Testing tooth and denture cleaning ability of geriatric inpatients
clinical validation study

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Background

Insufficient oral health and oral hygiene have the potential to jeopardize geriatric patients' nutrition intake, to raise the risk of respiratory and cardio-vascular diseases, and to impair the quality of life. In the daily clinical routine, it is difficult for medical staff to distinguish between geriatric patients who are capable of autonomously performing sufficient oral hygiene and those who need assistance. For this decision, a short and simple test is proposed.

Aim

Evaluation of whether the Timed Test for Money counting (TTMC), complemented with testing the range of shoulder motion by gripping the backside of the neck (NG), predicts the ability of geriatric inpatients to independently perform effective oral hygiene.

Methods

- Study population: 74 geriatric inpatients, 64.9% females, aged between 66 and 98 years (mean age: 84.1± 5.8 years)
- Study period: 05/2016 – 05/2017
- Oral examinations: recording of dental caries with the DMFT Index, periodontal health with Periodontal Screening Index (PSI), dental plaque on natural teeth with the Turesky modified Quigley Hein Index (TI), and plaque on dentures with the Denture Hygiene Index (DHI)
- Dental plaque was recorded before (t1) and after (t2) autonomous oral hygiene
- Self-perceived oral hygiene was assessed by questionnaire
- Standardized TTMC&NG testing (Fig. 1): completeness of the test procedure and time needed
- Results from standard geriatric assessments were taken from medical records
- Ethical approval: Ethics Committee of Jena University Hospital (4590-11/15), Trial Registration: DRKS000011095

Fig. 1: Geriatric in-patient performing the Timed Test for Money counting (TTMC)(left) and gripping the backside of the neck (NG)(right)

Results

Oral health

- Acute oral pain: 9.5% (n=7)
- Acute dental treatment need: 60.8% (n=45)
- Dental status: DMFT = 23.6 (±3.1); edentulous: 38.8% (n=28); dentures: 85.1% (n=63)
- Periodontal status: PSI=0: 10.9 (n=5), PSI=1-2: 45.7% (n=21); PSI=3-4: 43.5% (n=20)
- Dental plaque: TI at t0: 2.74±1.07; DHI at t0: 0.45±0.31
- Self-evaluated oral hygiene: very good: 5.4% (n=4); good: 68.9% (n=51); satisfactory: 25.7% (n=19)
- Self-perceived problems in performing oral hygiene: 16.2% (n=12)
- Performance of oral hygiene without any help: 87.8% (n=65)

Fig.2. Examples of oral situations in the study population

Factors influencing plaque reduction (Tab.1)

- TTMC and TTMC&NG significantly influenced plaque reduction on both teeth and dentures
- TTMC time cut-offs were significantly associated only with the plaque reduction on teeth

Validation of the MMTC&NG (Tab.2)

- Sensitivity is high (86.4% for tooth cleaning and 77.8% for denture cleaning)
- Negative Predictive Value is high (75.9% for tooth cleaning and 72.7% for denture cleaning)
- Passing vs. failing the TTMC&NG had better positive and negative predictive values than the time cut-offs

Tab.1: Factors influencing plaque reduction on teeth (measured by TI) and on dentures (Measured by DHI) in geriatric in-patients

Factor		TI Diff t0-t1 mean (SD)	P*	DHI Diff t0-t1 mean (SD)	P*
Study population		0.8 (0.5)		0.2 (0.2)	
Age	< 84 years	0.8 (0.2)	0.319	0.2 (0.2)	0.115
	≥ 85 years	0.9 (0.2)		0.3 (0.2)	
Sex	males	0.9 (0.4)	0.393	0.2 (0.2)	0.191
	females	0.3 (0.2)		0.3 (0.2)	
Oral hygiene (Self-evaluation)	very good	0.3 (0.3)	0.129	0.3 (0.3)	0.485
	good	0.9 (0.4)		0.3 (0.2)	
	satisfactory	0.8 (0.5)		0.2 (0.2)	
Subjective problems in performing oral hygiene	yes	1.1 (0.4)	0.111	0.3 (0.2)	0.192
	no	0.8 (0.5)		0.2 (0.2)	
Performing oral hygiene without help	yes	0.8 (0.5)	0.682	0.2 (0.2)	0.432
	no	0.9 (0.4)		0.3 (0.2)	
Geriatric Depression Scale (GDS)	No depression	0.8 (0.5)	0.653	0.3 (0.2)	0.089
	Slight depression	0.8 (0.3)		0.2 (0.1)	
	Moderate/major depression	1.0 (0.7)		0.4 (0.2)	
Barthel Scale	Low-level care	0.8 (0.5)	0.887	0.3 (0.2)	0.412
	Medium-level care	0.8 (0.4)		0.2 (0.2)	
	High-level care	0.7 (0.5)		0.2 (0.1)	
Mini Mental State Examination (MMSE)	No significant cognitive impairment	0.8 (0.4)	0.300	0.3 (0.2)	0.550
	Slight/moderate cognitive impairment	1.0 (0.6)		0.3 (0.2)	
	Severe cognitive impairment	0.7 (0.3)		0.2 (0.2)	
TTMC time cut-offs	<45 seconds	0.9 (0.6)	**0.003**	0.3 (0.2)	0.081
	45-70 seconds	1.0 (0.4)		0.3 (0.2)	
	>70 seconds	0.5 (0.3)		0.2 (0.1)	
TTMC&NG	passed	0.9 (0.4)	**0.015**	0.3 (0.2)	**0.014**
	failed	0.5 (0.3)		0.2 (0.1)	
TTMC	passed	0.9 (0.5)	**0.016**	0.3 (0.2)	**0.031**
	failed	0.6 (0.3)		0.2 (0.1)	

* ANOVA test, Significant values are displayed in bold

Tab. 2: Validation of the TTMC&NG for tooth brushing and denture cleaning

	TTMC&NG vs. Tooth cleaning	TTMC&NG vs. Denture cleaning	TTMC<70 sec vs. Tooth cleaning	TTMC<70 sec. vs. Denture cleaning
Sensitivity	**86.4%**	**77.8%**	86.4%	60.9%
PPV	59.4%	55.2%	50.0%	50.0%
Specificity	40.9%	48.5%	50.0%	36.8%
NPV	**75.0%**	**72.7%**	50.0%	86.4%

Conclusion

The TTMC&NG served as a suitable predictor for the ability of geriatric inpatients to autonomously perform effective tooth brushing and denture cleaning. It might help geriatric medical staff to identify geriatric inpatients unable to perform sufficient oral hygiene by themselves