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Four-Handed Technique in Dental Education: Integrative Review*

Técnica de trabajo a cuatro manos en la educación odontológica: Revisión integrativa

Técnica de trabalho a quatro mãos na educação odontológica: Revisão integrativa

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Abstract:

Background: Since the 1970s, the World Health Organization has defined four-handed dentistry as a simplified method with defined tasks within the work team. It has been mainly implemented in clinics and universities in Brazil, the United States, Spain, and Chile. The comprehensive adult dental clinic (Sixth semester) and the pediatric dental clinic (Seventh and Eighth semesters) of the pre-doctoral dental program at El Bosque University' Dental School (Bogotá, Colombia) use this method. However, theory on four-handed dentistry has not been included in the curriculum yet. **Purpose:** To explore and describe the influence of the four-handed method in the training of general dentists in order to justify its inclusion in the predoctoral curriculum. **Methods:** A search of articles was carried out until June 2020. Full-text selected articles were analyzed, and findings related to this study's purpose were included in the review. **Results:** 13 articles were chosen. Findings are organized in three thematic axes: background and general aspects of the technique, benefits of the technique in the training of general dentists, and description of the four-handed care model as an exercise in the pediatric dental clinics, also called Growth and Development clinics, at El Bosque University. **Conclusions:** Patient care using a four-handed method can contribute to the development of soft skills, critical thinking, problem solving through collaborative work, and promoting meaningful learning in students. **Keywords:** dental education, dental schools, dental students, dentistry, four-handed dentistry.

Resumen:

Antecedentes: La Organización Mundial de la Salud desde los años setenta define la atención a cuatro manos en odontología como una modalidad simplificada con tareas delimitadas dentro del equipo de trabajo, que se ha implementado en consultorios y universidades principalmente en Brasil, Estados Unidos, España y Chile. En Colombia, la clínica integral de adultos de sexto semestre y las de odontopediatria de séptimo y octavo semestre de la Universidad El Bosque (Bogotá, Colombia) trabajan usando este método, pero la teoría sobre esta técnica todavía no se ha incluido en el plan de estudios de dicha facultad. **Objetivo:** Explorar y describir la influencia de la técnica de trabajo a cuatro manos en la formación del odontólogo general, con el propósito de justificar su inclusión en dicho plan de estudios. **Métodos:** Se desarrolló una búsqueda de artículos hasta junio de 2020. Los seleccionados se evaluaron en texto completo y la información relacionada con el objetivo de este estudio se incluyó en la revisión. **Resultados:** Se seleccionaron 13 artículos y los resultados se presentan en tres ejes temáticos: antecedentes y generalidades de la técnica, beneficios de la técnica en la formación del odontólogo general y descripción del modelo de atención a cuatro manos como ejercicio en las Clínicas de Crecimiento y Desarrollo de la Universidad El Bosque. **Conclusiones:** La atención a cuatro manos puede contribuir al desarrollo de competencias blandas, al pensamiento crítico y la resolución de problemas por medio del trabajo colaborativo, promoviendo el aprendizaje significativo en los estudiantes. **Palabras clave:** educación en odontología, estudiantes de odontología, facultades de odontología, odontología, odontología a cuatro manos.

Resumo:

Antecedentes: Desde a década de 1970, a Organização Mundial da Saúde definiu a odontologia a quatro mãos como um método simplificado com tarefas definidas dentro da equipe de trabalho. Foi implementado principalmente em clínicas e universidades no Brasil, Estados Unidos, Espanha e Chile. A geral clínica odontológica para adultos (sexto semestre) e a clínica odontológica pediátrica (sétimo e oitavo semestres) do programa de pré-doutorado odontológico da Faculdade de Odontologia da Universidade El Bosque (Bogotá, Colômbia) usam este método. No entanto, a teoria sobre odontologia a quatro mãos ainda não foi incluída no currículo. **Objetivo:** Explorar e descrever a influência do método a quatro mãos na formação de cirurgiões-dentistas generalistas, afim de justificar sua inclusão no currículo pré-doutorado. **Métodos:** Uma busca de artigos foi realizada até junho de 2020. Os artigos selecionados em texto completo foram analisados, e os achados relacionados ao objetivo deste estudo foram incluídos na revisão. **Resultados:** foram selecionados 13 artigos. Os resultados estão organizados em três eixos temáticos: antecedentes e aspectos gerais do método, benefícios do método na formação de dentistas generalistas e descrição do modelo de atendimento a quatro mãos como exercício na clínica odontológica pediátrica, também denominado clínica de Crescimento e Desenvolvimento, na Universidade El Bosque. **Conclusões:** O atendimento ao paciente por meio de um método a quatro mãos pode contribuir para o desenvolvimento de soft skills, pensamento crítico, resolução de problemas por meio do trabalho colaborativo e promoção de aprendizagem significativa nos alunos.

Palavras-chave: educação em odontologia, estudantes de odontologia, faculdades de odontologia, odontologia, trabalho a quatro mãos.

INTRODUCTION

In Latin America, the teaching-care relationship describes three fundamental concepts: a) care vision, as an alternative for universities to participate in the supply of health services; b) teaching-educational vision, conceived as a pedagogical strategy that allows learning linked to the work of the assistance services; and c) transformative vision, defined as a strategy that articulates educational institutions and health services, in an effort to adapt it to the real needs of the population (1). Dental schools, in addition to having the teaching-care model in dental clinics, adopt the articulation between educational institutions and health services, which allows: improving care, guiding the production of knowledge, and training of professionals in health fields (2).

Taking into account that dental care service delivery is governed by internal statutes within each school, which in turn are conditioned to different national and international standards, students and future professionals who develop activities in clinics must know how to articulate three aspects into their activity: a) work rules, b) knowledge and skills corresponding to their area of praxis, and c) teamwork. Dental care for students has commonly been delivered through the two-handed technique/method, that is, one student for each dental unit. In this sense, the history of dentistry has broken paradigms regarding attention techniques, leaving behind the independent and solitary activity, and replacing it with a simplified attention to four and six hands (3).

Since the 1970s, the World Health Organization (WHO) has defined the four-handed care technique in dentistry as a simplified care modality with well-defined tasks within the work team (4). This modality not only offers better performance, greater productivity, and the safeguarding of ergonomic principles that protect the health of professionals (5,7) but also favors student learning by doing, teamwork, assertive communication, and critical thinking during clinical activities, while generating a space for knowledge socialization (8).

Although this technique has been described since the 1970s by the WHO (4) and has been increasingly implemented in dental offices and university clinics in various countries, in Colombia there are no publications describing the implementation of this method in educational institutions. For this reason, the purpose of this integrative review of literature was to explore and describe the influence of the four-handed work technique in the training of general dentists, in order to justify its inclusion in the curriculum.

MATERIALS AND METHODS

A search of titles was carried out in the PubMed, EBSCO, ProQuest, Bireme, Cochrane, Google Scholar, and El Bosque University library collection. The search strategy included the terms and connectors “four-handed technique” AND “dental schools” OR “dental students” OR “dental education,” which was also conducted in Spanish and Portuguese. Articles were selected in Spanish, English, and Portuguese up to June 2020, whose topics were related to the four-hand care practice in educational settings, including comparisons of productivity through cohort studies, literature reviews, non-experimental observational studies, and perception studies of both professionals and students regarding the added value of teamwork with peers. Chosen articles were assessed in full text and relevant information was included in the review. Findings are presented in three thematic axes; two of them are based on the information available in the literature: (a) background and generalities of the technique and (b) benefits of the technique in the training of the general

dentist. The third axis, (c) is based on the description of the four-handed care model as an exercise at El Bosque University's Growth and Development Clinics in the 2016-2020 period.

FINDINGS AND DISCUSSION

The initial reference search strategy showed 262 titles of which 231 were excluded for not being relevant to the research topic, since they did not focus on topics different from academic training (Figure 1). The 13 articles chosen (literature reviews, non-experimental observational studies, and cohort studies) showed the benefits of using the four-handed method in the training of the general dentist (Table 1).

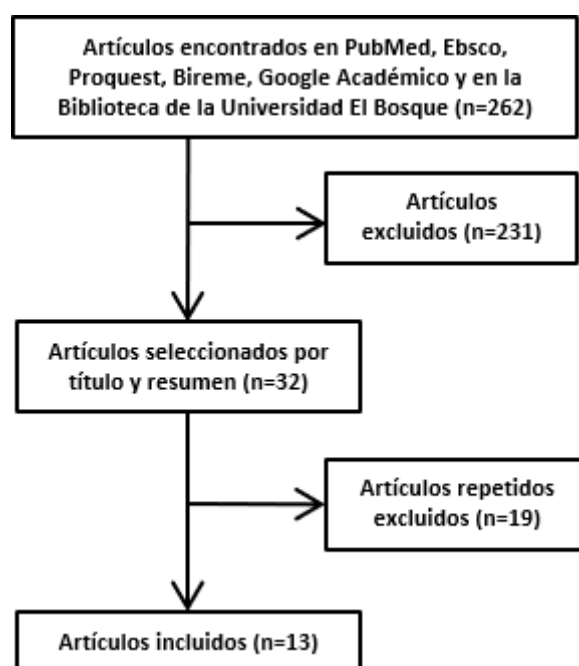


FIGURE 1
Reference Search Strategy

Background and Generalities of the Method

Dental assistants emerge on the dental care scene as the complexity and demands of the professional practice increases. Likewise, the demand for quality care is steadily growing. Therefore, greater physical and mental strength is demanded of the dentist (9). Vega (2010) states that four-handed dentistry was developed in the 190s as a result of research carried out at the University of Alabama School of Dentistry. It is mentioned for the first time in the proceedings of the Training Dental Students to Use Chairside Assistant's conference, and described as the coordinated exercise between two operators working at the same time on the same operative field, establishing defined tasks for each member of the team (10,11). This is aimed at improving productivity in the doctor's offices and, in turn, reducing stress and the emergence of musculoskeletal diseases (12,13). The four-handed method has clear goals: saving clinical time, greater control of body posture, dentist's increased focus on work, reducing dentist's role in other procedures such as transfer of materials and instruments, and increased productivity (7,11,14).

According to Vega (2010) and Chasteen, cited by Holmes *et al.*, (2010), this method has two benefits: First, it makes the job of dentist, hygienist, and assistant easier, because stress and fatigue are minimized. Second, it maximizes productivity while maintaining quality standards (7,10). Advantages include: it makes procedures

easier, reduces work time, and improves service quality, which benefits both patient and dentist, since the work is carried out under more favorable physical and psychological conditions for all those involved (14,15). In the dental pediatric practice, in addition, this technique facilitates behavior management during patient care and reduces treatment time, especially in those patients with negative behavior or with special needs (4).

The above described supposes the need to having minimum requirements and changing guidelines within the work team, in order to obtain the benefits that come from the technique (14). These not only refer to changes in the physical infrastructure of the clinic, which allows operators to position themselves appropriately around the dental unit, but also to changes in the way of coordinating and relating to the team. An important prerequisite for the success of this method is anticipating the needs of others and planning (7). This notion may seem basic; however, many dentists and assistants struggle to refine the technique (16).

To achieve good coordination and complementarity during dental care, the duties and tasks of the team members must be well defined, along with the parameters and roles in the interaction between the dentist and the dental assistant. The skills necessary to carry out teamwork take time to develop, so that only practice and experience contribute to achieving real improvements in four-handed dental practice (17). Therefore, it is appropriate to start with this type of practice in the undergraduate (predoctoral) and postgraduate (postdoctoral) training in dental schools and train dentists early in this practice.

This method has been increasingly implemented in dental offices and university dental clinics in different countries. Examples are the Complutense University of Madrid (Spain), the University of Sao Paulo (Brazil), the University of Iowa (United States), and the University of Chile. In Colombia, El Bosque University School of Dentistry began in 2016 its first steps to the technique in the school's clinics.

Benefits of the Method to Train General Dentists

Despite the fact that this technique was described almost 50 years ago, most of the research on it has been based on its benefits on ergonomics, productivity, and stress reduction. However, few studies are available in the literature evaluating its benefits in the training of general dentists. In this review, 13 articles were included that studied different aspects of the four-handed technique that influenced the training of dental students. The following stand out: productivity in academic training clinics, development of soft skills, and student perception (Table 1).

University professors have the duty to adapt their teaching to new realities, using didactic strategies that facilitate consistent and long-lasting learning. Thus, the four-handed method acquires special significance when it comes to the training of professionals in health sciences. Included in the concept of teaching-service and in the meaningful learning process, the teaching of the four-handed technique contributes to the comprehensive training of dentists (8). From the technical point of view, it is a matter of respecting the roles in each job position (operator-assistant) and acquiring skills in assisting and handling instruments and materials, using the knowledge learned and having strict control over biosecurity rules (4).

According to what has been reported, the four-handed technique increases productivity by 33 % - 75 % in clinics of dental schools. It also increases efficiency, the quality of care, and reduces stress (7,15). Specifically, four-handed work led to a 51 % increase in the number of daily appointments and a 75 % increase in daily charges for the University of Iowa School of Dentistry (7). A study from the University of Santo Amaro (Brazil) also shows higher productivity when students work in pairs than when they work alone (18).

The dental assistant must know the procedures and help the dentist during them, anticipating their needs and responding promptly to requests without interfering with the vision of the operating field, or limiting their movements (15,17). This guarantees more efficient care. Among the studies reviewed, Qualtrough (2001) found that 63 % of students stated that efficiency was one of the most relevant advantages of working with a dental assistant (19). However, in another study, 21 % considered that the technique did not facilitate time management during the appointment (20). At the University of Malaysia, more than 95 % of the

students considered that they learned from their partner and that clinical procedures were carried out more easily under this modality. Even so, 85 % would like to work alone, suggesting that students do not understand the concept of peer work. Then, the student in the role of assistant must know the theoretical foundation of the procedures to be carried out (17) and the bases of four-handed work to develop a fluid and efficient practice.

Working in pairs in dental training practices also favors learning-by-doing, since communication processes are established between both operators. Each one of them has a specific role in the clinical area, performs defined tasks, plans the time of care, and projects the goals to be met. From the academic point of view, both students are encouraged to know the theoretical background, the technique, and the materials of the procedures to be carried out (14). In the same way, compliance with biosafety regulations, organization of the work environment, and behavior management are promoted, especially in pediatric patients (21). Critical thinking is also promoted in the dentist-assistant-teacher team during clinical activities, since a space is created for the socialization of knowledge through debate, support, decision, and evaluation of the clinical situations raised (8).

From the student perspective, working with a partner allows them to develop skills that facilitate explaining, analyzing, finding ideas and alternatives for solving problems (22), as well as solving and developing plans for patient care (23). Similarly, the majority of the students surveyed consider that the mentor-apprentice relationship motivated them to learn (24) and even enjoyed teaching others and felt comfortable with the role of leader. 86.2 % recommended peer-assisted learning (20). However, 15 % of those surveyed stated that this technique negatively affects learning (20).

Vega *et al.* summarize it this way,

When executing a task, any process needs a few moments of reflection beforehand. During this reflection, you should plan what you want to do; what is it going to be done for; how it will be executed; with what elements, materials or instruments; how long its duration is planned, etc. In other words, everything must be planned in a "scientific" way [quote translated] (10).

With the four-handed technique, teamwork is favored by promoting flexibility and adaptability, valuing diversity, ethical and civic behavior, and building good relationships and greater social interaction (22). In the spaces for the socialization of knowledge, the student learns to communicate, to work with others, and to solve conflicts resulting from the interrelation in the groups. Under this dynamic, students and tutors recognize their potentialities and weaknesses and propose individual and common objectives (16). Roberts *et al.* (2018) found that 60 % - 65 % of the students felt more confident and communicated more easily with patients (20). However, one study found that more than half of the students faced problems with their partners and, although 60 % did not consider that it was an obstacle for their education (24), some recommended forming couples according to the personality of the students or rotate them throughout the term (20).

Teamwork learning in a well-balanced way is an aptitude that must also be transmitted and exemplified in classrooms. It is based on understanding the other, developing common projects, and resolving discrepancies with respect, in order to promote values related to pluralism and mutual understanding (25). Finally, "learning-by-becoming" is favored, exposing the personalities of instructors and students, and developing autonomy of judgment and personal and social responsibility (26).

Likewise, the chosen articles discuss the difficulties that students reported when implementing the four-handed technique among pairs, which mainly lie in: a) difficulty in establishing the tasks of each team member, which can affect the work relationships, and b) when the pair of students are of the same academic level, the development of leadership skills can become a challenge, that is, if there is no legitimate authority, teamwork can be more difficult (22). In this regard, Preoteasa *et al.* (2017) stated that, to have real four-handed dentistry, one must have well-defined specific roles:

The dentist is the one who coordinates the entire process while providing dental care, is in charge of establishing the work protocol, the steps of the treatment, and what will be the instruments and materials necessary to carry out the procedure... (17)

For this reason, to obtain better results, students must know the method well and have received adequate practical and theoretical training (15,20). Since teamwork is a skill to be learned, it should be considered in the curriculum of each school (19). Additionally, to achieve an efficient application of this technique in dental schools, an adequate infrastructure is required, sufficient space for two ergonomic stools for both operators, an ergonomic dental chair for the patient, enough space to organize materials and instruments, and adequate lighting.

TABLE 1
Studies Included in the Review

Authors	Title	Purpose	Relevant Findings
Holmes <i>et al.</i> (2009) (7)	Comparison of student productivity in four-handed clinic and regular unassisted clinic	To compare the productivity of fourth-year students using the four-handed technique versus those with two-handed models of attention.	51 % increase in the number of daily appointments and 75 % increase in daily revenue.
Dalai <i>et al.</i> (2014) (11)	Four-handed dentistry: an indispensable part for efficient clinical practice	To familiarize young dental professionals and clinicians with the concepts of four-handed dentistry and the ways in which current technology can be applied in the modern dental office.	An increase in productivity was proved, varying from 33 % to 75 %, and to be more effective, four-hand dentistry must include appropriate training through practice and content to dental assistants.
Singh <i>et al.</i> (2014) (15)	Application of four-handed dentistry in clinical practice : a review	To introduce young dentists and clinicians to the fundamentals of four-handed dentistry and the ways it can be part of the technologically advanced dental setup.	Increase in clinical productivity between 33 % and 75 %. Increased efficiency and ease of work. To obtain better results with this technique, one must have knowledge about it and adequate training by providing practical and theoretical training to assistants.
Romero <i>et al.</i> (2003) (18)	Clinical productivity of undergraduate students of the integrated dental clinic discipline at the University of Santo Amaro School of Dentistry	To compare clinical productivity of students in morning and evening courses, on individual and peer work, on procedures performed on patients at the dental clinic.	Higher productivity when students work in pairs, compared to when they work alone.
Qualtrough (2001) (19)	Student operator-assistant pairs: an update.	To evaluate the opinions of students who worked under the operator-assistant pair system.	83 % of students enjoyed and benefited from working in pairs; a smaller percentage reported problems with their partner, but in general they defined their experience as positive. 12 % of fifth-year students felt that their patients also benefited. 63 % of students stated that efficiency was one of the most relevant advantages of working with a dental assistant.

TABLE 1 (CONT.)

Robert <i>et al.</i> (2018) (20)	Dentists' perceptions of their peer learning experiences in dental school and effects on practice.	To inquire dentists if they were trained in peer-assisted learning in dental schools, in order to know their perceptions and recommendations.	Peer-assisted learning positively influenced students: it favored leadership attitudes, motivated them to teach others, facilitated communication with patients, promoted self-confidence and acceptance of team feedback.
Bello & Pérez (2012) (21)	Elements to be considered by the clinical instructor in dentistry for the development of clinical teaching strategies	To highlight elements to be considered by the clinical instructor for the development of professional practices in dentistry.	The dental instructor must implement continuous training in clinical practice, as well as human sensitivity to help develop critical and investigative thinking in students, in an environment suitable for teaching and learning.
Abu <i>et al.</i> (2014) (22)	Pairing as an instructional strategy to promote soft skills amongst clinical dental students.	To identify the development of soft skills when students work in pairs in their clinical practice.	The peer-work technique promotes good interpersonal relationships, teamwork, critical thinking, and problem-solving ability.
Ahmad <i>et al.</i> (2012) (23)	Clinical pairing revisited: a study at the University of Malaya, Malaysia.	Evaluate the perception of dental students about peer work, and identify the advantages, disadvantages, and acceptance of its implementation.	More than 95 % considered they learned from their partners and clinical procedures were carried out more easily under this modality. However, 85 % would prefer to work alone, which contradicts other answers and shows that students do not understand the peer work concept.
Mills <i>et al.</i> (2017) (24)	Power of peers: students' perceptions of pairing in clinical dental education.	To evaluate, through surveys, the perception of third-and-fourth-year dental students regarding peer tutoring during clinical practice.	68.9 % stated peer learning helped to solve and develop plans for patient care. 64.3 % affirmed that the mentor-apprentice relationship motivated them to learn and 70.1 % reported that it helped the learning experience.
Davies <i>et al.</i> (2009) (27)	Perceptions of a simulated general dental practice facility: reported experiences from past students at the Maurice Wohl General Dental Practice Centre.	To evaluate perceptions students had of a clinical practice whose main focus was teamwork and cooperative learning.	75 % of students rated four-handed dental practice as a strength of the dentistry program.
Sheridan <i>et al.</i> , (2015) (28)	Dental students' perceived value of peer-mentoring clinical leadership experiences.	To identify differences in the perceived value of a CLE methodology (clinical leadership experiences) by second- and fourth-year dental students.	CLE favors orientation, individual attention, and general comfort.
Clark (2019) (29)	Transformation of the dental faculty to promote changes in dental education.	To determine which components of "hands-on simulation" affect subsequent hands-on performance in first-year dental students.	Preclinical work with an assistant or peer assistant showed advantages in the performance and performance of the students.

Four-Handed Attention Model as a Practice in the Growth and Development Clinic at El Bosque University, 2016-2020

Despite the advantages reported with the implementation of this method in dental training clinics in different countries, in Colombia there are no studies describing its use in dental school. In the case of El Bosque University School of Dentistry, there is an incipient training process that allows students to develop the ability for this type of work. The seventh-and-eighth-semester Growth and Development Clinic of the undergraduate (predoctoral) program at El Bosque University adopted the four-hand care model since 2016. At the beginning of each semester, students receive instruction on work methodology; however, they lack prior formal and structured training.

Instructors randomly assign work pairs among students of the same academic level. In general, changes are not accepted unless there are irreconcilable differences between students or history of having them. They must always work as teams, so if one of the team members cannot attend the clinic due to health or other issues, then the couple must postpone the patient's appointment, as long as it is not a dental emergency.

Students of the aforementioned semesters see pediatric patients twice a week in a six-hour shifts. During each shift, members of each team distribute times equally, so that each student participates in two roles: dentist (operator one) and assistant (operator two). At the beginning of each activity, both operator one and operator two must be prepared to provide clinical care and jointly present the protocols for each procedure to be performed.

The work structure at El Bosque University coincides with that used at the University of Iowa School of Dentistry (7), in which students in their role as dentists (operators) see patients during a determined time and are assisted by their peers. Once the first part of the session is done, there is time devoted to cleaning and disinfecting the clinical area and the students switch roles. Therefore, in the same clinical shift, each student will have attended two patients and participated in two different roles. Each student performs the practice in both roles and is assessed through an evaluation matrix (rubric) designated for each of them. In the role of operator one, content knowledge, the step by step of each procedure, and the behavior management of the pediatric patient are assessed. The operator two is also assessed about content knowledge, organization of the physical space, teamwork, and participation in managing the patient's behavior.

From an operational point of view, the model allows to reduce the time of attention per patient, taking into account that each one of them presents different characteristics and needs. It also favors teamwork. From an academic point of view, it promotes meaningful learning.

CONCLUSIONS

The four-handed care technique constitutes a work modality that favors collaborative and meaningful learning. In addition, it promotes the development of good interpersonal relationships, critical thinking, and problem solving, which represent soft skills. Those competences, according to some authors, should be developed for the personal and professional improvement of the dentist in training.

The four-handed technique is used in the dental clinics of El Bosque University in Bogotá, Colombia, specifically the Growth and Development clinic. Despite its short implementation experience, this method has already shown it provides healthy working conditions for the student, offers advantages in the teaching-learning process, and strengthens the theoretical and clinical competences for the care of pediatric patients. However, its application requires a locative adaptation of the clinics.

RECOMMENDATIONS

In order to objectively evaluate the effects of the four-handed care model in the training of the general dentist, studies are needed to evaluate the learning curves of groups of students trained under this modality as compared to individual work. Likewise, more research is necessary to compare the productivity of dental clinics under both work modalities, among other aspects related to academic dental training.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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Notes

- * Original research. Integrative review of literature.

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