INCREASING THE PERCENTAGE OF OLDER ADULTS RECEIVING DENTURE WITHIN EIGHT WEEKS IN PARIT RAJA DENTAL CLINIC

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Abstract

Timely denture delivery is essential for restoring oral function, aesthetics, and quality of life among older adults. However, a verification study in Parit Raja Dental Clinic revealed that only 38.4% of older adults received dentures within eight weeks, below the Ministry of Health's Key Performance Indicator target of ≥50%. This quality improvement project aimed to increase the percentage of older adults receiving dentures within eight weeks by identifying contributing factors and implementing targeted interventions. A problem analysis chart identified five main contributing factors, with the most significant being repetition of critical denture fabrication stages, particularly the bite registration and impression stages, due to varying levels of skill and experience among dental officers. Interventions were implemented from February 2021 to December 2023, including a denture workshop, a supervised tagging system between senior and new dental officers, and an innovative tool, the Burner Box, complemented by a quick guide to improve bite registration efficiency. The percentage of older adults receiving dentures within eight weeks increased from 38.4% (2020) to 66.7% (2021), 84.5% (2022), and 82.4% (2023). Continuous supervision and training fostered confidence and competence among dental officers, reducing repetition frequency and ensuring better patient outcomes. The initiative has since been expanded to all dental clinics in Batu Pahat District and will be replicated across Johor state with an elevated standard of 80% set for 2025.

KEYWORDS: Denture, older adult, quality improvement study, bite registration, dental public health

Problem

Edentulism contributes substantially to the global oral disease burden and significantly affects older adults' oral function and quality of life (1). Timely denture provision is essential to restore mastication, nutrition, and psychosocial well-being. However, delays in denture delivery can compromise dietary intake, general health, and dignity among older adults (2). With Malaysia's ageing population projected to increase (3), the demand for timely prosthodontic care in public clinics is expected to rise, highlighting the need to address inefficiencies in denture service delivery (4).

Systemic service disruptions and workflow bottlenecks have severely impaired delivery timelines, causing the proportion of older adults receiving dentures at Parit Raja Dental Clinic within the standard eight-week period to drop sharply from 82.8% in 2018 to 38.4% in 2020. A verification study in January 2021 confirmed that only 38.4% of older adults received their dentures within eight weeks of request falling below Key Performance Indicator (KPI) standard of ≥50%. Given the multi-stage nature of denture fabrication, these delays worsen functional and psychosocial outcomes, highlighting a critical gap in service efficiency, resilience, and patient-centered care.

To address this gap, a quality improvement (QI) initiative was undertaken at Parit Raja Dental Clinic, a public facility under the Batu Pahat District Dental Office, Johor State Oral Health Department, Ministry of Health Malaysia. The clinic is operated by 17 staff members (five permanent dental officers, two contract dental officers under the New Dental Officer Programme, one dental technician, two dental therapists, four dental surgery assistants, two healthcare assistants, and one driver).

Historically, the clinic experienced rising overall attendances from 5,050 new and 1,853 repeat visits in 2017 to 6,331 new and 2,958 repeat visits in 2018, before COVID-19 Movement Control Order (MCO) restrictions caused attendances to fall to 794 new and 156 repeat visits in 2019. In 2020, attendances rebounded to 5,612 new and 2,150 repeat visits across all age groups. Among these, older adults (age >60 years) accounted for 273 new cases (4.9%) and 445 repeat visits (20.7%), with 90 complete dentures provided to 52 patients and 41 removable partial dentures provided to 29 patients.

Using the Nominal Group Technique (NGT) guided by SMART criteria, the project team prioritised this service delivery delay due to its direct impact on patient health outcomes and clinic performance. The primary aim was to increase the percentage of older adult patients receiving complete or partial dentures within eight weeks from 38.4% to above 50% at Parit Raja Dental Clinic within a 12-month period (January to December 2021).

Background

Global and national authorities, including the World Health Organization and the Ministry of Health (MOH), have emphasised oral health as an essential component of universal health coverage, highlighting the importance of prevention, early intervention, and intersectoral collaboration to support healthy ageing (5). Edentulism contributes to more than one-third of the global oral disorder disability burden, and timely denture provision plays a vital role in restoring occlusion, aesthetics, and oral health–related quality of life (1). Malaysia's older adult population is projected to reach 15.0% by 2030 (3), increasing demand for prosthodontic care in public clinics. The ageing process increases susceptibility to tooth loss due to cumulative oral disease, systemic health conditions, and medication-induced xerostomia (4). Older adults with poor-fitting or delayed dentures often resort to soft, nutrient-deficient diets, leading to reduced nutritional intake and lower quality of life (1). Dentures improve mastication, digestion, and self-esteem among older adults, and are increasingly recognised as important for maintaining general health and well-being, including prevention of malnutrition, frailty, and cognitive decline (6). However, denture construction is a multi-step procedure involving consultation, impression taking, bite registration, try-in, and issue stages (7). Clinical challenges

such as excessive alveolar ridge resorption may compromise denture fit and retention, necessitating remakes or additional adjustments, which can prolong treatment time and make completion within eight weeks difficult (8).

In this study, the term older adults is used instead of elderly to reflect a more person-centred and respectful terminology that aligns with current public health and gerontology literature (9). The term older adults emphasises active ageing and avoids the potentially ageist connotations associated with the word elderly (9). In Malaysia, individuals aged 60 years and above are classified as older adults, consistent with the definition adopted by the MOH's Health Information System and the United Nations (10,11). This age threshold is widely used in national and international research to represent the ageing population segment. Oral rehabilitation among older adults is recognised as a core service under Malaysia's National Oral Health Strategic Plan (NOHSP) 2022–2030 (12) and the MOH KPI framework, which sets a target of completing at least 50% of denture cases within eight weeks (13). Evidence from local audit data indicated that many clinics fall well below these standards; for example, only about 23.9% of patients in one QI project in Kedah state received removable dentures within eight weeks, far below the KPI target, reflecting systemic delays in prosthesis delivery across settings (14). Furthermore, international experiences with public dental services frequently report prolonged waiting times for basic dental care, with some regions documenting average waits exceeding a year for public dental services (15), underscoring the broader challenge of timely denture completion in resource-limited systems. The MOH KPI benchmark of completing at least 50% of denture cases within eight weeks standardised delivery timelines to ensure functional adaptation, maintain residual ridge integrity, and improve clinical outcomes. These efforts align with Malaysia's ageing policy frameworks, such as the National Policy for Older Persons (2011) and the National Action Plan for Healthy Ageing (2018–2023), both emphasising independence, nutrition, and psychosocial well-being (16,17). The project also supports Sustainable Development Goals 3 and 10, which promote healthy ageing and reduce inequalities through equitable oral health access (18). Timely denture provision contributes directly to these goals by restoring oral function and promoting social participation among older adults.

However, delays in denture issuance often arise from multiple factors, including operator skill, laboratory workflow, and patient compliance. The fabrication process requires precision at every stage, and errors or repetitions, particularly during impression taking and bite registration, result in time wastage and poor-fitting dentures (19). Previous studies from Croatia, Jordan, and the United Kingdom have shown that operator experience, guided supervision, and adherence to standardised procedures significantly influence denture quality and completion time (19–21).

This quality improvement project aligns with the MOH's strategic objective to strengthen service efficiency and workforce competency while advancing sustainable quality improvement (18). In addition, NOHSP Priority Area Five emphasises digital innovation and capacity-building, such as skill enhancement programmes and the integration of digital records, as key enablers for sustaining improvements (12). International studies, such as those from the United Kingdom, have proposed several strategies to improve the efficiency of denture service delivery in response to similar challenges (22,23). These include simplified denture fabrication techniques, such as reduced-visit or two-visit complete denture protocols, which shorten treatment duration without compromising patient satisfaction or clinical outcomes; strengthening operator competency through structured training, supervision, and adherence to standardised protocols to reduce procedural errors and remakes; improvements in laboratory workflow and coordination between clinics and technicians, including the adoption of digital technologies such as computer-aided design and manufacturing; and patient-focused strategies, including appointment compliance monitoring and oral health

education to minimise delays from missed visits or poor adaptation. Leveraging these strategies ensures equitable service delivery despite human resource and infrastructure limitations, particularly in rural settings.

Measurement

This QI study was conducted from January 2021 to December 2023, encompassing three annual Plan–Do–Study–Act (PDSA) cycles (verification, intervention, and post-intervention/ sustainability phases). The duration of each PDSA cycle was 12 months, allowing sufficient time for planning, implementation, evaluation, and refinement of interventions. Although PDSA cycles are commonly conducted over six months, a twelve-month cycle was deliberately adopted in this project. Denture provision involves a multistage clinical and laboratory process with variable case complexity, requiring a longer period to capture sufficient cases for stable measurement. In addition, monitoring of denture timeliness is aligned with the MOH annual KPI reporting framework, making a yearly cycle more appropriate. The extended cycle also allowed adequate time for training, supervision, and consolidation of skills among newly posted dental officers, as well as assessment of sustainability beyond short-term improvements.

The study team consisted of seven dental officers, one dental technician, and four dental surgery assistants in Parit Raja Dental Clinic. The dental officers were responsible for all clinical procedures, including patient assessment, impression taking, try-in, and denture issues. The dental technician carried out the denture fabrication process in the dental laboratory, while the dental surgery assistants supported the clinical workflow through patient clerking, preparation of impression materials, and chairside assistance. The project was led by the Supervising Dental Officer, who coordinated implementation, data verification, and adherence to MOH KPI reporting standards. Oversight and technical guidance were provided by the Dental Public Health Specialist in Batu Pahat District Office.

The key indicator followed MOH KPI No. 10 (2021):

$$\textit{Percentage of older adults receiving dentures within 8 weeks} = \frac{\textit{Number of older adults receiving dentures within 8 weeks}}{\textit{Total number of older adults receiving dentures}} \times 100$$

The standard set was ≥50% of older adults should receive dentures within eight weeks of being fit for fabrication. In this context, the eight-week period covers the complete denture fabrication process, including consultation, primary and secondary impressions, bite registration, try-in, and delivery of the completed denture. This indicator was selected as it represents national KPI No. 10, 2021 under the Primary Oral Healthcare Programme, MOH Malaysia. This KPI is set by the MOH as the national benchmark for timeliness of denture service delivery and is used by all public sector dental clinics (13). Monitoring this KPI allows clinics to track service efficiency, identify bottlenecks, and support timely functional oral rehabilitation among older adults. The indicator aligns with national priorities to improve functional oral rehabilitation and access to prosthodontic care in the ageing population (12).

Data sources included LP8-2 PIN.8/2019 cards, and PG207 reports from 2020-2023 (13). Data collected comprised the number of older adults receiving dentures, the date of fit for fabrication, and the date of denture issue, which allowed calculation of the time interval of eight weeks between the point when the denture was deemed fit for fabrication (following consultation and initial assessment) and the completion and delivery of the denture. Cases where patients defaulted on appointments were excluded. All data were verified by cross-checking LP8-2 PIN.8/2019 cards, and PG207 reports to ensure completeness and accuracy before analysis.

A verification study in 2020 showed that 38.4% of older adults received dentures within the stipulated timeframe. To identify potential contributing factors, a brief internal online questionnaire was developed by the Quality Assurance team and distributed to

seven dental officers in Parit Raja Dental Clinic. The tool, created using Google Forms, consisted of three structured questions exploring factors affecting confidence and competency in denture fabrication, as well as stages most frequently repeated. The questionnaire was reviewed by the clinic's Supervising Dental Officer and the District Dental Officer, who is also a Dental Public Health Specialist, to ensure appropriateness to the project objectives. The questionnaire is presented in Appendix 1.

No patient-level data collection or work process audit was conducted, as the project focused primarily on identifying provider-related factors contributing to delays in denture completion. The problem analysis chart revealed five main contributing factors:

1. Increased demand for new denture cases
2. Repetition of complicated fabrication steps
3. Lengthy procedure time
4. Differences in operator skill and experience
5. Low dental technician-to-patient ratio

The most actionable factors were selected for intervention.

Initial Assessment of the Problem

The potential factors contributing to the low percentage of older adults receiving dentures within eight weeks in Parit Raja Dental Clinic are shown in Figure 1.

Increased demand for dentures among older adults, due to poor denture maintenance, loss of functional teeth, and patient preference for spare or lower-cost prostheses, has led to a heavier workload. The proportion of edentulous patients aged 60 years and above attending Parit Raja Dental Clinic increased from 20.8% in 2019 to 28.0% in 2020, indicating a rising demand for denture services at the clinic. Limited manpower, particularly the reliance on a single dental technician and the need to coordinate both clinical and laboratory stages, further extended turnaround time. The multi-stage denture fabrication process, involving several personnel, was also prone to procedural delays. Communication gaps between dental officers and technicians, as well as the complex steps required for full dentures, often led to repetition of work. Baseline service data from 2020 revealed 29 denture cases requiring repetition of one or more fabrication stages, with eight cases involving repeated impression taking, 18 cases involving repeated bite registration, and three cases requiring a denture re-try. In addition, variations in clinical skills and experience among dental officers, coupled with inadequate guidance for new officers, contribute to inefficiencies. Analysis of operator experience showed that 27 of these cases were managed by dental officers with less than two years of experience, while only two cases involved operators with more than two years of experience, suggesting a possible correlation between operator experience and procedural repetition. Overall, these organisational, technical, and human factors collectively delayed completion and reduced the proportion of older adults receiving dentures within the target period.

Figure 2 shows the standard process of care of denture fabrication in Parit Raja Dental Clinic. On the other hand, Table 1 shows the Model of Good Care (MOGC), which outlines each critical step and the corresponding criteria that support high-quality denture fabrication.

Retrospective data extracted from clinical records and performance reports were analysed descriptively to determine the proportion of cases requiring repetition at each denture fabrication stage. Results showed that 50.0% (29/58) of cases involved repetition of one or more denture fabrication stages, predominantly the bite registration stage (62.0%). A simple correlation analysis indicated an inverse relationship between years of working experience and repetition frequency, particularly at the impression and bite registration stages, suggesting that the need for repetition decreased with increasing working experience. Findings from the internal staff questionnaire were analysed using frequency distribution, revealing critical factors affecting performance: lack of knowledge in impression-taking (28.6%), inadequate bite registration skills (71.4%), complexity of the bite registration technique (85.7%), and lengthy procedures (57.1%). A majority of the dental officers (71.0%) had

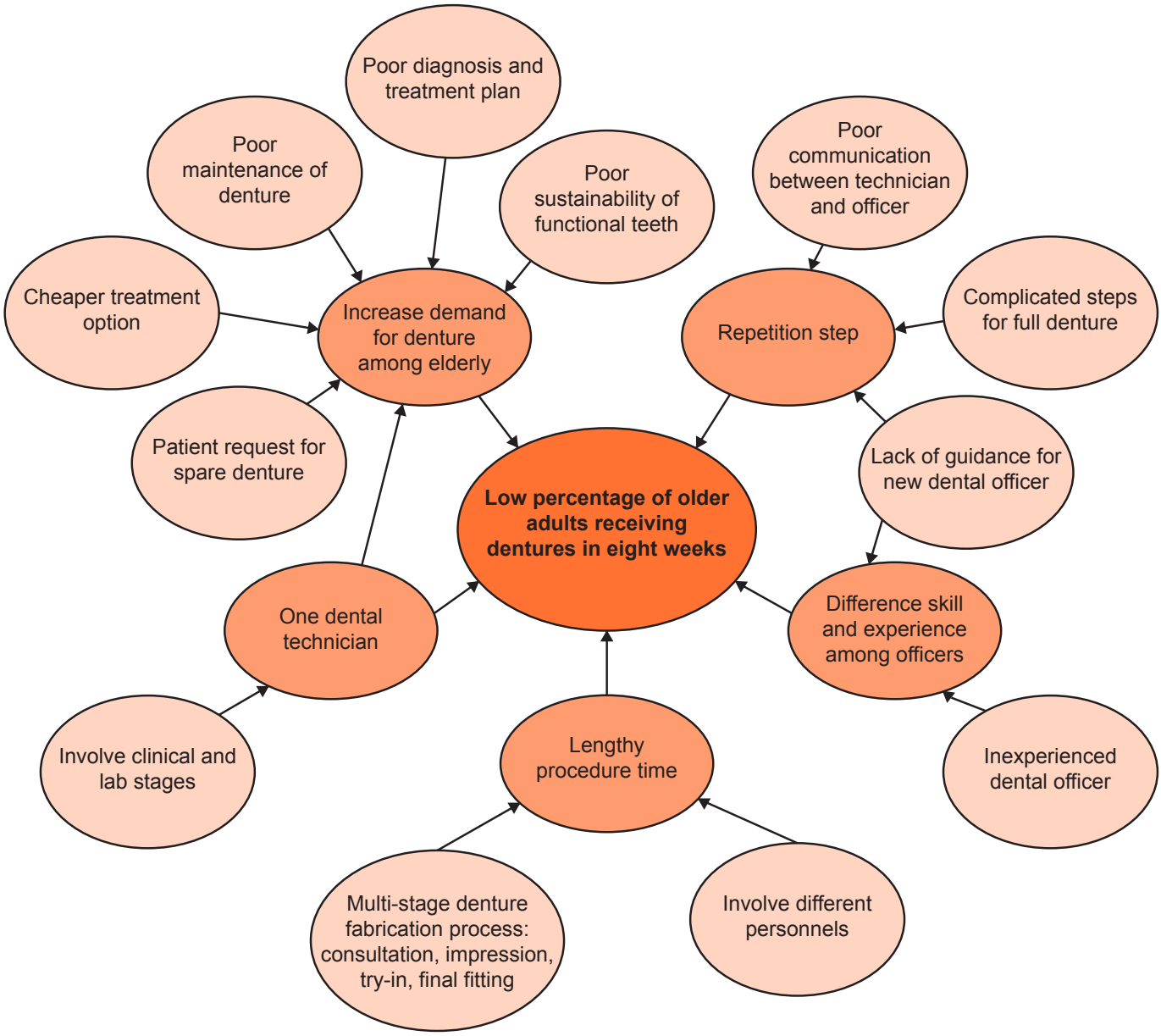
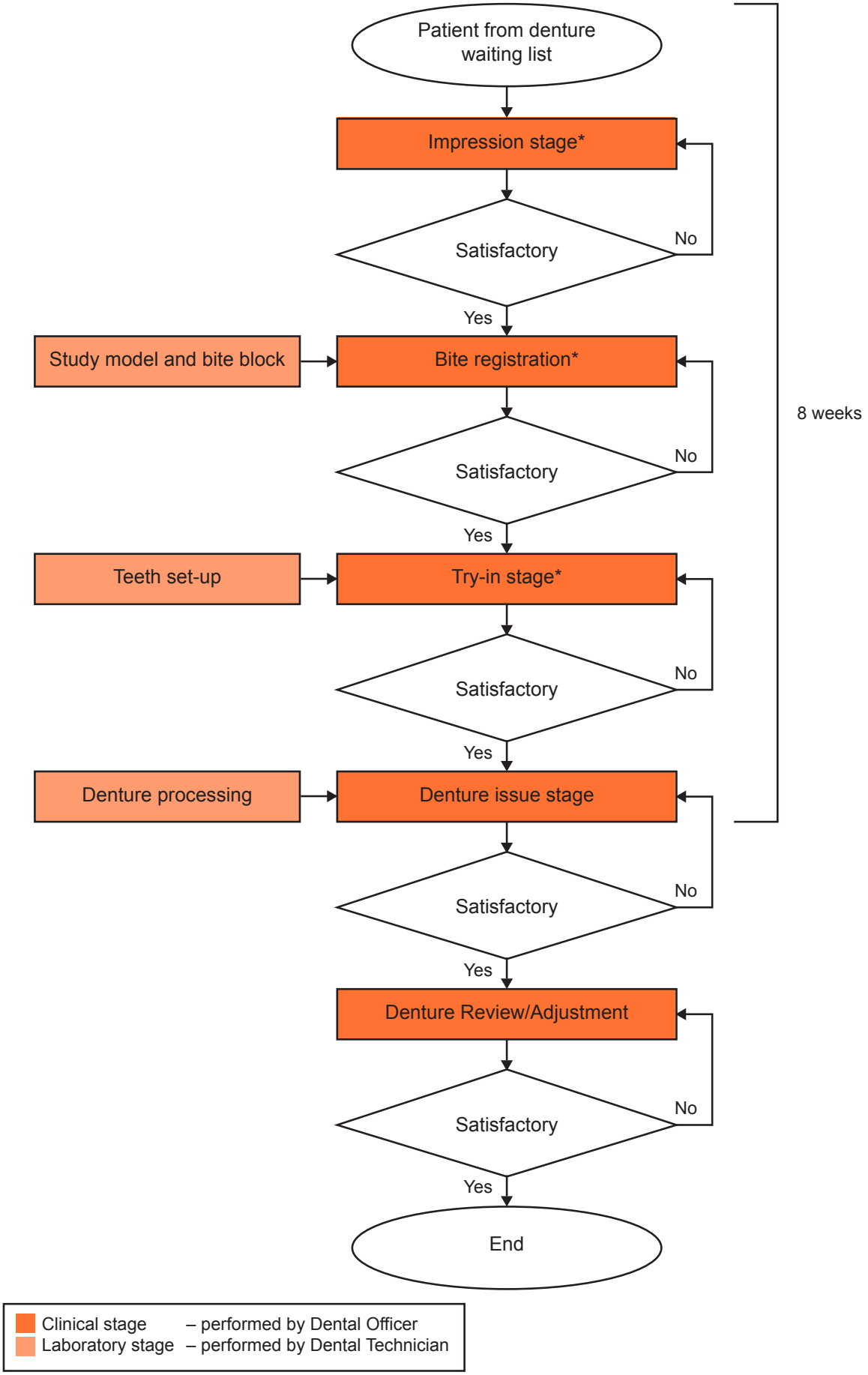


Figure 1: Problem analysis chart on the low percentage of older adults receiving dentures within eight weeks in Parit Raja Dental Clinic



* indicates critical steps

Figure 2: Standard process of care for denture fabrication in Parit Raja Dental Clinic

less than two years of experience, indicating a need for supervision and structured skill development. This assessment also identified system-level factors, including limited dental technician support and constrained laboratory capacity. These findings were consistent with national trends, where infrastructure limitations and human resource shortages remain key barriers to achieving timely denture completion (24,25).

Strategy

The MOGC (Table 1) outlines each critical step and the corresponding criteria that support high-quality denture fabrication. The improvement process was guided by the PDSA framework and implemented over three annual cycles from 2021 to 2023. Each cycle lasted 12 months and applied the same set of interventions: training and skill enhancement, guided supervision, and innovation with process optimisation. These interventions were continuously refined based on performance results and feedback from the previous cycle. This approach allowed the team to plan, implement, review, and adjust strategies in a systematic and sustainable manner while maintaining consistency with annual MOH KPI reporting.

Cycle 1 (January to December 2021): Initial Implementation

The first cycle focused on capacity building. Cycle 1 consisted of three-phased interventions: (Phase 1) hands-on workshop, (Phase 2) supervised tagging, and (Phase

Table 1: MOGC for improving the percentage of older adults receiving dentures within eight weeks in Parit Raja Dental Clinic

Step	Process of Care	Criteria	Standard	Verification	Cycle 1	Cycle 2	Cycle 3
1.	Impression stage	Ensure all anatomical landmark recorded adequately	100%	70.0%	100%	100%	100%
		To ensure suction is present upon removal	100%	90.0%	100%	100%	100%
2.	Bite registration stage	To ensure a bite with stable occlusion is achieved	100%	70.0%	100%	100%	100%
		To ensure the centric relation is recorded	100%	70.0%	100%	100%	100%
3.	Try-in stage	To ensure the patient is satisfied with the denture's appearance	100%	100%	100%	100%	100%
		To confirm the bite achieved as the previous bite registration	100%	80.0%	100%	100%	100%

3) introduction of the Burner Box and quick guide. All dental officers attended a hands-on denture workshop that emphasised impression-taking and bite registration (Phase 1). They were subsequently paired with senior mentors through a tagging system for guided supervision (Phase 2). An innovative tool, the Burner Box, and a quick guide for bite registration (Figure 3) were introduced (Phase 3) to improve efficiency and reduce procedural errors. The Burner Box was developed by the Innovation Team from the Batu Pahat District Dental Health Office. It consists of a metal box that securely houses essential instruments for denture fabrication, including a wax knife, wax scraper, Fox plane, divider calliper, wax sheet, fire lighter, ruler, pencil, Bunsen burner, rubber mixing bowl, gauze, and stapler bullets. The design allows the Bunsen burner to be safely enclosed, preventing accidental flame extinguishing and reducing fire hazards. It also helps maintain workspace cleanliness by containing melted wax and facilitates easier cleaning and disinfection after patient treatment. The tool was primarily intended for dental officers performing chairside denture fabrication, particularly during the bite registration and try-in stages. While the Burner Box was not formally endorsed, verbal feedback from users indicated that it improved workflow organisation and shortened procedural time, enhancing overall efficiency in denture fabrication.

Cycle 2 (January to December 2022): Refinement and Reinforcement

The second cycle emphasised refinement of the same interventions. Refresher workshops were conducted for newly posted dental officers, followed by a structured tagging system in which each junior officer was paired with a senior permanent officer for real-time supervision during denture fabrication. The supervision was carried out by senior dental officers within the clinic, coordinated by the Clinic Head, to ensure consistent application of standardised clinical techniques and to provide immediate feedback during key stages such as impression taking and bite registration. Although no formal pre- and post-assessment was conducted, this hands-on mentorship allowed ongoing evaluation through direct observation and feedback. Routine audits were conducted monthly as part of the clinic's internal quality review process. These audits were separate from the supervision activities and involved reviewing denture case records, tracking completion timelines, and verifying adherence to the MOGC criteria. The audits also examined the frequency of case repetitions and documented reasons for delays, enabling the team to identify workflow bottlenecks and implement corrective actions promptly. Findings from the audits were discussed during monthly review meetings, where progress was evaluated, and further improvements were planned collaboratively by the clinic team.

Cycle 3 (January to December 2023): Consolidation and Sustainability

The third cycle aimed to sustain improvements and institutionalise the MOGC (Table 1). Peer coaching and periodic evaluations were introduced to maintain performance standards despite staff rotation, with each senior officer supervising two junior officers at key stages of denture fabrication. Continuous monitoring through PG207 reporting ensured that the improvements were maintained and aligned with the MOH KPI standard.

Each PDSA cycle concluded with an end-of-year review to evaluate progress, measure outcome indicators, and plan adjustments for the following cycle.

Results

Post-intervention outcomes showed marked improvement over three consecutive PDSA cycles. Each annual cycle reflected the impact of the corresponding strategies implemented that year.

Cycle 1 (January–December 2021): Initial Implementation

Following the introduction of training workshops, guided supervision, and the Burner Box innovation, procedural efficiency improved significantly. Repetition rates in the bite registration stage decreased from 62.0% to 28.6%, indicating improved operator skill and reduced procedural errors. The percentage of older adults receiving dentures within eight weeks increased from 38.4% in 2020 (pre-intervention) to 66.7% in 2021. The Achievable Benefit Not Achieved

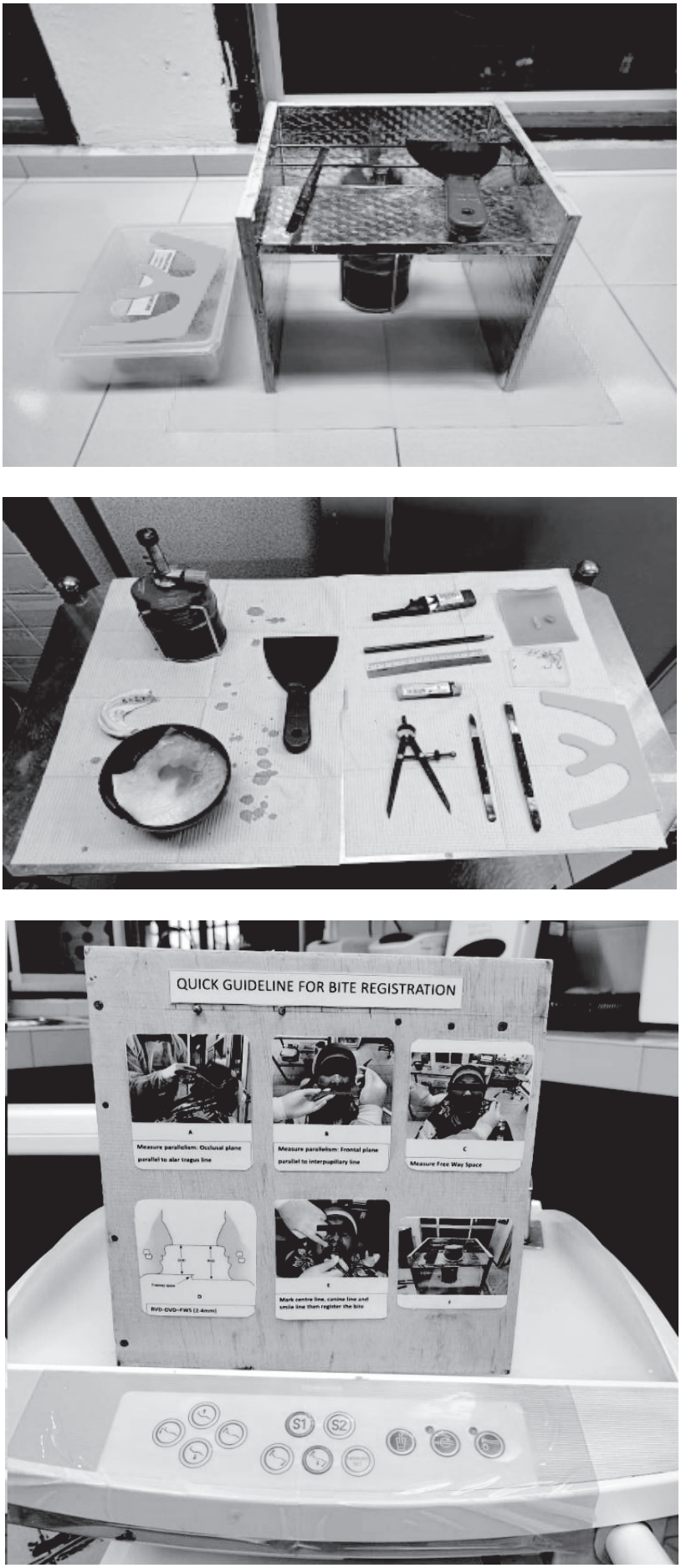


Figure 3: Burner box and quick guideline to improve efficiency during bite registration

(ABNA) improved from 11.6% to –16.7% (Figure 4), showing substantial progress toward the MOH target.

Cycle 2 (January–December 2022): Refinement and Reinforcement

During the second cycle, continuous supervision, refresher workshops, and workflow refinement were emphasised. These strategies led to further improvements, with 84.5% of older adults receiving dentures within eight weeks. This represented a 17.8% increase from the previous year, confirming that reinforcement and standardisation enhanced consistency and maintained skill levels among new officers.

Cycle 3 (January–December 2023): Consolidation and Sustainability

In the third cycle, peer coaching and continuous monitoring ensured sustained adherence to the MOGC. Despite staff rotation and varying case complexity, performance remained high at 82.4%. The slight reduction from 84.5% in 2022 may be attributed to the onboarding of new officers and a higher proportion of complex edentulous cases requiring additional clinical adjustments. Nevertheless, the sustained outcome beyond the MOH KPI target of 50% demonstrated that the improvements were institutionalised and resilient to workforce changes. Overall, the number of older adults receiving dentures within eight weeks rose from 42 out of 63 in 2021 to 70 out of 85 in 2023. Staff feedback highlighted improved clinical confidence, shorter procedural time, and reduced workload stress, confirming the positive impact of skill enhancement, supervision, and innovation on service quality.

Figure 4 shows the percentage of older adults receiving dentures within eight weeks at Parit Raja Dental Clinic from 2020 to 2023. The year 2020 served as the baseline before any intervention. The following three years correspond to three PDSA cycles, each lasting one year. Progressive improvement was observed after each cycle, increasing from 38.4% in 2020 (baseline) to 66.7% in 2021 (Cycle 1), 84.5% in 2022 (Cycle 2), and 82.4% in 2023 (Cycle 3). These findings demonstrate that repeated implementation and continuous refinement of interventions across three annual cycles effectively improved and sustained performance above the MOH KPI target of 50%. In addition to improved timeliness, the reduction in procedural repetition and remakes contributed to lower material costs, decreased laboratory burden, better utilisation of manpower, and reduced patient visits, thereby enhancing overall service efficiency and cost-effectiveness.

Lessons and Limitations

This project demonstrated that guided training, procedural innovation, and mentorship can effectively improve clinical efficiency. However, limitations included dependence on senior officers' availability for supervision, varying patient cooperation levels, and laboratory workload that occasionally delayed completion. The project also relied on internal motivation rather than external incentives, which may affect sustainability without continuous monitoring.

Conclusion and the Next Steps

The interventions significantly improved denture delivery timelines, surpassing the national KPI. The success of this project demonstrates that structured training, mentorship, and procedural innovation can meaningfully improve oral healthcare service quality and patient outcomes in the public sector. Sustained adherence to the MOGC ensures continuity of these gains. By aligning with the National Oral Health Strategic Plan (2022–2030) and the global Vision 2030 for Oral health (12), this initiative supports Malaysia's commitment to provide equitable, efficient, and person-centred care for its ageing population. Continued monitoring and district-wide implementation will further contribute to achieving Sustainable Development Goals 3 (Good Health and Well-Being) and 10 (Reduced Inequalities). Sustaining this improvement requires continued supervision, periodic workshops, and adherence to the standardised workflow. The project has been expanded to all dental clinics in the Batu Pahat District as of 2024, with plans for replication across Johor. Aggregated data from the participating clinics show that the percentage of older adult patients receiving dentures within eight weeks consistently met or

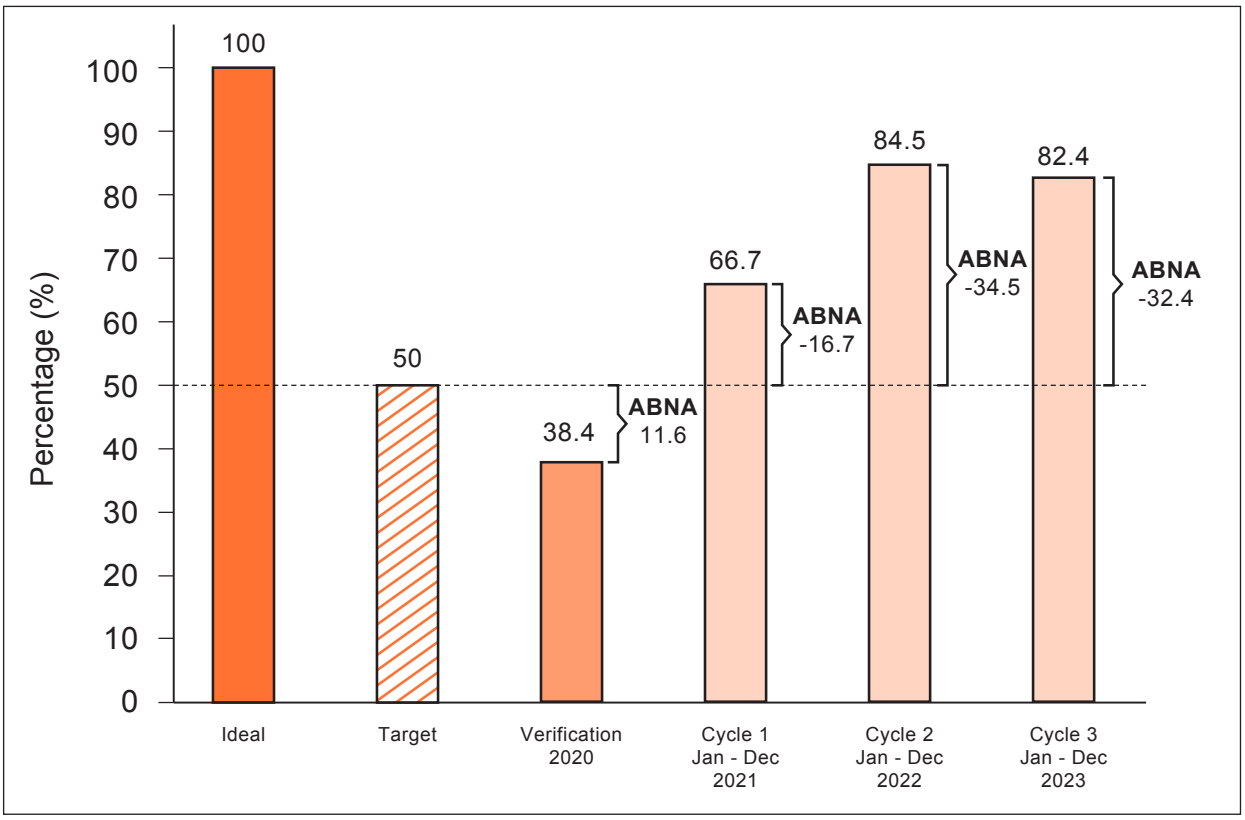


Figure 4: Percentage of older adults receiving dentures within eight weeks in Parit Raja Dental Clinic from 2020 to 2023

exceeded the original KPI, with individual clinics achieving between 53.5% and 92.7% completion rates. For 2025, the district raised the KPI standard to 80% and plans to patent the Burner Box design through Intellectual Property Corporation of Malaysia (MyIPO) to facilitate nationwide adoption as a practical tool in public dental clinics. The project successfully achieved and exceeded its original SMART aim of increasing the percentage of older adult patients receiving dentures within eight weeks from 38.4% to above 50%, demonstrating sustained improvement over three consecutive years.

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Conflict of Interest

The authors declare that there was no conflict of interest.

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Appendix 1: Online Questionnaire for Assessment of Dental Officers' Perspectives on Denture Fabrication Challenges

Online Questionnaire KP Parit Raja

Increasing the Percentage of Elderly Patients Receiving Denture Within 8 Weeks in

Klinik Pergigian Parit Raja

Name: _____

Working experience

☐ Less than 2 years
☐ 2 years and above

What are the factors affecting your confidence and competency in denture fabrication?

☐ Lack of knowledge in impression taking
☐ Lack of skill in conducting bite registration
☐ Complicated technique of bite registration stage
☐ Lengthy procedure time

Which denture fabrication stage that you have repeated?

☐ Impression taking
☐ Bite registration
☐ Denture try in
☐ Denture issue