# Oral health of southern Chinese children and adolescents with severe hypodontia

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**Summary.** *Objective.* The aim of this study was to assess the oral health condition of southern Chinese children and adolescents with severe hypodontia.

*Methods.* This was a cross-sectional clinical study in the dental teaching hospital in Hong Kong. Twenty-five children and adolescents with severe hypodontia, and a comparison group of 25 age- and gender-matched controls took part. Verified clinical examination techniques were used to assess the pattern of missing teeth, tooth spacing, dental caries, periodontal condition, enamel defects, and tooth wear. Statistical comparisons were made between groups using independent Student *t*-tests and chi-square tests.

*Results.* The mean number of congenitally missing permanent teeth in the severe hypodontia group was 9·1 (SD = 5·0), with the maxillary lateral incisor being the most common missing tooth (14·5%). There were significant space discrepancies in both jaws between groups (P < 0.001). Caries prevalence was low with no difference between groups. There was no difference in periodontal condition between groups, with about half of the participants having no gingival inflammation. The severe hypodontia group had more enamel defects (P = 0.043), enamel hypoplasia (P = 0.044) and tooth wear (P = 0.005) than the comparison group. Three of the severe hypodontia group had ectodermal dysplasia. *Conclusions.* The oral health condition of southern Chinese children and adolescents with severe hypodontia was good in terms of caries experience and periodontal health. However, the increased prevalence of developmental defects of enamel and tooth wear complicates already complex interim and definitive prosthodontic management, and may increase psychosocial impact.

### Introduction

Hypodontia, the congenital absence of teeth, is reported to have a prevalence ranging from 0.1% to 0.6% in the primary dentition and from 3.5 to 6.5% in the permanent dentition [1]. There is an ethnic bias in the clinical presentation of hypodontia. In Caucasians, the mandibular premolar is the most commonly missing tooth, whereas in southern Chinese, the mandibular lateral incisor is the most frequently missing [2,3]. The prevalence of severe hypodontia is less well documented and is generally less than 1%. It may be associated with inherited conditions such as ectodermal dysplasia [4,5]. The definition of severe hypodontia remains contentious, with more than four, five and six missing teeth being commonly used definitions [5]. In severe hypodontia, the functional and psychosocial impact is more profound and the restorative management more complex [5,6].

The oral health status of children and adolescents with hypodontia has not been fully investigated. Nonetheless, there is evidence to suggest that oral hygiene is better and there is less dental caries in the hypodontia-related spaced dentition [2]. An association between hypodontia and enamel defects has also been noted, particularly in relation to severe hypodontia and systemic diseases [2,7].

Epidemiological studies on the oral health status of children and adolescents in various parts of the world have revealed diverse disease patterns [8-10]. Ethnicity

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appears to have an influence on gingival condition and caries experience [11,12], and perceptions of oral health may also differ between groups [13]. However, there is a lack of information about ethnic differences in the pattern of oral diseases and disorders among children and adolescents with hypodontia.

The objective of this study was to assess the oral health condition of southern Chinese children and adolescents with severe hypodontia.

#### Subjects and methods

There were two experimental groups in this crosssectional study: (1) children and adolescents with severe hypodontia, and (2) an age- and gendermatched comparison group. Participants with severe hypodontia were recruited from patients attending a Paediatric Dentistry and Orthodontics hypodontia clinic. All eligible children and adolescents with severe hypodontia agreed to take part. The definition of severe hypodontia was more than four missing permanent teeth, excluding third molars [5]. The target age range of the participants was 10-18 years since the crown development of all permanent teeth except third molars is usually completed between 10 and 14 years of age [14]. The comparison group was recruited from patients attending Paediatric Dentistry and Orthodontics for a periodic review of their dental condition. All participants were southern Chinese. The study was approved by the Ethics Committee of the University of Hong Kong. Participants/carers gave written informed consent. The study took place in Hong Kong from February to December 2002.

#### Clinical assessment

All clinical examinations were performed by a trained and calibrated examiner. The procedures took place in a dental chair under normal dental lighting. Since probing may cause bacteraemia and infective endocarditis in susceptible individuals, a mouth mirror was used for the examination. Gauze was utilized to isolate areas of interest. The examination procedures and diagnostic criteria used generally followed those recommended by the World Health Organization [15]. The medical status of participants was documented, notably the presence of systemic disease. Extraoral defects and the intraoral soft tissue condition were noted. The number of sound, decayed, missing (as a result of caries) and filled teeth/ surfaces was assessed to describe dental caries

experience. The Modified Gingival Index was used to assess periodontal health [16]. This index was used because it avoided the probing of gingival tissues and provided a more specific description of gingival inflammation. Teeth were assessed for enamel opacities and hypoplasia using the modified Dental Defects of Enamel (DDE) index [17]. Tooth wear was assessed using the modified Tooth Wear Index (TWI) [18]. Space analysis was performed using dental study casts and calipers [19].

Ten patients were re-examined (five control and five with severe hypodontia) and agreement in assessments was compared employing Kappa statistics. The Kappa values were greater than 0.69 for all indices used.

#### Data analysis

Data were coded and analysed using the SPSS for Windows 11·0 computer program (SPSS Inc., Chicago, IL, USA). Simple frequency distribution tables were produced to determine the prevalence of oral conditions. Comparisons of oral health condition between groups were made using the independent Student *t*-test for continuous variables and the chi-square test for categorical variables. Where necessary, data were log transformed to permit parametric analyses. The level of significance was set at 0.05.

## Results

Fifty children and adolescents participated in this study. There were 25 in the severe hypodontia group and 25 in the comparison group. The mean age of the hypodontia group was 14.5 years (SD = 2.7 years, range = 10-18 years), and for the comparison group, it was 14.4 years (SD = 2.6 years, range = 10-18 years). There were 16 males and nine females in each group. No significant age or gender differences were observed between groups (P > 0.05).

The mean number of congenitally missing permanent teeth in the severe hypodontia group was 9.1 (SD = 5.0, range = 4–20) and the most frequent number was five (24%). The distribution of missing permanent teeth is shown in Fig. 1. The maxillary lateral incisor (14.5%) was the most commonly missing tooth, followed by the mandibular second premolar (11.4%), the mandibular central incisor (10.1%) and the maxillary second premolar (9.6%). The prevalence of missing incisor teeth was the same in both jaws. Mandibular first molars and maxillary central incisors were least likely to be missing (1.8% and 2.2%,



**Fig. 1.** Percentage of missing permanent teeth (n = 228), by location, in the severe hypodontia group (n = 25).

respectively). The prevalence of hypodontia was greater in the maxilla compared with the mandible, with a ratio of 1.7:1. The prevalence of bilateral hypodontia was four times greater than the unilateral condition. Three people in the severe hypodontia and two others were uncertain, whereas none of the comparison group reported a family history of hypodontia. The mean space discrepancies in the maxillary and mandibular arches were 27.7 mm (SD = 20.4 mm) and 24.7 mm (SD = 18.2 mm), respectively, for the hypodontia group and -2.9 mm (SD = 7.1 mm) and -0.7 mm (SD = 18.2 mm), respectively, for the comparison group, with a statistical difference between groups (P < 0.001).

In the severe hypodontia group, the major medical conditions were three cases of ectodermal dysplasia, two with repaired cleft lip and palate, one with a history of non-Hodgkin's lymphoma and one with a history of pineal immature teratoma. The lymphoma case was treated with chemotherapy at 2 years of age and the teratoma case was treated with surgery and chemotherapy at 6 years of age. In the comparison group, there was one case of repaired submucosal cleft palate and one of pulmonary stenosis.

There was no statistical difference in the distribution of extraoral defects between groups, with the majority having a normal appearance (P > 0.05). Two of the severe hypodontia group had abnormalities of the upper and/or lower lips, and five of the hypodontia and four of the comparison groups had ulceration, and erosion of fissures in the nose, cheek or chin. Those with ectodermal dysplasia had a characteristic facial appearance. More than half the

participants had no intraoral soft tissue lesions. Aphthae were the most common lesions in both groups (22%). There was no difference in the frequency or distribution of intraoral lesions between the two groups (P > 0.05).

Table 1 indicates the caries experience for both dentitions in the severe hypodontia and comparison groups. The caries prevalence was generally low in both dentitions with no differences between groups (P > 0.05). There were more filled primary teeth (P = 0.024), and more filled primary and permanent tooth surfaces (P = 0.018) in the severe hypodontia group.

The prevalence of gingival inflammation is shown in Table 2. Half of the participants had no gingival inflammation. Those with gingival inflammation had mainly generalized mild or moderate inflammation. There was no statistical difference in the prevalence between the experimental groups (P > 0.05).

The prevalence and extent of all types of enamel defects are shown in Tables 3 and 4. Enamel defects in the permanent dentition were present in all of the severe hypodontia group and 21 of the comparison group (P = 0.043). The nature of the enamel opacity was predominantly demarcated (38%) or diffuse patchy type (40%) with no difference in prevalence between groups (P > 0.05). The majority of participants (80%) had no enamel hypoplasia, although there was slightly more (16%) in the hypodontia group (P = 0.044). About half of the hypodontia group had other enamel defects (discoloration) compared with 12% in the comparison group (P = 0.003).

	Hypodontia $(n = 25)$		Comparison $(n = 25)$			
	Mean	SD	Mean	SD	Significance*	
Primary teeth						
Sound	2.40	3.07	0.16	0.62	0.001	
Decayed	0.16	0.62	0.04	0.20	0.365	
Filled	1.96	3.32	0.28	1.21	0.024	
Primary tooth surfaces						
Sound	16.36	17.01	1.84	7.70	0.000	
Decayed	0.16	0.62	0.08	0.28	0.561	
Filled	4.08	7.08	0.28	1.40	0.014	
Missing because of caries	0	0	0	0	-	
Permanent teeth						
Sound	13.04	5.74	24.2	2.94	0.000	
Decayed	0.72	1.31	1.16	2.30	0.410	
Filled	4.80	3.48	3.12	2.80	0.066	
Missing because of caries	0	0	0	0	-	
Permanent tooth surfaces						
Sound	78.28	23.26	122.60	4.96	0.000	
Decayed	0.72	1.46	1.24	2.54	0.379	
Filled	7.36	6.54	3.76	3.03	0.018	
Missing because of caries	0	0	0	0	-	

Table 1. Caries experience in the severe hypodontia and comparison groups: (SD) standard deviation.

\*Individual *t*-tests.

Table 2. Prevalence of gingival inflammation in the severe hypodontia and comparison groups.

Severity of	Number of teeth	Hypodontia $(n = 25)$		Compari		
inflammation		Number	Percentage	Number	Percentage	Significance'
Absence	None	10	40	15	60	0.829
	More than one	15	60	10	40	
Localized mild	None	2	8	2	8	0.528
	More than one	23	92	23	92	
Generalized mild	None	1	4	2	8	0.078
	More than one	24	96	23	92	
Moderate	None	4	16	5	20	0.083
	More than one	21	84	20	80	
Severe	None	20	80	23	92	0.602
	More than one	5	20	2	8	

\*Chi-square exact tests.

Details of tooth wear characteristics are shown in Table 5. Where there was enamel loss, the severity on the buccal, lingual and occlusal surfaces was less than one-third of the dentine surface exposure. There was a greater loss of buccal, lingual and occlusal tooth substance in the severe hypodontia group (P = 0.005). The mean number of teeth with loss of enamel on the incisal surface was 3.9 (SD = 2.7, range = 0–10). The severity of the incisal surface loss was greater in the severe hypodontia group (P = 0.039). There was no cervical tooth loss in any participant.

#### Discussion

The present cross-sectional study involved relatively small convenience samples in a hospital setting, and therefore, potential sampling bias should be taken into account when interpreting the data. However, severe hypodontia is an uncommon condition that is complex to treat. The hypodontia clinic at the Prince Philip Dental Hospital is the only specialist clinic of its kind in Hong Kong. It has been operating for more than 10 years and has a strong referral base throughout the dental community. Thus, the patients

		Hypodontia $(n = 25)$		Comparison $(n = 25)$		
Type of defect	Number of teeth	Number	Percentage	Number	Percentage	Significance*
Opacity	None	1	4	2	8	0.779
	White/cream demarcated opacity	11	44	8	32	
	Yellow/brown demarcated opacity	0	0	0	0	
	Diffuse opacity-lines	2	8	3	12	
D D C	Diffuse opacity-patchy	9	36	11	44	
	Diffuse opacity-confluent	2	8	1	4	
	Confluent/patchy + staining + loss of enamel	0	0	0	0	
Hypoplasia	None	17	68	23	92	
	Pits	5	20	2	8	0.044
	Missing enamel	3	12	0	0	
Other defect	None	12	48	22	88	0.005
	Other defect (discoloration)	13	52	3	12	

Table 3. Prevalence of enamel defects in the severe hypodontia and comparison groups. For all participants, the most frequently occurring condition was chosen for each type of enamel defect.

\*Chi-square exact tests.

Table 4. Type and extent of enamel defects in severe hypodontia and comparison groups.

		Hypodontia $(n = 25)$		Comparison $(n = 25)$		
Type of defect	Extent	Number	Percentage	Number	Percentage	Significance*
Opacity	Normal	1	4	2	8	0.437
	Less than one-third	13	52	17	68	
	Between one- and two-thirds	9	36	6	24	
	At least two-thirds	2	8	0	0	
Hypoplasia	Normal	17	68	23	92	0.066
	Less than one-third	6	24	2	8	
	Between one- and two-thirds	1	4	0	0	
	At least two-thirds	1	4	0	0	
Other defect	Normal	12	48	22	88	0.003
(discoloration)	Less than one-third	2	8	0	0	
	Between one- and two-thirds	0	0	1	4	
	At least two-thirds	11	44	2	8	

\*Chi-square exact tests.

with severe hypodontia described in this study are likely to be typical of the condition in southern Chinese children and adolescents in Hong Kong.

The mandibular and maxillary second premolars, the maxillary lateral incisors and the mandibular central incisors were the four most frequently missing permanent teeth in the severe hypodontia group, comprising 45.6% of the total number of missing teeth. These findings are in close agreement with the findings of Rasmussen [5] in a cohort of 33 Swedish children with severe hypodontia. The prevalence of missing maxillary lateral incisors (14.5%) appeared to greater than mandibular second premolars (11.4%) in contradistinction to previous findings in southern Chinese children [3]. However, this difference may be related to the relatively small severe hypodontia group sample size. There were more missing teeth in the maxilla and bilaterally missing teeth were more common than the unilateral condition, which supports previous observations by Rasmussen [5]. A number of severe hypodontia patients described a family history of missing teeth as expected. Whilst severe hypodontia is often associated with inherited conditions and syndromes [4,5], only three of the severe hypodontia group were diagnosed as having ectodermal dysplasia.

Given the significant difference in the number of congenitally missing teeth between the severe hypodontia and comparison groups, the observed major differences in space discrepancy in the maxillary and mandibular arches between groups were expected. Orthodontic redistribution of space in the

	Hypodontia		Comparison		
Location and condition*	Mean number of teeth	SD	Mean number of teeth	SD	Significance <sup>†</sup>
Buccal, lingual and occlusal					
No loss of enamel surface characteristics	16.60	4.22	21.96	3.21	0.000
Loss of enamel surface characteristics	4.32	2.93	4.68	3.26	0.683
Loss of enamel exposing dentine for less than one-third of the surface	0.84	1.28	0.04	0.20	0.005
Loss of enamel exposing dentine for more than one-third of the surface	0.00	0.00	0.00	0.00	_
Complete loss of enamel or exposure of secondary dentine	0.00	0.00	0.00	0.00	_
Complete loss of enamel and pulp exposure	0.00	0.00	0.00	0.00	_
Incisal					
No loss of enamel surface characteristics	5.60	2.77	8.00	2.86	0.004
Loss of enamel surface characteristic	2.08	2.06	3.32	2.63	0.069
Loss of enamel just exposing dentine	1.48	1.76	0.60	1.08	0.039
Loss of enamel and substantial loss of dentine, but not exposing pulp or secondary dentine	0.08	0.28	0.00	0.00	0.161
Loss of enamel and substantial loss of dentine with exposure of secondary dentine	0.28	0.89	0.00	0.00	0.129
Loss of enamel and substantial loss of dentine with pulp exposure	0.00	0.00	0.04	0.20	0.327

Table 5. Modified Tooth Wear Index values for the severe hypodontia and comparison groups: (SD) standard deviation.

\*No tooth surface loss was recorded in the cervical region of any participant.

†Two-sample Student t-tests.

severe hypodontia case is often required as part of interdisciplinary management prior to definitive prosthodontic care [20].

The caries prevalence was low and similar in both experimental groups. Since the public water supply is fluoridated in Hong Kong (0.5 p.p.m.), a low caries prevalence would be anticipated. There were more retained and filled primary teeth in the severe hypodontia group, most probably because of prolonged retention in the absence of permanent successors; for example, to retain alveolar bone in an area considered suitable for future transplantation or implant therapy [2].

The gingival condition was similar in both experimental groups with about half having no inflammation. Although the spaced dentition in the severe hypodontia group may have facilitated oral hygiene procedures, it did not appear to improve gingival health as has been reported previously [2]. The similarity in oral hygiene may be a result of the ethnic and cultural practices of the study group, or indeed, their sociodemographic background. It is acknowledged that participants in the severe hypodontia and comparison groups may have had better gingival health as a consequence of dental hospital attendance. However, in the Hong Kong Oral Health Survey 2001 [21], 59.5% of 12-year-olds were assessed as requiring professional tooth cleaning, suggesting that the present findings are reasonably representative.

Enamel defects, mainly enamel opacity, were detected in all severe hypodontia patients and most of the comparison group. King and Wei [22] have reported the almost universal presence of enamel defects, mostly opacities, in a population-based study of Hong Kong Chinese 12-year-olds in contradistinction to a lower prevalence in Caucasian and Indian populations. In the present study, it is notable that enamel hypoplasia, although relatively uncommon in both groups, was more prevalent in patients with severe hypodontia. The prevalence of more extensive developmental defects on enamel in the severe hypodontia group supports the previous notion of an association between hypodontia and developmental enamel defects [2,7].

Tooth wear, as measured by the modified TWI, was more common in the severe hypodontia group. In addition, the magnitude of tooth surface loss (incisal and facial surfaces) was greater in severe hypodontia patients. Tooth wear associated with severe hypodontia was most probably caused by the increased functional load on a reduced number of occluding tooth pairs, compounded by weakened tooth structure associated with the high prevalence of developmental defects of enamel. This finding highlights the need for careful monitoring of tooth condition in severe hypodontia and restoration of tooth tissue to maintain the integrity of the reduced dentition until definitive tooth replacement is undertaken.

#### What this paper adds

• This paper reports on a study of a small group of Southern Chinese children and adolescents with severe hypodontia.

• Results suggest affected children have a higher prevalence of enamel defects and tooth wear than a matched control group.

• Contrary to previous findings there was little clear difference in gingivitis.

Why this paper is important for paediatric dentists

• The treatment of severe hypodontia is often complex. This paper suggests that difficulties may be compounded by systemic disorders associated with the condition and also by the high prevalence of enamel defects and tooth wear.

**Résumé.** *Objectif.* Evaluer la santé bucco-dentaire des enfants et adolescents du sud de la Chine présentant une agénésie dentaire sévère.

*Protocole et mise en place*. Etude clinique transversale au sein de l'hôpital d'enseignement dentaire de Hong Kong.

*Matériels et Méthodes.* Vingt-cinq enfants et adolescents avec agénésie sévère et un groupe de comparaison de 25 enfants et adolescents appariés en âge/sexe y ont pris part. Des techniques confirmées d'examen clinique ont été utilisées pour évaluer les patterns de dents absentes, l'espacement dentaire, les caries dentaires, l'état du parodonte, les défauts de l'émail et l'usure des dents.

*Résultats*. Le nombre moyen de dents permanentes absentes congénitalement dans le groupe agénésie sévère était de 9,1 (SD 5,0), l'incisive latérale étant la dent manquant le plus fréquemment (14,5%). Les différences d'espace dans les deux mâchoires étaient significatives entre les deux groupes (p = 0,001). La prévalence des caries était faible, sans différence entre les groupes. Il n'y avait pas de différence quant à l'état parodontal, environ la moitié des participants ne présentant pas d'inflammation gingivale. Le groupe agénésie présentait plus de défauts de l'émail (p = 0.043), hypoplasie de l'émail (p = 0,044) et d'usure des dents (p = 0,005) que le groupe témoin. Trois des cas d'agénésie avaient une dysplasie ectodermique.

*Conclusions*. L'état de santé buccal des enfants et adolescents du sud de la Chine présentant une agénésie sévère est bon en terme de caries et de santé parodontale. Cependant, la prévalence accrue de défauts de l'émail et d'usure des dents complique la situation déjà complexe ainsi que la prise en charge prothétique définitive et peut augmenter l'impact psycho-social. **Zusammenfassung.** Ziel. Bestimmung der Mundgesundheit von Kindern und Jugendlichen mit ausgeprägter Hypodontie in Südchina.

*Design und Untersuchungsumfeld*. Querschnittstudie in einem zahnmedizinischen Lehrkrankenhaus in Hong Kong.

Stichprobe und Methode. Es nahmen teil eine Gruppe von 25 Kindern und Jugendlichen mit ausgeprägter Hypodontie sowie eine Kontrollgruppe von 25 nach Alter und Geschlecht gematchten Kindern und Jugendlichen. Es wurden übliche klinische Methoden zur Bestimmung der Verteilung der Nichtanlagen, Zahndiastema, Karies, parodontale Verhältnisse, Schmelzdefekte und Zahnabrasion. Statistische Vergleiche zwischen den Gruppen wurden mit unabhängigen t-Tests und chi-Quadrat-Tests durchgeführt.

*Ergebnisse*. Die mittlere Zahl von Nichtanlagen in der Hypodontie-Gruppe lag bei 9.1 Zähnen (+/–5.0), wobei der seitliche OK-Schneidezahn am häufigsten (14.5%) betroffen war. Die Gruppen unterschieden sich statistisch signifikant hinsichtlich der Platzverhältnisse, sowohl im Oberkeifer als auch im Unterkiefer (p < 0.001). Die Kariesprävalenz war niedrig ohne Unterschiede zwischen den Gruppen. Auch die parodontalen Verhältnisse unterschieden sich nicht, rund die Hälfte der Teilnehmer waren entzündungsfrei. Die Hypodontie-Gruppe wies häufiger Schmelzdefekte (p = 0.043) Hypoplasien (p = 0.044) und Zahnabrasionen (p = 0.005) auf als die Kontrollgruppe. Drei Teilnehmer der Hypodontie-Gruppe litten an ektodermaler Dysplasie.

Schlussfolgerungen. Die Mundgesundheit von südchinesischen Kindern und Jugendlichen mit Hypodontie war gut im Hinblick auf Karies und parodontale Gesundheit. Die erhöhte Prävalenz von Zahnstrukturanomalien und Abrasionen kompliziert die temporäre und definitive prothetische Rehabilitation und könnte psychosoziale Auswirkungen bewirken.

**Resumen.** *Objetivo*. Valorar el estado de salud bucal de niños y adolescentes del sur de China con hipodoncia severa.

*Diseño y lugar*. Un estudio clínico transversal en el hospital de enseñanza dental de Hong Kong.

*Materiales y método*. Tomaron parte 25 niños y adolescentes con hipodoncia severa que se compararon a un grupo de 25 niños emparejados por edad/sexo. Las técnicas clínicas de verificación se usaron para valorar el patrón de dientes ausentes, espacio dentario, caries, estado periodontal, defectos del esmalte y desgaste

dentario. Se hicieron comparaciones estadísticas entre grupos usando tests de la t independientes y tests de la chi-cuadrado.

Resultados. La media de dientes permanentes ausentes congénitamente en el grupo de hipodoncia severa fue de 9,1 (D.S. 5,0), siendo los incisivos laterales superiores los más frecuentemente ausentes (14,5%). Hubo discrepancias de espacio significativas en ambas arcadas entre grupos (p < 0,001). La prevalencia de caries fue baja con ninguna diferencia entre grupos. No hubo diferencias en el estado periodontal entre grupos, con aproximadamente la mitad de los participantes sin tener inflamación gingival. El grupo con hipodoncia severa tenía más defectos del esmalte (p < 0.043), hipoplasia del esmalte (p < 0.044) y desgaste dentario (p < 0.005) que el grupo comparado. Tres del grupo con hipodoncia severa tenía displasia ectodérmica.

*Conclusiones.* La salud bucal de los niños y adolescente del sur de China era buena en términos de presencia de caries y salud periodontal. Sin embargo, el aumento de la prevalencia de los defectos del desarrollo del esmalte y el desgaste dentario complica la ya de por sí compleja espera y el tratamiento protésico definitivo, pudiendo aumentar el impacto psicológico.

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