ANALIZA STATISTICA IN MEDICINA

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PRINCIPIILE DE ANALIZĂ STATISTICĂ

- În cursul cercetării medicale, investigatorul trebuie să răspundă la anumite întrebări care se referă la o populaţie ţintă, în cadrul populaţiei generale.

- Cercetarea trebuie să se focalizeze doar pe un segment din populaţia ţintă (eşantion pe principii randomizate).

- Rezultatele cercetărilor pe eşantion vor fi extrapolate întregii populaţii ţintă, folosind metode de analiză statistică.

- Astfel, se poate estima (nu calcula cu exactitate) media polpulaţiei ţintă prin determinarea mediei eşantionului studiat.

- **Cu cât eşantionul folosit este mai mare, cu atât media lui se apropie de media reală a populaţiei ţintă.**

$\bar{x}$

Eroarea standard şi intervalul de confidenţă pentru medii

Studierea altui eşantion din populaţia ţintă va genera o altă medie, deci este necesară cuantificarea erorii standard a mediei (SEM).

Table 1 Mean shear bond strength values (standard error) of glass ionomer cement sealers to bovine dentine submitted to three conditioning protocols

Sealer	Shear bond strength (MPa) per dentine conditioning[a]		
	H_2O	2.6% NaOCl	17% EDTA + 2.6% NaOCl
Ketac-Endo	0.46 (0.71)	0.18 (0.09)	0.12 (0.09)
KT-308	1.00 (0.76)	0.99 (0.56)	0.55 (0.42)
ZUT	0.79 (0.39)	0.91 (0.61)	0.49 (0.25)

[a] All irrigants were individually delivered with a syringe over a 30-second period.

$\bar{x}$

Pentru cuantificare gradului în care media eşantionului diferă de media populaţiei, se calculează un interval de valori care conţine media populaţiei (μ) şi care se numeşte interval de confidenţă.

$\frac{\sigma}{\sqrt{n}}$

Pentru calcularea intervalului de confidenţă (pentru eşantioane mari cu distribuţie normală) se foloseşte următoarea formulă:

95% interval de confidenţă = (media eşantionului) ± 1,96 x SEM

Nu se poate garanta 100% că media eşantionului deviază în acest interval, deoarece există o şansă de 5% ca eşantionul să se situeze în afara intervalului.

Table 4 Prevalence of remaining teeth, root filled teeth and teeth with periapical destructions [mean, standard deviation and confidence interval for mean and ratio (95% CI)]

		No. teeth			No. rf			No. pa			R rf (%)		Samp	R pa (%)		Samp
	n	Mean	SD	CI	Mean	SD	CI	Mean	SD	CI		CI	rf (%)		CI	pa (%)
1968																
1908	48	13.7	7.8	11.5–16	3.7	3.3	2.7–4.6	0.7	1.0	0.4–1	27.4	19.5–35.3	77.1	5.1	3–7.3	45.8
1914	133	18.2	7.2	16.9–19.4	3.8	2.9	3.3–4.3	0.7	1.0	0.5–0.9	22.4	19.3–25.4	91.7	3.6	2.7–4.7	40.6
1918	319	17.8	7.3	17–18.6	3.5	3.0	3.2–3.8	0.8	1.3	0.7–0.9	20.0	18–21.9	82.4	5.6	3.8–7.3	43.3
1922	378	19.8	7.0	19.1–20.5	3.6	2.8	3.3–3.8	0.8	1.2	0.7–0.9	18.5	17–20.1	85.7	5.0	4–5.9	45.8
1930	342	23.1	5.5	22.5–23.7	3.1	2.8	2.8–3.4	0.6	1.1	0.5–0.9	13.6	12.2–14.9	82.7	2.8	2.2–3.4	34.2
Total	1220	19.8	7.2	19.4–20.2	3.4	2.9	3.3–3.6	0.7	1.2	0.7–0.8	18.3	17.4–19.2	84.3	4.4	3.8–5	41.9
1980																
1908	24	13.4	7.6	10.2–16.57	4.4	3.5	3–5.9	0.5	0.8	0.2–0.9	34.2	21.7–46.8	79.2	3.5	0.6–6.4	33.3
1914	97	16.7	7.3	15.3–18.2	4.1	3.0	3.5–4.7	0.6	1.0	0.4–0.8	28.0	23.5–32.6	93.8	4.2	1.9–6.5	37.1
1918	225	17.7	6.7	16.8–18.5	4.1	3.2	3.7–4.5	0.5	0.8	0.4–0.6	24.1	21.5–26.8	87.5	2.9	2.2–3–5	35.6
1922	261	18.9	6.9	18.1–19.7	4.2	3.0	3.9–4.6	0.8	1.2	0.7–0.9	24.1	21.8–26.4	91.5	5.4	3.9–6.9	47.1
1930	310	21.8	5.9	21.1–22.5	3.9	3.1	3.5–4.2	0.7	0.9	0.6–0.8	19.2	17.3–21	89.3	3.7	2.9–4–5	45.5
1942	106	25.4	4.8	24.5–26.3	3.1	2.8	2.5–3.6	0.5	0.7	0.4–0.6	13.1%	10.7–15.5	84.9	2.0	1.5–2.6	38.7
Total	1023	19.8	7.0	19.4–20.3	4.0	3.1	3.8–4.2	0.6	1.0	0.6–0.7	22.1%	20.9–23.3	89.2	3.8	3.3–4.3	41.9
1992																
1908	12	13.4	6.8	9.1–17.7	3.3	3.2	1.2–5.4	0.3	0.5	−0.04–0.6	25.4	10.7–40	90.9	4.4	−1.3–10.2	27.3
1914	52	17.5	5.9	15.9–19.1	4.4	3.3	3.4–5.3	0.5	0.9	0.2–0.7	26.6	20.5–32.7	94.1	2.6	1–4.2	27.5
1918	153	16.4	7.3	15.3–17.6	4.0	3.2	3.5–4.5	0.4	0.8	0.3–0.5	26.1	22.7–29.5	86.0	3.1	2–4.3	26.7
1922	233	17.7	7.1	16.8–18.7	4.3	3.2	3.9–4.7	0.5	1.0	0.4–0.7	26.9	23.9–29.9	87.8	3.6	2.5–4.8	33.5
1930	254	21.1	6.1	20.3–21.8	4.1	3.0	3.7–4.4	0.5	0.9	0.4–0.6	20.9	18.7–23.2	87.3	2.9	2–3.7	34.9
1942	97	24.1	5.7	23–25.3	3.4	2.9	2.8–4	0.4	0.7	0.2–0.5	15.1	12.3–17.9	86.6	1.7	1–2.4	25.8
1954	66	28.1	2.2	27.5–28.6	0.9	1.4	0.6–1.3	0.3	0.6	0.1–0.4	3.3	2–4.7	45.3	1.0	0.3–1.6	17.2
Total	867	19.9	7.2	19.4–20.4	3.8	3.1	3.6–4	0.5	0.9	0.4–0.5	21.9	20.5–23.2	84.7	2.8	2.4–3.3	31.1

n, Number of subjects; No. teeth, number of teeth (mean, standard deviation, confidence interval for mean); No. rf, number of root filled teeth (mean, standard deviation, confidence interval for mean); No. pa, number of teeth with periapical destruction (mean, standard deviation, confidence interval for mean); R rf, ratio of root filled teeth (confidence interval for ratio); Samp rf, sample prevalence (ratio of subjects with ≥1 root filled tooth); R pa, ratio of teeth with periapical destruction (confidence interval for ratio); Samp pa, sample prevalence (ratio of subjects with ≥1 tooth with periapical destruction).

Nivelul de la care se decide că un rezultat este semnificativ statistic se numeşte nivel de semnificaţie.

Prin convenţie, în cercetarea medicală $P<0,05$, adică rezultatele testului sunt semnificative statistic (asociaţia expunere-boală este considerată semnificativă statistic).

Valoarea lui P sub 0,05 este un ghid şi nu o regulă.
De exemplu, dacă $P<0,01$, nivelul de semnificaţie este 1%.

P reflectă două dimensiuni:
- mărimea eşantionului
- magnitudinea diferenţei dintre două grupuri de date studiate.

Dacă se doreşte extrapolarea rezultatelor, obţinute la eşantionul testat, la întreaga populaţie din care provine eşantionul, atunci acesta trebuie să îndeplinească anumite condiţii:

➔ să fie reprezentativ pentru populaţia studiată; în acest sens, poate fi stratificat după anumite variabile;

➔ să fie aleator; constituirea trebuie făcută prin tragere la sorţi;

➔ să fie de talie suficientă; precizia unui sondaj aleator se poate determina prin calcule.

Metode statistice în cercetarea medicală

- Alegerea metodei de analiză statistică într-un studiu, depinde de tipul de date introduse şi de compararea ce urmează a fi făcută între acestea.

- !!! Trebuie evitată aplicarea eronată a unor teste pentru variabilele luate în studiu, cu stabilirea unor concluzii nerelevante.

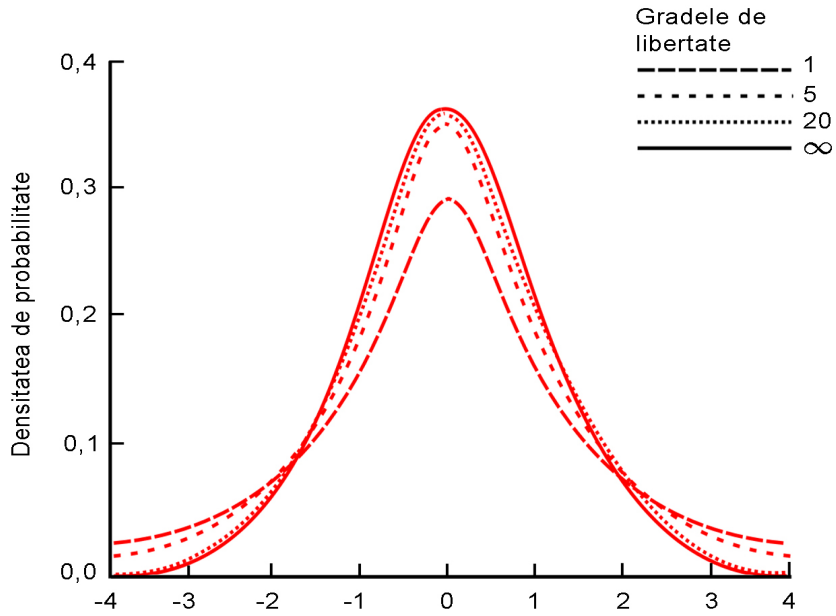
Fiecare test statistic are o distribuţie a probabilităţii, care se împarte între o arie de acceptare a ipotezei şi o arie de respingere a ei.

Distribuţia normală este acea dispersie particulară a valorilor unei variabile în jurul unei medii ce urmează legea matematică a lui Gauss. Ea se caracterizează prin medie şi deviaţie standard, numiţi parametrii distribuţiei.

Metodele folosite pentru studiul distibuţiei normale se numesc parametrice, iar acelea care studiază o distribuţie particulară a variabilelor, se numesc metode nonparametrice.

TESTUL STUDENT (T)

Distribuţia t a fost descrisă pentru prima dată de WS Gossett în 1908 sub pseodonimul „Student”, fiind cunoscut şi astăzi ca testul Student.
Testul t se bazează pe distribuţia t care este considerată normală şi este reprezentată de o familie de curbe.



Prezentarea grafică a distribuţiei normale şi a distribuţiei t cu diverse grade de libertate.

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Co-site digital optical microscopy and image analysis: an approach to evaluate the process of dentine demineralization

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Abstract

De-Deus G, Reis CM, Fidel RAS, Fidel SR, Paciornik S. Co-site digital optical microscopy and image analysis: an approach to evaluate the process of dentine demineralization. *International Endodontic Journal*, **40**, 441–452, 2007.

Aim To introduce and explore the potential of digital optical co-site microscopy and image analysis for the observation of changes in dentine surfaces during demineralization. The effect of ethylenediamine tetra-acetic acid (EDTA) was evaluated quantitatively and longitudinally.

Methodology Three maxillary human molars were sectioned transversely at the cemento-enamel junction, and the crowns discarded. Subsequently, discs approximately 3 mm thick were cut in the cervical third of the root and a standardized smear layer produced. Co-site image sequences of the dentine surface subjected to 17% EDTA were obtained over the experimental period (15, 30, 60, 180 and 300 s). Sixteen images were obtained in each dentine sample for each experimental time, thus, a total of 48 image fields were obtained. For each field, an image analysis routine automatically discriminated open dentine tubules and measured their number, area fraction and minimum diameter, thus allowing the quantification of the demineralization process. The Student *t*-test was used to analyse the data.

Results The number of open tubules remained essentially constant during the demineralization process. The area fraction increased from 9% to 32%. Tubule minimum diameter increased from 1.5 to 3.0 μm. The changes over time for the area fraction and minimum diameter were significant for comparison between all experimental times ($P < 0.05$).

Conclusions The methodology developed for longitudinal observation of dentinal surfaces was fast, robust and reproducible. It could be easily extended to other chelating substances, thus contributing to the understanding of the demineralization process and in establishing an optimal time-effect relationship in the clinical application.

Keywords: co-site optical microscopy, dentine demineralization, digital image analysis, endodontic chelators, longitudinal observation.

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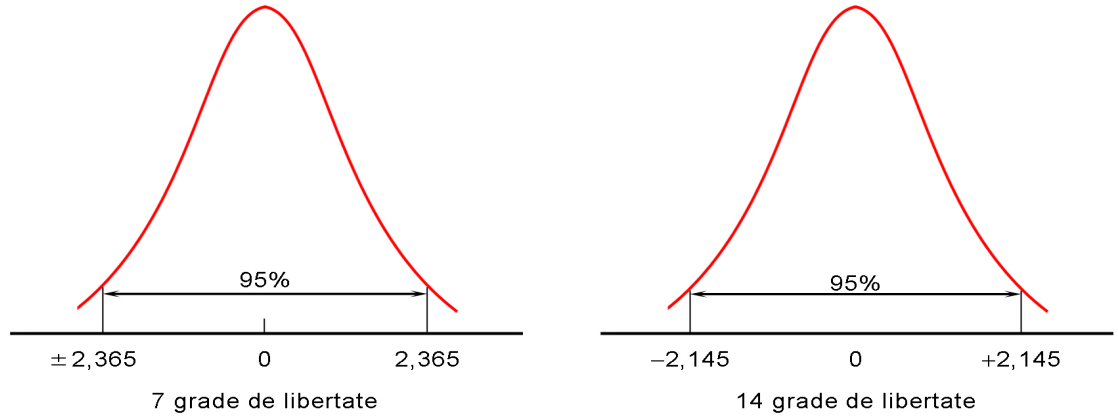
Familia de curbe diferă prin gradul lor de libertate, ce influenţează aria de distribuţie.



Testul t se foloseşte pentru a compara medii ale unor valori continue cantitative atunci când numărul de observaţii (eşantionul) este mic (sub100).
Testul se poate aplica pe un eşantion sau pe două eşantioane.
Testul se găseşte în pachetele soft Statistics, Systat, Minitab etc..

- TIPURI DE TESTE T

  TESTUL T SIMPLU PENTRU UN EŞANTION (ONE SAMPLE)

  ACEST TEST TESTEAZĂ IPOTEZA DATELOR DE LA UN SINGUR EŞANTION DE PACIENŢI DIN CADRUL UNEI POPULAŢII CU O MEDIE A VARIABILELOR CUNOSCUTĂ.

  LA FEL CA TOATE CELĂLALTE TESTE T, ACEST TIP DE TEST PRESUPUNE CĂ EŞANTIONUL ESTE LUAT DINTR-O POPULAŢIE CU O DISTRIBUŢIE NORMALĂ.

TESTUL T PENTRU DOUĂ EŞANTIOANE (TWO- SAMPLE T TEST, UNPAIRED)

- Acest studiu va include două grupuri independente de observaţii, neîmperecheate care nu sunt neapărat de aceeaşi mărime (n), la pacienţi cu aceeaşi afecţiune.

  Exemplu, două grupuri de pacienţi cu aceeaşi boală care primesc tratament diferit.

  Se vor compara grupurile între ele din punct de vedere al modificării unui parametru biologic care evidenţiază evoluţia pozitivă după unul dintre tratamentele aplicate.

TESTUL WILCOXON IMPERECHEAT

- Testul Wilcoxon împerecheat este un test non-parametric /neparametric utilizat ca alternativă la testul t împerecheat, atunci când variabilele analizate nu urmează o distribuţie normală.

- Parametric - mulţimea supusă observaţiei aparţine unei distribuţii, deci distribuţia este cunoscută.
- Neparametric - nu se cunoaşte ce distribuţie au datele supuse observaţiei.

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Haemostatic agents used in periradicular surgery: an experimental study of their efficacy and tissue reactions

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Abstract

von Arx T, Jensen SS, Hänni S, Schenk RK. Haemostatic agents used in periradicular surgery: an experimental study of their efficacy and tissue reactions. *International Endodontic Journal*, **39**, 800–808, 2006.

Aim To evaluate the haemostatic efficacy and the histologic tissue responses after the application of different haemostatic agents used in periradicular surgery.

Methodology The study was conducted in the calvarium of six rabbits. Standardized bone defects (diameter 4 mm) were trephined, and different haemostatic agents were applied and compared with control defects: bone wax (left for 10 min), Stasis® (ferric sulphate, left for 5 s), Expasyl™ (aluminium chloride, left for 2 min and left permanently *in situ*), and a combination of Expasyl™ (2 min) and Stasis® (5 s). The sites were photographed before the application and after the removal of the haemostatic agents. Three independent examiners judged the initial and final bleeding (on the photographs) using a bleeding score for each site and treatment. The results were compared using Wilcoxon's signed rank test. For the histologic analysis, three animals were killed after 3 weeks and three animals after 12 weeks. Transverse, nondecalcified sections were stained with combined basic fuchsin and toluidine blue for descriptive histology.

Results The most efficient haemorrhage control was provided by Expasyl™ in combination with Stasis® and by Expasyl™ alone, whereas bone wax had the weakest bleeding reduction effect. The histologic analysis after 3 weeks demonstrated an inflammatory and foreign body tissue response towards all haemostatic agents. At 12 weeks, this tissue response was less pronounced but still present in sites treated with bone wax or Expasyl™. In general, the inflammatory tissue reactions were limited to the bone defects, and never extended into the surrounding tissues.

Conclusions Expasyl™ alone or in combination with Stasis® appeared to be the most efficient of tested agents to control the bleeding within the bony defects created in a rabbit calvarium model.

Keywords: aluminium chloride, bone wax, ferric sulphate, haemorrhage control, periradicular surgery.

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Testul U Mann-Whitney

ESTE O ALTERNATIVĂ NEPARAMETRICĂ A TESTULUI T, ECHIVALENT TESTULUI T INDEPENDENT, ŞI UTILIZAT ATUNCI CÂND UNA SAU MAI MULTE DIN IPOTEZELE TESTULUI T NU SUNT ÎNDEPLINITE.

ESTE UTILIZAT ÎN COMPARAREA MEDIANELOR A DOUĂ EŞANTIOANE/GRUPURI INDEPENDENTE, CÂND VARIABILELE NU SUNT NORMAL DISTRIBUITE, LA FEL CUM TESTUL T INDEPENDENT COMPARĂ MEDIILE A DOUĂ GRUPURI CU VARIABILE CU DISTRIBUŢIE NORMALĂ.

DECI, ACEST TEST ESTE DESTINAT TESTĂRII IPOTEZELOR ATUNCI CÂND EŞANTIONELE (GRUPURILE) DE DATE SUPUSE TESTĂRII NU AU O DISTRIBUŢIE NORMALĂ.

EL POATE TESTA RANGUL A DOUĂ GRUPURI DE DATE PENTRU A STABILI EGALITATEA SAU LIPSA DE EGALITATE A MEDIANELOR CELOR DOUĂ MULŢIMI DE UNDE PROVIN DATELE.

Measurement of strain on tooth roots during post removal with the Eggler post remover

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Abstract

Castrisos T, Palamara JEA, Abbott PV. Measurement of strain on tooth roots during post removal with the Eggler post remover. *International Endodontic Journal*, **35**, 337–344, 2002.

Aim The aim was to measure root surface strains in teeth when removing cast post/cores with the Eggler post remover.

Methodology Two groups of 10 teeth each were tested: group 1 had 1 mm thickness of dentine coronally, and group 2 had 2 mm thickness of dentine. After root filling, 10 mm long cast post/cores were constructed and cemented with zinc phosphate cement, and strain gauges were applied to the roots. The post/cores were removed with the Eggler post remover whilst strain measurements were being recorded. Posts were removed twice: initially along the long axis of the tooth and then at a 10° angle to the long axis. Comparisons between groups 1 and 2 were analysed statistically with the Mann–Whitney *U*-test whilst strains within each group were analysed with the Wilcoxon Signed Rank test at the 95% level of confidence.

Results There was no significant difference in the strains measured between groups 1 and 2, and no significant difference within each group when removing posts along the long axis of the tooth and at a 10° angle. Three teeth in group 1 and one tooth in group 2 fractured when removing posts at the 10° angle. Three fractures were small slivers of dentine at the point where the Eggler's repeller arms contacted the tooth mesially and distally, whilst one tooth (from group 1) fractured obliquely.

Conclusions Post removal with the Eggler device is a relatively safe procedure but care must be taken when there is a possibility of pulling the post out in a nonaxial direction or when less than 1 mm of dentine surrounds the apical end of the post.

Keywords: post removal, posts, strain.

Received 11 December 2000; accepted 22 May 2001

Testul Friedman

TESTUL FRIEDMAN ESTE DESTINAT ANALIZEI NEPARAMETRICE A EXPERIMENTELOR BLOC ALEATORII (CÂND DISTRIBUŢIILE NU SUNT NORMALE).

EL ESTE O SOLUŢIE ALTERNATIVĂ A ANALIZEI DISPERSIEI PENTRU DOUĂ GRUPURI DE DATE EŞANTIONATE.

EXPERIMENTELE BLOC ALEATORII SUNT O GENERALIZARE A EXPERIMENTELOR PERECHE, IAR TESTUL FRIEDMAN ESTE O GENERALIZARE A TESTULUI APLICATE LA EXPERIMENTELE PERECHE.

Heat shock induces the synthesis of the inflammatory mediator leukotriene B_4 in human pulp cells

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Abstract

Eberhard J, Zahl A, Dommisch H, Winter J, Acil Y, Jepsen S. Heat shock induces the synthesis of the inflammatory mediator leukotriene B_4 in human pulp cells. *International Endodontic Journal*, **38**, 882–888, 2005.

Aim To measure the synthesis of leukotriene B_4 (LTB_4) in cultures of human dental pulp cells induced by heat shock.

Methodology Primary pulp cells (PC) and dental pulp stem cells (DPSC) were cultivated under appropriate conditions. For the characterization of PC the expression of dentine sialophosphoprotein (DSPP) was evaluated by reverse transcription-polymerase chain reaction. Thermal stimulation of cell cultures was performed at temperatures of 37, 38, 39, 40, 42 and 45 °C for stimulation times of 5 and 30 s. LTB_4 was quantified by reversed-phase high-performance chromatography and differences between the LTB_4 concentrations of controls and heat stimulated cells were analysed with Friedman analysis of variances by ranks and multiple comparisons ($P < 0.05$).

Results Both cell cultures expressed DSPP under the conditions of the present experiment. The analysis revealed significantly enhanced LTB_4 synthesis following thermal stimulations at 38, 39, 40, 42 and 45 °C compared with unstimulated controls for both PC and DPSC.

Conclusion The present study demonstrated the capability of pulp cells to synthesize the arachidonic acid mediator LTB_4 in response to heat shock. LTB_4 has the capacity to induce inflammatory reactions and to sensitise afferent nociceptive nerve endings. LTB_4 synthesis is induced by minor temperature changes, which are relevant for various clinical situations.

Keywords: arachidonic acid, heat shock, leukotriene, pulp cells.

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