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The efficacy of Italian guidelines in promoting oral health in children and adolescents

ABSTRACT

Aim The purpose of the study was to evaluate the efficacy of the guidelines on oral health published by the Italian Health Ministry.

Materials and methods Study Design: 1239 patients (582 girls and 657 boys) with a mean age of 4.46 (SD 2.81) years were evaluated before application of the guidelines by paediatricians (T0) for the presence of caries, gingivitis, diseases of the oral mucosa, and malocclusion. Only patients aged 6 months, 3 years, 6 years, and 9 years at T0 were taken into consideration. All patients were reevaluated after application of the ministerial guidelines (T1). Methods: the study took place over a 3-year period. Enrolled patients referred to the outpatient clinics of three paediatricians of the Province of Genoa who strictly applied the ministerial guidelines. Statistics: χ^2 test analysis was performed to evaluate a statistically significant decrease in the incidence of caries, gingivitis and diseases of the oral mucosa.

Results After a 3-year follow-up collected data underlined a statistically significant decrease in the incidence of dental caries, gingivitis and oral mucosal diseases after implementation of the recommended ministerial guidelines. A statistically significant decrease of malocclusions was also evident in the elder patients (12 years old at T1).

Conclusion The accurate implementation of the Guidelines is supported. Only collaboration and increased synergy between paedodontists and paediatricians can fulfill the objectives which were the reason for publishing the "National guidelines for the

promotion of oral health and the prevention of oral diseases in developmental age".

Keywords Dental caries; Diseases of the oral mucosa; Gingivitis; Guidelines; Malocclusion.

Introduction

Despite significant improvements in terms of general health, the incidence of dental disease among paediatric patients remains high. Currently, in Italy, more than 20% of 4-year-old children have dental caries, with this incidence rising to 44% in the 12-year-old population [Campus et al., 2007]. On October 10, 2008, the Italian Ministry of Labour, Health and Social Policies published the first edition of the "National guidelines for the promotion of oral health and prevention of oral diseases in developmental age", followed by an update in November 2013 [2013]. These guidelines aim to offer all professionals involved in oral health (i.e. gynecologists, paediatricians, neonatologists, dentists and dental hygienists) clear-cut guidelines. The handbook is based on the best available scientific evidence in preventing caries, gingivitis, periodontitis, stomatitis, and orthognathic disorders of the jaws, in children from zero to fourteen years of age. Indeed, simple interventions such as proper brushing techniques and routines, the use of plaque disclosing tablets, a healthy diet, regular check-ups by the dental practitioner, together with prophylactic therapies, among which sealants and fluoride prophylaxis, may lead to saving teeth.

Purpose of this study was to evaluate the efficacy of the guidelines put forth by the Italian Ministry of Labour, Health and Social Policies after the implementation of a synergistic programme between paedodontists and paediatricians. Paedodontist's surveillance and monitoring, along with active cooperation by paediatricians, are essential tools to early detect and prevent issues, which could exacerbate when left unsolved in the early stages of growth and development. Considering the prevalence of diseases and the importance of the health problems that they represent, particular attention was paid to the following topics.

- Prevention of carious lesions.
- Prevention of gingivitis.
- Prevention of diseases of the oral mucosa.
- Prevention of orthopaedic problems of the jaws.

Materials and methods

The project was divided into 3 stages: Stage 1, Ministerial guidelines notification to the paediatricians; Stage 2, enrollment of the patients and guidelines implementation; Stage 3, evaluation of the results. Patients included were

those who referred to the outpatient clinics of three paediatricians in Genoa, Italy, for their 6 month, 3 year, 6 year, and 9 year checkups, from March 1st 2010 to June 1st 2010. During the first stage paediatricians joining the project were trained on the ministerial guidelines. Formative development was carried out by paedodontists through a series of specific events. Aim of the events was to display advices on evaluation rising from combined evidence based observations and experts opinion.

Guidelines for prevention of carious lesions

The use of fluoride in caries prevention is necessary for all children. Fluoride supplements are to be prescribed by the paediatrician in agreement with the paedodontist [Ferro et al., 2014] to children from 6 months to 6 years of age, topic supplementation consists in fluoride toothpaste (at least 1000 ppm) twice a day in pea-size dose. In case of objective difficulties in the use of toothpaste guidelines suggest systemic supplementation (6 months-3 years of age 0.25 mg/die fluoride in drops; 3-6 years of age 0.5 mg/die fluoride in drops or pills). To children over 6 years of age, topic supplementation consists in fluoride toothpaste (high fluoride content, 1,000 ppm) twice a day [Adair, 2006]. Dental sealants: to be applied within 2 years from eruption. Their integrity should be checked every 6 to 12 months [Ahovuo-Saloranta et al., 2004]. Banishment of dummies dipped in sugary substances and baby bottles containing sugary liquids with non-nutritional purpose [Bishara et al., 2006]. Discouraged consumption of food and beverages rich in simple carbohydrates away from the main meals [Karjalainen, 2007; Bauguna et al., 2013].

Guidelines for prevention of gingivitis

Correct use of toothbrush, at least twice a day [Honkala, 1984; Scorzetti, 2013]. For children between 0 and 3 years of age, oral hygiene must be performed by parents: before teeth eruption the baby's gums have to be wiped with a damp gauze after feeding. Oral hygiene for children aged 4 to 5 years, under parental supervision, using the roll technique with a soft bristle-small head toothbrush.

Guidelines for prevention of diseases of the oral mucosa

Adequate dietary and pharmacological supervision is recommended in patients affected by systemic diseases involving the oral mucosa, either directly or through therapeutic side effects (GERD, coeliac disease, asthma, nephropathy, primary and secondary immunodeficiency, epilepsy and other). Patients undergoing inhaled steroids treatment must rinse their mouth after each dose [Ellepola et al., 2001]. In presence of systemic diseases, psychomotor disorders, mental illnesses, syndromic diseases and disabilities, domestic oral hygiene has to be increased with the informed involvement of parents and support staff, together with periodic checkups with the dentist and/or the dental hygienist [Bessa et al., 2004; Faulks et al., 2000; Almomani et al., 2006]. Oncological

patients are recommended dental advice prior, during and after therapy [Epstein et al., 2003]. In failed regression of ulcerative or white lesions of the oral mucosa after therapy or removal of local causes, patients must be referred to the dental practitioner, after a 14-day attentive monitoring.

Guidelines for prevention of orthopaedic problems of the jaw

Breastfeeding must be encouraged in order to promote a correct maxillary development [Vazquez-Nava et al., 2006]. Adequate lip competence, correct lingual posture, nasal respiration, and correct transverse diameters of the palate are related with breastfeeding [Carrascoza et al., 2006; Viggiano et al., 2004; Ortu et al., 2014]. Non-nutritive sucking, together with allergic rhinitis, seems to be the main cause of posterior crossbite in children under the age of 5 [Vazquez-Nava et al., 2006]. Discourage non-nutritive sucking after 2 years of age, interrupt it within the next year: non-nutritive sucking (thumb-sucking or finger-sucking, pacifier use, sucking on lips or tongue) can result in malocclusions (anterior open bite, posterior crossbite, Class II malocclusion) if prolonged after the child's third year of age [Poyak, 2006; Zardetto et al., 2002].

Children with predominantly oral respiration, and narrow maxilla, can benefit from orthopaedic maxillary expansion [Pirelli et al., 2005]. Oral-breathing children generally manifest a Class II malocclusion, contraction of the transverse diameter of the upper maxilla (ogival palate), augmented anterior facial height, and wide mandibular angle. These defects are closely interrelated with low tongue posture and hypotonic facial muscles, which are caused by oral respiration.

Constant monitoring of patients who present a low or forward tongue rest posture, in order to prevent dentoalveolar open-bite and excessive mandibular growth: a low and forward rest posture of the tongue causes anterior dentoalveolar openbite, furthermore it causes excessive mandibular growth, speech difficulties and upper front teeth protrusion.

During the second stage patients from 3 different paediatricians who were referred to the dental practitioners for their 6 months, 3 years, 6 years and 9 years checkups were enrolled. As instructed by the paedodontists, recommendations from the ministerial guidelines were applied to all patients included in the study. Data were collected at two different times:

Time 0: Initial data collection at the time of the 6 months, 3 years, 6 years and 9 years checkups

Time 1: Final data collection at the time of the 3 years, 6 years, 9 years and 12 years checkups, at about 3 years from the first evaluation (Time 0).

During the third stage comparisons were made between the same age groups at a distance of three years (e.g. the group that at Time 0 was 6 years old was compared with the group that at Time 1 was 6 years old), in order to evaluate any changes in lifestyle and in oral health conditions, before (Time 0) and after (Time 1) the

implement of the ministerial guidelines.

Statistical analysis

Descriptive statistics were performed. Qualitative variables were summarised in terms of absolute frequencies or percentages, and quantitative variables were summarised in terms of mean ± standard deviation. A comparison of frequencies was performed by the Chi-square test or by the Fisher Exact test (in case of expected frequencies less than 5). All tests were two-sided and a p<0.05 was considered statistically significant. The software used for statistical analyses was Excel 2010 (Microsoft Corp. Redmond, WA, USA).

Results

At Time 0 were enrolled 1,239 patients, (657 males, mean age 4.46±2.81 years) and divided according to the age at checkup: 6 months (228 patients, 111 males, mean

age 0.51±0.31 years), 3 years (417 patients, 231 males, mean age 3.04±0.52 years), 6 years (387 patients, 204 males, mean age 5.92±0.57 years), 9 years (207 patients, 111 males, mean age 8.96±0.59 years).

Table 1 shows the oral conditions at Time 0.

At Time 1, the same 1,239 patients (mean age 7.62±2.81 years) were re-evaluated and divided according to the age at checkup: 3 years (patients aged 6 months at Time 0, mean age 3.76±0.31 years), 6 years (patients aged 3 years at Time 0, mean age 6.29±0.52 years), 9 years (patients aged 6 years at Time 0, mean age 9.17±0.57 years), 12 years (patients aged 9 years at Time 0, mean age 12.21±0.59 years). Table 2 shows oral conditions at Time 1.

Table 3 shows the relationship between oral conditions at Time 0 vs. Time 1.

At the 6 months, 3 years and 6 years checkups, patients enrolled at Time 0 followed the paediatrician's recommendations and instructions, with a reduction in caries incidence. This reduction is statistically significant at

| | | | AGED 3 | | AGED 6 | | AGED 9 | |
|---------------------|--|---|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | YES N (%) | NO N (%) | YES N (%) | NO N (%) | YES N (%) | NO N (%) |
| CARIES | | | | | | | | |
| Prevention | Fluoride Prophylaxis | Oral route (0.25 mg/die) | 114 (27.34) | 303 (72.66) | 60 (15.50) | 237 (84.50) | 21 (10.14) | 186 (89.86) |
| | | Toothpaste (fluoride content 500 ppm) | - | - | 198 (51.16) | 189 (48.84) | 144 (69.57) | 63 (30.43) |
| | | Toothpaste (fluoride content 1,000 ppm) | - | - | - | - | 159 (76.81) | 48 (23.19) |
| | Dental sealants | - | - | 0 (0) | 387 (100) | 51 (24.64) | 156 (75.36) | |
| | Sweetened pacifier | 174 (41.73) | 243 (58.27) | 204 (52.71) | 183 (47.29) | 99 (47.83) | 108 (52.17) | |
| | Simple sugars away from main meals | 63 (15.11) | 354 (84.89) | 252 (65.12) | 135 (34.88) | 111 (53.62) | 96 (46.38) | |
| INCIDENCE | | | 33 (7.91) | 384 (92.09) | 117 (30.23) | 270 (69.77) | 117 (56.52) | 90 (43.48) |
| GINGIVITIS | | | | | | | | |
| Prevention | Toothbrushing performed by parents | | 189 (45.32) | 228 (54.68) | 147 (37.98) | 240 (62.02) | 99 (47.83) | 108 (52.17) |
| | Autonomous toothbrushing | | - | - | 258 (66.67) | 129 (33.33) | 135 (65.22) | 72 (34.78) |
| INCIDENCE | | | 138 (33.09) | 279 (66.91) | 150 (38.76) | 237 (61.24) | 84 (40.58) | 123 (59.42) |
| MUCOSITIS | | | | | | | | |
| Prevention | Rinsing after inhaled steroid therapy | | 81 (19.42) | 336 (80.58) | 258 (66.67) | 129 (33.33) | 75 (36.23) | 132 (63.77) |
| | Checkup by the paedodontist if at risk | | 0 (0) | 417 (100) | 33 (8.53) | 354 (91.47) | 24 (11.59) | 183 (88.41) |
| INCIDENCE | | | 177 (42.45) | 240 (57.55) | 117 (30.23) | 270 (69.77) | 84 (40.58) | 123 (59.42) |
| MALOCLUSIONS | | | | | | | | |
| Prevention | Breastfeeding | | 192 (46.04) | 225 (53.96) | 192 (49.61) | 195 (50.39) | 114 (55.07) | 93 (44.93) |
| | Removal of pacifier within the 3rd year of age | | 72 (17.27) | 345 (82.73) | 186 (48.6) | 201 (51.94) | 96 (46.38) | 111 (53.62) |
| | Oral breather and contracted maxilla | | - | - | 144 (37.21) | 243 (62.71) | 78 (37.68) | 129 (62.32) |
| | Low and forward tongue position | | - | - | 78 (20.16) | 309 (79.84) | 39 (18.84) | 168 (81.16) |
| INCIDENCE | | | 150 (35.97) | 267 (64.03) | 144 (37.21) | 243 (62.79) | 114 (55.07) | 93 (44.93) |

TABLE 1 Oral conditions at Time 0.

TABLE 2 Oral conditions at Time 1.

| | | | AGED 3 | | AGED 6 | |
|---------------------|--|---|-------------|-------------|-------------|-------------|
| | | | YES N (%) | NO N (%) | YES N (%) | NO N (%) |
| CARIES | | | | | | |
| Prevention | Fluoride Prophylaxis | Oral route (0.25 mg/die) | 183 (80.26) | 45 (19.74) | - | - |
| | | Toothpaste (fluoride content 500 ppm) | - | - | 390 (93.53) | 27 (6.47) |
| | | Toothpaste (fluoride content 1,000 ppm) | - | - | - | - |
| | Dental sealants | - | - | 39 (9.35) | 378 (90.65) | |
| | Sweetened pacifier | 213 (93.42) | 15 (6.58) | - | - | |
| | Simple sugars away from main meals | 87 (38.16) | 141 (61.84) | 102 (24.45) | 315 (75.54) | |
| INCIDENCE | | | 0 (0) | 226 (100) | 60 (14.39) | 357 (85.61) |
| GINGIVITIS | | | | | | |
| Prevention | Toothbrushing performed by parents | | 195 (85.53) | 33 (14.47) | - | - |
| | Autonomous toothbrushing | | - | - | 306 (73.38) | 111 (26.62) |
| INCIDENCE | | | 15 (6.58) | 213 (93.42) | 78 (18.71) | 339 (81.29) |
| MUCOSITIS | | | | | | |
| Prevention | Rinsing after inhaled steroid therapy | | 180 (78.95) | 48 (21.05) | 282 (67.63) | 135 (32.37) |
| | Checkup by the paedodontist if at risk | | 0 (0) | 228 (100) | 30 (7.19) | 387 (92.81) |
| INCIDENCE | | | 63 (27.63) | 165 (72.37) | 72 (17.27) | 342 (82.73) |
| MALOCLUSIONS | | | | | | |
| Prevention | Breastfeeding | | 144 (63.16) | 84 (38.84) | - | - |
| | Removal of pacifier within the 3rd year of age | | 147 (64.47) | 81 (35.53) | - | - |
| | Oral breather and contracted maxilla | | - | - | 162 (38.85) | 255 (61.15) |
| | Low and forward tongue position | | - | - | 57 (13.67) | 360 (86.33) |
| INCIDENCE | | | 66 (28.95) | 162 (71.05) | 138 (33.09) | 279 (66.91) |

| | | | AGED 9 | | AGED 12 | |
|---------------------|--|---|-------------|-------------|-------------|-------------|
| | | | YES N (%) | NO N (%) | YES N (%) | NO N (%) |
| CARIES | | | | | | |
| Prevention | Fluoride Prophylaxis | Oral route (0.25 mg/die) | - | - | - | - |
| | | Toothpaste (fluoride content 500 ppm) | - | - | - | - |
| | | Toothpaste (fluoride content 1,000 ppm) | 348 (89.92) | 39 (10.08) | 180 (86.96) | 27 (13.04) |
| | Dental sealants | 147 (37.98) | 240 (62.02) | - | - | |
| | Sweetened pacifier | - | - | - | - | |
| | Simple sugars away from main meals | 189 (48.84) | 198 (51.16) | 144 (69.57) | 63 (30.43) | |
| INCIDENCE | | | 102 (26.36) | 285 (73.64) | 78 (37.68) | 129 (62.32) |
| GINGIVITIS | | | | | | |
| Prevention | Toothbrushing performed by parents | | - | - | - | - |
| | Autonomous toothbrushing | | 291 (75.19) | 96 (24.81) | 159 (76.81) | 48 (23.19) |
| INCIDENCE | | | 81 (20.93) | 306 (79.07) | 105 (50.72) | 102 (49.28) |
| MUCOSITIS | | | | | | |
| Prevention | Rinsing after inhaled steroid therapy | | 303 (78.29) | 84 (21.71) | 141 (68.12) | 66 (31.88) |
| | Checkup by the paedodontist if at risk | | 51 (13.18) | 336 (86.82) | 45 (21.74) | 162 (78.26) |
| INCIDENCE | | | 108 (27.91) | 279 (72.09) | 51 (24.64) | 156 (75.36) |
| MALOCLUSIONS | | | | | | |
| Prevention | Breastfeeding | | - | - | - | - |
| | Removal of pacifier within the 3rd year of age | | - | - | - | - |
| | Oral breather and contracted maxilla | | 84 (21.71) | 303 (78.29) | 48 (23.19) | 159 (76.81) |
| | Low and forward tongue position | | 21 (5.43) | 366 (94.57) | 18 (8.70) | 189 (91.30) |
| INCIDENCE | | | 99 (25.58) | 288 (74.42) | 81 (39.13) | 126 (60.87) |

the 3 years checkup (p=0.0124), at the 6 years checkup (p<0.0018), and at the 9 years checkup (p<0.00001).

The relationship between patients aged 3 years, 6 years and 9 years, before and after implementation of the recommendations of the ministerial guidelines (Time 0 and Time 1) suggests increased adherence to fluorine prophylaxis (systemic, at the 3 years checkup, p<0.00001; topic, twice a day use of fluoride toothpaste, at the 6 years checkup, p<0.00001; topic, twice a day use of fluoride toothpaste, at the 9 years checkup, p<0.0129). Furthermore, reduction in the use of sweetened pacifiers and baby bottles supplying non-nutritional sugary beverages (at the 3 years checkup, p<0.00001) is observed. Again, an increase in dental sealants is observed (at the 6 years checkup, p<0.00001; at the 9 years checkup, p = 0.0002), as well as a decrease in consumption of high sugar food and drinks away from the main meals (at the 3 and 6 years checkup, p<0.00001; at the 9 years checkup, p = 0.05210).

A statistically significant reduction of gingivitis incidence emerges from the study (at the 3 years checkup, p<0.00001; at the 6 years checkup, p=0.0003; at the 9 years checkup, p=0.0033). Oral hygiene, from 0 to 3 years of age, shows a significant boost, first of all through the recommended use of gauze for wiping gums in babies, and through toothbrushing performed by a parent (p<0.00001). Improvement is also seen in autonomous toothbrushing performed by the child himself (at the

6 years checkup, p=0.023). Again, an increase in autonomous toothbrushing at the 9 years checkup is observed (65.22% vs. 75.19%), but statistical significance cannot be proved (p=0.1375).

For both 3 and 6 years checkups, the incidence of mucositis appears significantly decreased (p=0.0317 and p=0.0124). No significant reduction is observed at the 9 years checkup (p=0.0574), although a certain reduction in percentage is noted (40.58% vs. 20.93%). Oral cavity rinsing after inhaled steroids treatment (quite common in D.A.), significantly increased at the 9 years checkup (p<0.00001), results unchanged at the 6 years checkup (p=0.8673). The increase in paedodontic checkups is not statistically significant for white ulcerative lesions, which show no regression after therapy or removal of any local causes, after 14 days of careful monitoring. The same for patients with systemic diseases, or patients with handicaps, neither at the 6 years checkups (p=0,685), or at the 9 years checkup (p=0.7491).

The incidence of malocclusions was statistically significantly reduced at the 3 years (p=0.2968) and 6 years (p=0.4805) checkups, and even more significantly at the 9 years checkup (p<0.00001). Increase in breastfeeding to promote the correct development of the maxillae was statistically significant at the 3 years checkup (p=0.0163). Statistically significant is also interruption of pacifier use within the age of 3 years, as per paedodontist's

| | | | AGED 3 | AGED 6 | AGED 9 |
|---------------------|--|---|----------|----------|----------|
| | | | P | P | P |
| CARIES | | | | | |
| Prevention | Fluoride Prophylaxis | Oral route (0.25 mg/die) | <0.00001 | - | - |
| | | Toothpaste (fluoride content 500 ppm) | - | <0.00001 | - |
| | | Toothpaste (fluoride content 1,000 ppm) | - | - | 0.0129 |
| | Dental sealants | | - | <0.00001 | 0.0002 |
| | Sweetened pacifier | | <0.00001 | - | - |
| | Simple sugars away from main meals | | <0.00001 | <0.00001 | 0.05210 |
| INCIDENCE | | | 0.0124 | 0.0018 | <0.00001 |
| GINGIVITIS | | | | | |
| Prevention | Toothbrushing performed by parents | | <0.00001 | <0.00001 | - |
| | Autonomous toothbrushing | | - | 0.23 | 0.1375 |
| INCIDENCE | | | <0.00001 | 0.0003 | 0.0033 |
| MUCOSITIS | | | | | |
| Prevention | Rinsing after inhaled steroid therapy | | <0.00001 | 0.8673 | <0.00001 |
| | Checkup by the paedodontist if at risk | | - | 0.685 | 0.7491 |
| INCIDENCE | | | 0.0317 | 0.0124 | 0.0574 |
| MALOCLUSIONS | | | | | |
| Prevention | Breastfeeding | | 0.0163 | - | - |
| | Removal of pacifier within the 3rd year of age | | <0.00001 | - | - |
| | Oral breather and contracted maxilla | | - | 0.7199 | 0.0101 |
| | Low and forward tongue position | | - | 0.1558 | 0.028 |
| INCIDENCE | | | 0.2968 | 0.4805 | <0.00001 |

TABLE 3
Relationship between oral conditions at Time 0 vs. Time 1.

recommendations, at the 3 years checkup ($p < 0.00001$). The identification of children with oral breathing and narrow maxilla who were sent to the paedodontist for orthopaedic expansion of the maxillary bone was statistically significant at the 9 years checkup ($p = 0.0101$), whereas it was not statistically significant at the 6 years checkup ($p = 0.7199$), even though there an increase was noted (38.85% at Time 0, at the 6 years checkup, versus 61.15% at Time 1, at the 6 years checkup). The identification by the paediatrician of patients with a low and forward tongue posture, and their constant monitoring by the paedodontist in order to prevent overbite and excessive growth of the mandible, showed a statistically significant increase at the 6 years checkup ($p = 0.1558$) and at the 9 years checkup ($p < 0.00001$).

Conclusion

The cooperation between paedodontists and paediatrician turned out to be pivotal in children's oral health prevention. The collaboration and increased synergy between the practitioners can lead to an effective and efficient prevention of oral disease, resulting in the successful attainment of the objectives published in the "Guidelines for the promotion of oral health and the prevention of oral diseases in developmental age" released in 2008 and updated in 2013. Following the paedodontist's recommendations, the paediatrician can provide hints and advice for a correct oral hygiene, performed at first by parents and at a later stage by the child himself. A more attentive approach of the paediatrician towards oral health problems, allows to identify children at risk of oral disease, who are promptly sent to the dental practitioner for more specific monitoring. The paediatrician involvement allows to reach virtually all paediatric subjects, also thanks to the trustful relationship between parents and paediatrician, and the good practice of taking the child for routine checkups, and not only in case of illness. Thanks to the recommendations given by the paedodontist, the paediatrician can approach the whole household to the concept of oral health and oral health prevention, putting into effect hygiene standards and a correct behavior. In addition the paediatrician can refer those who are identified as at risk subjects to the care of the paedodontist before the actual onset of oral diseases. An incisive and effective prevention can only be brought by the synergistic partnership between paediatrician and paedodontist, in order to achieve the OMS' goals for oral health.

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