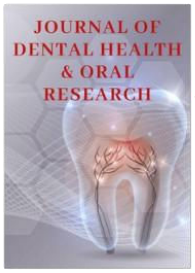

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Research Article

Changes in Dental Students' Perceptions Following an Elderly Simulation Program and Its Educational Effectiveness

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Abstract

As the number of older dental outpatient increases, it is essential for dental students to develop a practical understanding of age-related physical and psychological changes. This research aimed to evaluate shifts in students' perceptions of older adults and the educational impact of an elderly simulation training program. The study included 94 first-year dental students at Matsumoto Dental University. Participants wore an elderly simulation kit (including restraints, goggles, and earplugs) while completing walking tasks (including stair climbing) and a card-flipping task. Questionnaires administered before and after the training assessed definitions of older adults, perceptions of the elderly, and approaches to interactions with this population. Free-response data were analyzed using text mining (i.e., keyword association analysis). Results showed that mean walking time increased from 40.05 to 92.34 s, and card-flipping time increased from 5.6 to 31.61 s when wearing the elderly simulation kit. Before training, 55% of students defined the elderly as "65 years old," whereas post-training responses became more varied, including descriptions such as "individuals experiencing physical decline" or "depending on the person". Perceptions shifted from general concepts such as "mobility issues" to more specific difficulties including "poor eyesight" and "impaired hand dexterity". Approaches to interaction also changed, with increased awareness of proactive behaviors, such as "initiating conversation" and "polite engagement," replacing more stereotypical responses, such as "offering one's seat". These findings indicate that elderly simulation training is an effective educational approach for promoting intuitive understanding of physical limitations and fostering individualized, patient-centered perspectives beyond fixed assumptions.

Keywords: Elderly People; Simulated Experience of the Elderly; Keyword Association; Text Mining

Introduction

Japan's rapidly aging population presents major challenges for dental care [1]. According to a 2023 patient survey, individuals aged ≥65 years accounted for ~46% of all dental clinic visits, and demand for dental treatment among older adults continues to rise [2]. Effective care for older patients requires understanding age-related physical and psychological changes and adapting treatment to their specific needs. However, younger generations often have limited direct contact with the elderly. Although they may acquire theoretical knowledge, understanding the lived experiences of older individuals remains difficult [3,4].

This study aimed to determine how dental students' perceptions of older adults change through experiencing learning that simulates aging-related physical and psychological conditions. We report the results of a simulated elderly experience training program, examining how students perceived age-related limitations and assessing its educational impact.

Methodology

Before practical training, students attended a lecture on Japan's aging society, including definitions of older adults as individuals aged 65-74 (early elderly) and ≥75 years (late elderly). The study included 94 first-year dental students (68 males and 26 females) from Matsumoto Dental University, divided into four classes and then into two groups per class. Each group completed a walking task around the university gymnasium both while not wearing and wearing the elderly simulation kit (Fig. 1).

The simulation equipment used was the Elderly Experience Set L Size (Takaken Co., Ltd., LM-102, Tokyo, Japan), designed to replicate physical limitations in older adults, including reduced vision, hearing, and mobility. This set comprised elbow, knee, and finger restraints; goggles restricting vision; earplugs restricting hearing; and weights attached to the hands and feet (Fig. 1). Wearing this equipment allowed students to experience functional limitations similar to those encountered by elderly individuals in daily life [3].

During the walking task, participants followed a route that included stair climbing to simulate real-life mobility challenges. To further assess how physical limitations affect performance, a card-flipping task was conducted (Fig. 2), measuring delays in movement and visual-manual coordination (Fig. 3). Three white and three yellow cards were shuffled face down, and the time required to sort them by color was recorded and compared (Fig. 2). Both analyses were conducted using a paired t-test ($P<0.001$) to assess differences between conditions.

Because only one set of the elderly simulation kit was available for this practicum, two students were randomly selected from each group to undergo the measurements. In total, 32 students were selected (20 males and 12 females; mean age, 22.19 years). As the kit is difficult to put on without assistance, participants donned the equipment with the help of their group members. For female students, the kit was applied exclusively by other female students, and a female instructor was always assigned to supervise the practicum. All students were given the opportunity to experience wearing the goggles included in the elderly simulation kit.

An anonymous questionnaire was administered before and after the practicum. The survey assessed the following items:

1. Age perceived as elderly
2. Image/impression of the elderly
3. Awareness of how to interact with and show consideration for the elderly
4. Level of learning from the practicum content
5. Free-form comments or reflections

Survey data were statistically analyzed. Free-form responses (questions 2-5) were examined using text mining via analysis software (TrendSearch 2015 BellCurve) to analyze keyword association. This method involves extracting keywords based on parts of speech through morphological analysis of text data. During analysis, unclear terms were refine using extracted part-of-speech lists, including removal of irrelevant words (debris removal), standardization of expression (codification), and exclusion of unclear and unsuitable terms (e.g., organization names, personal names, and place names). Synonymous terms were consolidated into unified into keywords. This study was conducted as part of an educational program, with full consideration given to protecting participants' personal information.

Figure 1 : Senior Experience Kit
A: Photo with Kit Worn (Full Set)
B: Appearance When Worn

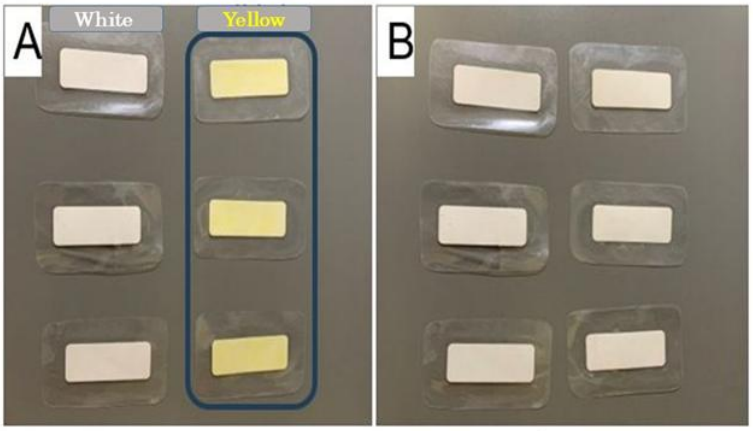


Figure 2 : These are cards used for a card-flipping game, A: Card front (left: white, right: yellow) B: Card back (left and right: white).In order to learn how physical limitations affect performance through a game format, we conducted a card-flipping game and measured delays in movement as well as visual and fine motor limitations.

Figure 3 : Card-Flipping Experience Practice.Students conducted the card-flipping experience practice while wearing the elderly simulation set. Three white and three yellow cards were prepared. After placin them face down, shuffling them, and then separating them into white and yellow groups, the time taken was measured.

Results

Overall, survey findings indicated that students' perceptions of the elderly changed markedly after the practicum. Regarding "the age personally associated with elderly individuals," before the practicum the most frequently cited age was 65 years, reported by 55% (52 students), followed by 70 years at 21% (20 students) and 60 years at 14% (13 students). After the practicum, 65 years old remained the most common response at 36% (34 students), followed by 70 years old at 20% (19 students), 80 years old at 13% (12 students), 60 years old at 11% (10 students), and 75 years old at 7% (7 students), indicating greater dispersion (Fig. 4). Furthermore, whereas all students initially reported only an age, after training more participants added qualifiers such as "if they feel restricted," "it varies by person so age is irrelevant," "it depends on the case," or "when body movements no longer follow intentions".

Regarding "imagery and impressions of the elderly," keyword association analysis revealed that before the practicum the top-ranked keyword was "mobility issues," with the highest importance value (5.79) and a frequency of 6. This was followed by "body," "frail," and "gentle"; the tenth-ranked keyword, "walking," had an importance value of 2.25. Free responses often reflected abstract concepts, such as "decline in abilities," "physical disability," and "everything is slow." After training, the top keyword shifted to "disability," with a higher importance value (8.24) and frequency (15), followed by "inconvenience," "body," and "movement"; the tenth-ranked keyword, again "walking," had an importance value of 2.54. Free responses increasingly included specific examples, such as "poor hearing," "poor eyesight," and "reduced dexterity." Previous studies have reported increased negative perceptions after simulated aging experiences and our results aligned with these studies, with negative perceptions becoming more concrete and detailed (Table 1) [2,5].

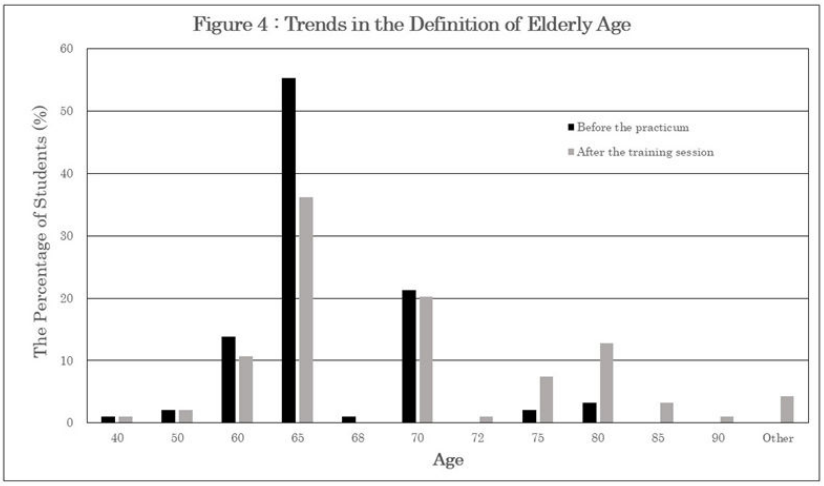
Regarding "awareness of how to interact with and consider the elderly," before the training the top keyword was "yield," followed by "seat," both with an importance value of 5.59 and a frequency of 9, highlighting "yielding one's seat." This was followed by "behavior," "assist," and "interact"; "luggage" ranked tenth with an importance value of 1.84. Overall, responses emphasized general interaction behaviors. After the practicum, the top keyword was "kind," with an importance value of 4.62 and a frequency of 6, followed by "words of encouragement", "volunteering" and "polite", "addressing" was ranked tenth with an importance value of 2.06 and a frequency of 4. Although values were more dispersed after training, pre- and post-training responses consistently included intentions such as "treat them kindly," "interact with consideration," and "address them appropriately" (Table 2).

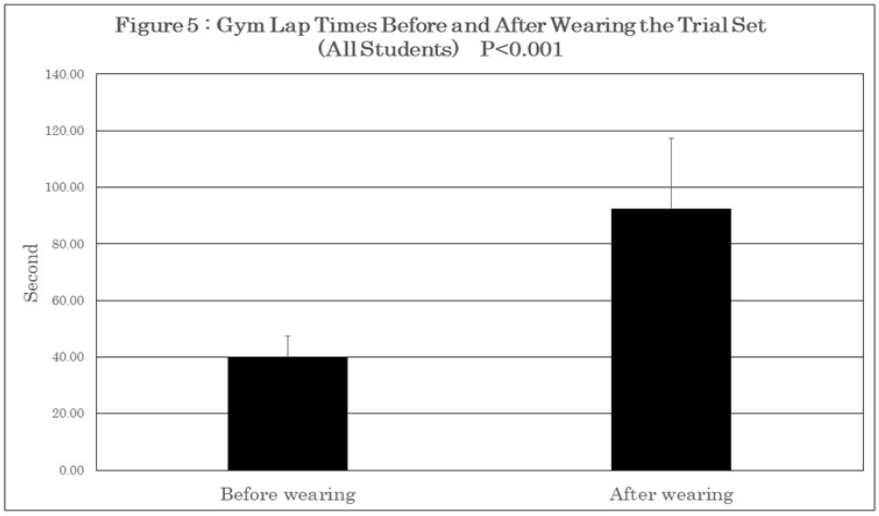
For "learning regarding practicum content," participants reported what they wished to learn before and what they learned afterward. Before the practicum, the top keyword was "elderly," appearing 62 times with an importance value of 5.21, followed by "feel," "inconvenience," and "feelings"; the tenth-ranked keyword, "learn," had an importance value of 1.98 and a frequency of 6. After the practicum, the top keyword shifted to "challenging," with an importance value of 6.09 and a frequency of 13, followed by "elderly," "inconvenience," and "important"; the tenth-ranked keyword, "assist," had an importance value of 1.87 and a frequency of 5. Before and after the practicum, themes such as "how to assist the elderly," "importance of greeting to establish communication and build trust," and "daily inconveniences experienced by elderly individuals" remained prominent (Table 3).

In the "free-form comments and learning" section, before the practicum the top keyword was "experience," with an importance value of 5.54 and a frequency of 14, followed by "elderly," "know," and "understand"; "self" was ranked tenth with an importance value of 2.09 and a frequency of 7. After the practicum, "good" was the top-ranked keyword, with an importance value of 3.02 and a frequency of 14, followed by "think," "easy to understand," and "experience"; the tenth-ranked keyword, "increase," had an importance score of 1.34 and a frequency of 3. Before training, responses included "understanding feelings through simulated experiences of the elderly," whereas after training responses included "it was easy to understand," "the experience helped comprehension," "this is a worthwhile practice," "experiencing being elderly was interesting," and "I would take this class again," with few students reporting "none in particular" (Table 4).

Participants also completed a lap around the gymnasium, including stair climbing, while wearing the simulation kit to measure walking time. The mean time before wearing the simulation kit (normal walking) was 40.05 s, which increased to 92.34 s after wearing the kit (Fig. 5). A significant increase was observed before and after wearing the kit across all participants, with no sex differences.

In the card-flipping task, the mean completion time increased from 5.6 s before wearing the kit to 31.61 s after wearing it (Fig. 6), representing an approximately sixfold increase. Significant differences were observed before and after wearing the kit, again without sex differences.





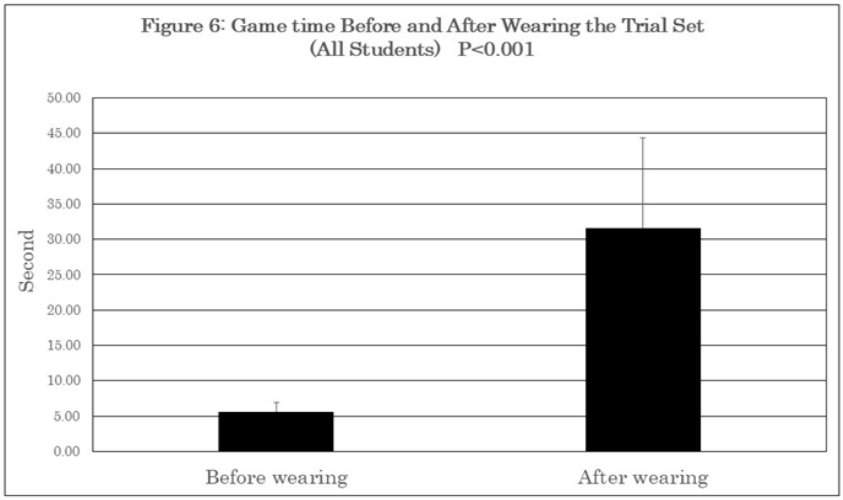


Table 1 : Survey Results on Perceptions and Impressions of the Elderly

Ranking	Pre-Practicum Questionnaire			Post-Practicum Questionnaire		
	Keyword	Importance	Occurrence frequency	Keyword	Importance	Occurrence frequency
1	Mobility issues	5.79	6	Disability	8.24	15
2	Body	5.74	15	Inconvenience	7.94	14
3	Frail	4.37	8	Body	6.65	24
4	Gentle	4.26	5	Movement	5.9	8
5	Unable	4.1	6	Mobility	4.77	12
6	Legs	3.42	5	Person	3.87	11
7	Weakening	3.24	7	Bad	3.86	7
8	Slow	3	7	Ear	3.62	7
9	Person	2.37	8	Eye	3.16	6
10	Walking	2.25	4	Walking	2.54	4

Table 2 : Survey Results on Awareness Regarding Approaches and Considerations for the Elderly

Ranking	Pre-Practicum Questionnaire			Post-Practicum Questionnaire		
	Keyword	Importance	Occurrence frequency	Keyword	Importance	Occurrence frequency
1	Yield	5.59	9	Kind	4.62	6
2	Seat	5.59	9	Words of encouragement	2.92	4
3	Behavior	2.78	5	Volunteering	2.66	3
4	Assist	2.64	10	Polite	2.49	3
5	Interact	2.47	7	Interaction	2.46	6
6	Polite	2.23	5	Consideration	2.36	5
7	Help	2.2	5	Assistance	2.28	5
8	Talk	2.09	4	Support	2.28	4
9	Hold	1.97	4	Body	2.22	6
10	Luggage	1.84	3	Addressing	2.06	4

Table 3 : Survey Results on Learning Progress Regarding Practical Training Content

Ranking	Pre-Practicum Questionnaire			Post-Practicum Questionnaire		
	Keyword	Importance	Occurrence frequency	Keyword	Importance	Occurrence frequency
1	Elderly	5.21	62	Challenging	6.09	13
2	Feel	2.85	7	Elderly	5.76	29
3	Inconvenience	2.8	6	Inconvenience	4.1	7
4	Feelings	2.52	5	Important	2.8	7
5	Difficult	2.49	6	People	2.62	8
6	Understanding	2.46	7	Reaching out	2.26	5
7	Life	2.36	7	Daily life	2.08	6
8	Perspective	2.29	6	Care	1.97	5
9	Own	1.98	8	Need	1.91	5
10	Learn	1.98	6	Assist	1.87	5

Table 4: Results of Free-Response Feedback and Learning Questionnaire

Ranking	Pre-Practicum Questionnaire			Post-Practicum Questionnaire		
	Keyword	Importance	Occurrence frequency	Keyword	Importance	Occurrence frequency
1	Experience	5.54	14	Good	3.02	14
2	Elderly	5.46	43	Think	2.3	11
3	Know	3.63	9	Easy to understand	2.17	4
4	Understand	3.54	14	Experience	2.11	10
5	Feelings	3.06	9	Simulated experience	2	4
6	Knowledge	2.3	7	Can do	1.87	5
7	Old people	2.23	4	Interesting	1.8	3
8	Understand	2.22	5	Want	1.74	5
9	Learn	2.16	6	Practical training	1.51	6
10	Self	2.09	7	Increase	1.34	3

Discussion and Conclusion

The simulated aging experience employed in this study represented a valuable tool for enabling students to directly experience the physical limitations of older adults and deepen their understanding of age-related physical and psychological changes. In particular, firsthand exposure to physical strain allowed students to appreciate how everyday actions, such as stair climbing or fine motor tasks, can become difficult for older adults. This enabled experiential understanding rather than merely intellectual recognition, representing a key strength of the training. Furthermore, survey results indicated a shift from fixed notions, such as "elderly ≥65 years" to a more flexible perspective emphasizing "physical limitations as defining characteristics of the elderly." Before the practicum, many students defined the elderly as those aged 65 years; however, after the practicum, responses such as "elderly refers to individuals experiencing physical decline, regardless of age" increased. Lectures describing early and late elderly stages also contributed to this perceptual shift. This change suggests growing awareness that elderly individuals should not be uniformly categorized by age but require support tailored to their physical and psychological condition. This change represents an important shift in awareness among students with limited direct contact with older adults and may influence future clinical training and patient interactions. Moreover, recognition that "each elderly person is different" is a critical concept for healthcare professionals. Understanding individual patient circumstances and tailoring care accordingly contributes directly to improved quality of life [5-7].

The elderly simulation kit functioned as an effective educational tool for student learning. During the practicum, the physical constraints imposed by the kit clearly demonstrated the challenges of stair climbing and simple manual tasks. Additionally, timing the card-flipping task while wearing the simulation kit showed that completion time increased approximately sixfold, providing intuitive understanding of how physical limitations affect performance speed. Because the simulation cannot fully reproduce all aspects of aging, combining it with direct interaction with older adults, such as facility visits or communication opportunities, would likely foster deeper understanding [8].

Future curricula incorporating simulated aging experiences should further enhance understanding of physical challenges and psychological burdens. To strengthen training, increasing opportunities for simulation participation may allow more students to gain direct experience [9,10]. Providing opportunities for direct interaction with older adults may also develop practical communication skills that simulation alone cannot offer. In addition, incorporating diverse scenarios addressing physical disability, dementia, and mental health may broaden perspectives [11]. Regular post-training reflection may further consolidate learning and deepen awareness. Through such improvements, students are expected to acquire more practical knowledge and skills applicable to elderly care and welfare.

Through an elderly simulation experience, students gained a deeper understanding of the physical and psychological limitations faced by older adults, fostering empathy and respect. Continued implementation of this training may further enhance students' ability to understand elderly individuals and respond appropriately in clinical settings.

Conflict of Interest

The authors declare that they have no conflicts of interest regarding the content of the article.

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Data Availability Statement

Not applicable.

Ethical Statement

This project was exempt from IRB review as it did not qualify as human subject research under federal regulations. This study complies with the Declaration of Helsinki and was reviewed and approved by the Ethics Review Committee of Matsumoto Dental University (approval number: 0392).

Informed Consent Statement
Informed consent was obtained from the participants involved in this study.

Consent for Publication
We obtained informed consent regarding publication from the students involved in this study, as stated in the manuscript.

Abbreviations and Nomenclature
No abbreviations or nomenclature are used in this manuscript.

Authors' Contributions
All authors contributed equally to this work and have reviewed and approved the final manuscript for publication.

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