about visions on the degree to which they possessed correct interpretations on the questions, given their explanations on the (dis)agreement with the statements. Moreover, the fact that the participants had to state their

thoughts about the questionnaire could have led to socially desirable results as they may have felt uncomfortable expressing their honest opinions on the VIPA. This effect, however, was minimised to a great extent by stating beforehand that the researcher was not amongst the original questionnaire designers (Willis, 1999). These limitations, therefore, all seem to relate to the TSTI method that was practised, indicating that other procedures may have been more fitting. Still research into the effectiveness of both the TSTI method and cognitive interviewing in general, have established the valuableness of the think aloud procedure (Buers et al., 2014; Jansen & Hak, 2005).

Additionally, the six medical specialists who took part in the study are employed at four different hospitals. Therefore, these participants are potentially familiar with other habits relating to image-based education. Nevertheless, this may have also enhanced identification of questionnaire-related problems and contributes towards the possible applicability of the questionnaire in other hospitals. Although the sample contained a variety of sociodemographic characteristics, adopting convenience sampling as a sampling method may have led to a biased sample. Approaching participants about their willingness to participate in the research study could have led to the inclusion of only motivated individuals. Though all participants who were approached agreed with the request, the findings may not be entirely generalisable to participants with, for instance, a less motivated attitude (Emerson, 2021).

Nonetheless, the current research involved the empirical target group, meaning that this has contributed extensively to the generalisability of the results. Therefore, the insights and knowledge that was obtained from especially the patients, is highly valuable because they closely resemble the respondents who will be asked to complete the questionnaire in the UMCG. Moreover, as stated above, the sample included a wide variety of socio-demographic characteristics, meaning that this could lead to the adjustment of the questionnaire, tailoring it to the differing OGS patient population. Furthermore, including both participant groups has led to diverse feedback, which could be utilised for optimal specialisation of the VIPA. Finally, the TSTI as a method of pretesting and investigation facilitated the realisation of relevant findings by including both observational and spoken data, sifting through the participants' perceived problem areas and strengths.

Practical Implications and Future Recommendations

Now that the research questions have been answered and the modifications are discussed, the adjustments are included in the questionnaire, resulting in the refined VIPA feasible for OGS patients (see Appendix F for the final version). The adjusted questionnaire

can throw light on their views on the effectiveness of 2D and 3D medical imaging. This is essential for the UMCG in understanding the added value of the implementation of the HoloLens in doctor-patient communication. They are therefore advised to implement the VIPA in a consistent manner to test the satisfaction with medical images among their OGS patient unit. This can facilitate the optimisation of image-based education, by implementing the insights into the preferences of the specific groups of OGS patients (e.g., age, diagnosis, level of education). As a result, other hospitals may benefit from the operationalisation of this revised version of the measure as well, to closely match their image-based education with the varying OGS patients.

However, the adjustments ask first of all for a repetition of the reliability and validation process before the questionnaire can do its actual work. Hence, with a view to future research, conducting factor analysis and computing correlations between the items, can examine the extent to which the VIPA is still measuring the two constructs ‘clearness’ and ‘importance’ now that the questions have been modified. The adapted version would most likely not be suitable for the original target group, trauma patients, due to their different background compared to OGS patients. For the same reason, it is expected that patients that vary extensively from OGS patients would need yet another adapted version to examine their satisfaction. Nevertheless, it can still be questioned if this version of the VIPA would be employable for a wider population, such as other patients within the OMFS domain. For instance, the importance of efficient image-based education for temporomandibular dysfunction patients is stressed by the abnormality’s role in chronic headaches and the comorbidity with anxiety and depression (Dıraçoğlu et al., 2016; Lupoli & Lockey, 2007). Furthermore, participation of specialists from different Dutch hospitals gave rise to the idea to examine the potential of the VIPA for OGS patients in other hospitals, thereby the possibility to design a uniform questionnaire for this patient group.

In addition, focus groups, where participants are grouped together to discuss with each other their views on the questionnaire can overcome the limitations related to the TSTI procedure. Focus groups may also be beneficial in handling future inclusion of the diametrically opposed groups (Kitzinger, 1995). Meaning that, the occurrence of unnecessary questionnaire adaptations can be prevented and prejudices and wrongful perceptions can be mitigated. As stated above, the inclusion of follow-up questions to determine the patients’ understanding is not viewed as possible for the current satisfaction measure. The UMCG can deliberate to include this aspect as an integrative part of their consultations, by considering the efficiency of using for instance the Teach-Back method (Yen & Ar, 2019). Additionally, this

study incorporated UMCG's view on 3D imaging, namely the use of MR technology. The preliminary VIPA was designed with a focus on 3D computer models. Hence, future research could target the variations in interactiveness both 3D techniques provide, and its role in the satisfaction of OGS patients.

In the end, this research study has led to an adapted VIPA version, drawing nearer to the possibility to employ the most effective, evidence-based medical imaging techniques for OGS patients. In the refined form, VIPA is viewed as closely aligning to OGS patients' degree of knowledge and medical situation, as well as the UMCG's protocol of applying the satisfaction measure. In its current form the results of this version cannot be used to draw conclusions about imaging techniques in OGS patients' satisfaction. As stated, validation is necessary to confirm the effectiveness of this finalised version before it can be applied in UMCG's practice as well as in other hospital instances. Hereby, with an eye to the future, doctor-patient risk communication can be enhanced, shared decision-making processes strengthened, and overall well-being of patients can be realised.

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Appendix A

Items of Questionnaire for Patient Satisfaction with Imaging (QPSI)

Items	Formulation
Item 1	The image provided clear information about my injury.
Item 2	The image was necessary to understand the doctor's explanation of my injury.
Item 3	Seeing the image allowed me to make a well-considered choice about my follow-up treatment together with my doctor.
Item 4	I understood the doctor's explanation of the image.
Item 5	The image motivated me to adhere to the doctor's recommendations.
Item 6	I am confident that an image contributes to a correct diagnosis of my injury.
Item 7	Prior to my treatment, I expected to see images during a consultation.
Item 8	Seeing the image of my injury was very important to me.
Item 9	When I got home, I could remember the information about my injury because I had seen an image during my consultation.
Item 10	The image made the explanation of my injury more understandable.
Item 11	I think the image provided me with a reliable impression of my injury.
Item 12	Seeing the image during consultations was reassuring for me.
Item 13	The image motivated me to work on my recovery.

Appendix C

Interview Scheme Participants (Step Three TSTI)

Vragenlijst

1. Wat is uw mening over de vragenlijst?
 - 1.1 Hoe voelde u zich tijdens het invullen van de vragenlijst?
2. *Wanneer een probleem zich voordeed tijdens het invullen van de vragenlijst:*
 - 2.1 Kunt u het probleem uitleggen dat zich voordeed wanneer u de vragenlijst invulde?
 - 2.2 Toen u [*het probleem*], waarom [*gedrag als gevolg van probleem*]?
3. Wat vindt u van de bewoording van de items?
 - 3.1 Waren er bepaalde vragen/woorden onduidelijk?
4. Wat vindt u van de lay-out van de vragenlijst?
5. Patiënten: Meet volgens u de vragenlijst, uw tevredenheid met medische beeldvorming of zijn er bepaalde onderwerpen of andere dingen die missen in de vragenlijst?
 - 5.1 Is het een representatieve vragenlijst?
5. Medisch specialisten: Is de vragenlijst compleet/representatief voor deze groep patiënten?
 - 5.1 Meet de vragenlijst tevredenheid of zijn er bepaalde onderwerpen of andere dingen die missen in de vragenlijst?

Medische beeldvorming patiënten

1. Hoe kijkt u aan tegen het gebruik van medische beeldvorming om geïnformeerd te worden over uw afwijking en/of behandeling?
2. Op welke manier kan volgens u het gebruik van medische beeldvorming bijdragen aan de manier waarop u uw afwijking en/of behandeling mogelijkheden begrijpt?
3. In hoeverre vindt u de vorm van medische beeldvorming waarmee u momenteel geïnformeerd wordt over uw afwijking/behandeling duidelijk?
4. Welke elementen van de medische beeldvormingstechniek die u hebt gezien waren duidelijk? Waarom?
5. Welke elementen van de medische beeldvormingstechniek die u hebt gezien waren niet of minder duidelijk? Waarom?
 - 5.1 Zijn dit aspecten die relevant zijn in het begrijpen van uw afwijking en/of behandeling?
 - 5.2 Zijn dit aspecten die relevant zijn in het begrijpen van uw tevredenheid met medische beeldvorming?
6. Welke aspecten van medische beeldvorming zijn volgens u het meest relevant voor een optimale ervaring?

Medische beeldvorming medisch specialisten

1. Hoe kijkt u aan tegen het gebruiken van medische beeldvorming om uw patiënten te informeren over hun afwijking en/of behandeling?
2. In hoeverre kunt u zien of uw patiënten de medische beeldvorming technieken begrijpen?
3. Welke medische beeldvorming techniek acht u het meest duidelijk voor MKA/orthognatische patiënten?
4. Door middel van welke medische beeldvorming techniek voelt u zich het meest zelfverzekerd in het informeren van uw patiënten?

Bedankt voor al uw inzichten, is er nog iets dat u wilt toevoegen voordat we eindigen?

Appendix F

Final Version of the VIPA

Vragenlijst Inventarisatie Patiënttevredenheid Afbeeldingen (VIPA) is erop gericht om het verschil van patiënttevredenheid te meten tussen het laten zien van 2D medische beelden en het laten zien van 3D medische beelden. De vragenlijst bestaat uit 13 items. Deze items meten 'het belang van zien van medische beelden (9 items) en 'duidelijkheid van het medische beeld (4 items). Deze onderwerpen dienen los van elkaar gescoord te worden. De antwoorden van de vragen 2, 3, 5, 7, 8, 9, 10, 12 en 13 moeten worden opgeteld en gedeeld worden door 9, om een gemiddelde score voor 'het belang van het zien van medische beelden' te berekenen. De antwoorden van de vragen 1, 4, 6 en 11 moeten worden opgeteld en gedeeld worden door 4, om een gemiddelde score te berekenen voor 'duidelijkheid van het medische beeld'. Deze scores kunnen worden gebruikt om de verschillen in patiënttevredenheid over het gebruik van 2D en 3D medische beelden in kaart te brengen. VIPA is gemaakt om verschil te meten tussen groepen patiënten. Dit betekent dat de vragenlijst niet gebruikt kan worden om van een individueel patiënt zijn tevredenheid berekent kan worden, maar dat de vragenlijst altijd gebruikt moet worden voor groepen patiënten. De vragenlijst is opgezet voor orthognatische patiënten met verschillende soorten afwijkende kaakstanden. De nieuwste versie van VIPA staat weergegeven op de volgende pagina's.

Patiënten kunnen VIPA invullen aansluitend aan een consult waarin ze 2D of 3D medische beelden hebben gezien. Patiënten vullen VIPA in aan de hand van hun ervaringen met de medische beelden die ze tijdens dat specifieke consult hebben gezien. De medische specialist vult in over welke type medisch beeld de vragenlijst gaat. Als er meerdere types medische beelden zijn laten zien, kiest de medische specialist het meest relevante type medische beeld uit en zal de patiënt de vragen invullen over dit type medische beeld. Aan het einde van de vragenlijst krijgen patiënten de optie om een antwoord toe te lichten, maar deze ruimte mag ook door patiënten worden gebruikt voor een algemene toelichting over het gebruik van medische beelden. Ten slotte is er de mogelijkheid voor patiënten om algemene opmerkingen te vermelden, wanneer hier behoefte aan is.

Vragenlijst Inventarisatie Patiënttevredenheid Afbeeldingen (VIPA)

In te vullen door medisch specialist:

Welk type medisch beeld is gebruikt tijdens het consult?: [_____]

(In geval van meerdere medische beelden, 1 type medisch beeld invullen)

Diagnose die is laten zien met het medische beeld: Mandibulaire prognathie Maxillaire prognathie Mandibulaire retrognathie Maxillaire hypoplasie Open beet

Type klasse afwijking: 1 2 3

Moment van invullen van vragenlijst: [_____]

In te vullen door patiënt:

Het doel van deze vragenlijst is om te onderzoeken hoe tevreden u bent met het gebruik van medische beeldvorming tijdens consulten. Om hier een goed beeld van te krijgen, is het van belang dat de antwoorden eerlijk worden ingevuld. Het invullen van deze vragenlijst is vrijwillig. Schrijf uw naam NIET op deze vragenlijst. Uw antwoorden zullen anoniem worden opgeslagen. Mochten er vragen zijn die u niet in wilt vullen, sla deze gerust over. Bedankt voor uw medewerking.

Geslacht: Man Vrouw Anders

Uw leeftijd: [_____]

Meest recente opleiding: Basisonderwijs LBO/VBO/VMBO MBO Havo VWO
 HBO Wetenschappelijk onderwijs/universiteit

Omcirkel bij de volgende stellingen het getal dat aangeeft in welke mate u het eens of oneens bent met de stelling. U kunt deze vraag beantwoorden aan de hand van uw ervaringen met het medische beeld dat u zojuist tijdens uw afspraak heeft gezien.

	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
1. Het medische beeld gaf duidelijke informatie over mijn afwijkende kaakstand.	1	2	3	4	5
2. Het medische beeld was nodig om de uitleg van de arts over mijn afwijkende kaakstand en het operatieplan te begrijpen.	1	2	3	4	5
3. Ik denk dat het zien van het medische beeld mij gaat helpen om samen met mijn arts een bewuste keuze te maken over mijn behandeling.	1	2	3	4	5
4. Ik begreep de uitleg van de arts over het medische beeld.	1	2	3	4	5
5. Het medische beeld motiveert mij om het behandeltraject in te gaan.	1	2	3	4	5
6. Ik heb vertrouwen dat het medische beeld bijdraagt aan een goede diagnose van mijn afwijkende kaakstand.	1	2	3	4	5
7. Ik had verwacht medische beelden te gaan zien tijdens mijn afspraak.	1	2	3	4	5
8. Het zien van het medische beeld van mijn afwijkende kaakstand was heel belangrijk.	1	2	3	4	5
9. Na het verlaten van de spreekkamer had ik een goed idee van mijn afwijkende kaakstand, omdat ik het medische beeld heb gezien tijdens mijn afspraak.	1	2	3	4	5
10. Het medische beeld maakte de uitleg over mijn afwijkende kaakstand en het operatieplan beter te begrijpen.	1	2	3	4	5
11. Ik vind de operatieplanning van de patiënt die ik heb gezien goed lijken op mijn gezicht.	1	2	3	4	5
12. Het medische beeld was geruststellend voor mij om te zien tijdens de afspraak.	1	2	3	4	5
13. Door het zien van de operatieplanning kan ik mij beter voorstellen hoe mijn operatie zal zijn.	1	2	3	4	5

Hoe tevreden bent u over het algemeen met het gebruik van medische beelden tijdens de afspraak die u zojuist heeft gehad? 1 betekent heel ontevreden en 10 heel tevreden

1	2	3	4	5	6	7	8	9	10
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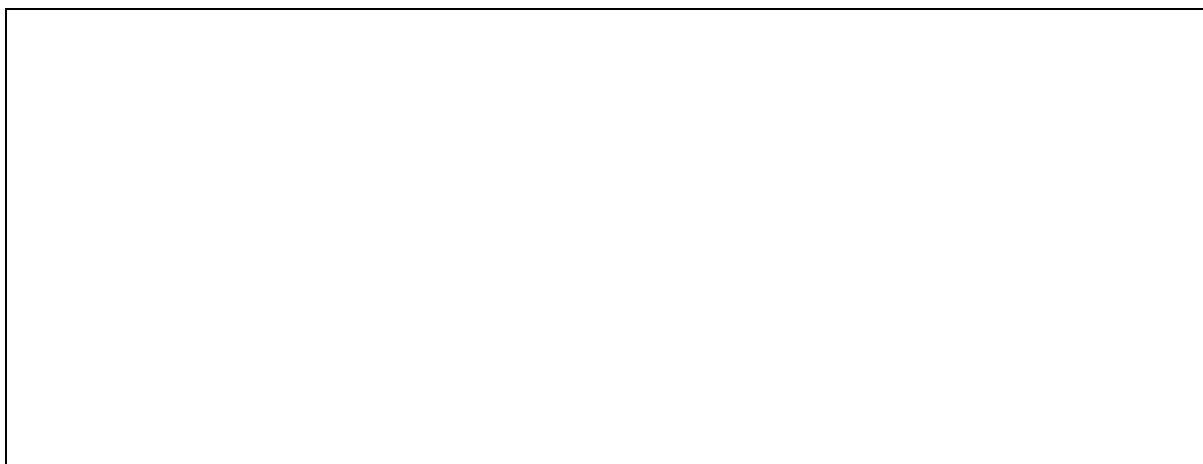
Raadt u het gebruik van medische beelden aan tijdens de afspraken van andere patiënten?

Ja Nee

Zou u uw antwoord willen toelichten?

Bedankt voor het invullen van deze vragenlijst! Door uw informatie krijgen wij beter inzicht in de wensen van onze patiënten en kunnen we onze behandeling daarop afstemmen.

Heeft u nog algemene opmerkingen? Laat deze gerust hier achter.

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