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# The role of wrist arthroscopy in diagnostic work-up and pre-operative planning: A systematic analysis of 125 patients with various wrist disorders

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## ABSTRACT

**PURPOSE:** The purpose of the present study was to investigate the beneficial role of arthroscopy in the management of 125 consecutive patients with various pathologic conditions of the wrist that underwent arthroscopic investigation.

**MATERIAL-METHODS:** We retrospectively reviewed 125 consecutive wrist arthroscopies performed in two Orthopaedic Upper Limb Units over a ten year period (2006-2015). There were 54 male and 71 female patients with a mean age at operation of 37 years old (range 12-64 years). The preoperative diagnostic work-up included clinical examination of the wrist, X-rays and MRI scan in all patients. Patients were categorised into three distinct groups: The 94 patients (75.2%) in *Group I* had an established preoperative diagnosis and arthroscopy was carried out for diagnostic confirmation, further investigation or therapeutic procedures. Those in *Group II* (12 patients, 9.6%) had persistent unexplained pain in the presence of normal physical and/or radiological findings and arthroscopy was conducted with diagnostic intent. The remaining 19 patients (15.2%) of *Group III* had also an established diagnosis and underwent arthroscopy mainly for staging and preoperative planning. Therapeutic arthroscopy was considered worthwhile when the procedure could be technically performed, independently of the ultimate outcome. In Group I the arthroscopy was considered beneficial when the pre-operative diagnosis was changed, excluded or limited in such a way that the management was changed; in Group II when a diagnosis was established and in Group III when the pre-operative planning was changed.

**RESULTS:** In Group I ($n$=94) arthroscopy confirmed the diagnosis in 43/94 cases (46%), and altered it in the rest; arthroscopy was beneficial in 25/43 (58.2%) patients of the group with confirmed diagnosis and in 32/51 (62.8%) of the group with altered diagnosis. In Group II ($n$=12) a new diagnosis related to preoperative symptoms was found in 9 cases (75%) and treated arthroscopically in 7 (78%). Finally, in Group III ($n$=19) arthroscopy fulfilled surgeons expectations in five patients, the procedure was of no value or inconclusive in 3 and led to modification of treatment plan to the worst in 11 (58%) cases.

**CONCLUSIONS:** Wrist arthroscopy has a wide range of applications, from simple irrigation and débridement

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to complex ligament reconstructions. Its value as a diagnostic tool is even more important when a clinical and/or radiological diagnosis cannot be established especially in patients with chronic wrist pain. In Group II (no preoperative diagnosis) we were able to establish a diagnosis in 9/12 cases and apply arthroscopic treatment in 78%, whereas in Groups I and III (known diagnosis), the percentage of concurred diagnosis was 43/113 (42.5%), the preoperative diagnosis was altered in 57.5% and a therapeutic arthroscopy was given in 55% of the patients. In all groups the arthroscopy was beneficial in more than half of the patients (53%) showing its value in the evaluation and treatment of various wrist disorders.

**KEY WORDS: wrist arthroscopy; evaluation; treatment; beneficial role; importance**

## 1. Introduction

Since its introduction more than three decades ago, wrist arthroscopy (WA) has been proved a useful investigation in defining the patterns, combinations and extent of soft tissue and bony abnormalities which are sometimes more extensive than clinically suspected [1,2]. Current indications of WA include triangular fibrocartilage (TFC) complex pathology, proximal and midcarpal instability, assisted fracture reduction, synovitis and arthritis, distal ulnar and carpal bone excisions and salvage procedures [3-8]. Although wrist arthroscopy can identify an anatomic abnormality, it cannot be used to differentiate between an asymptomatic degenerative or traumatic condition *vs.* a pathologic lesion that is the cause of wrist pain [9]. A thorough clinical wrist examination and proper imaging are still integral to any arthroscopic assessment [10,11]. The purpose of the present study was to investigate the beneficial role of arthroscopy in the management of 125 consecutive patients with various pathologic conditions of the wrist that underwent arthroscopic investigation.

## 2. Material amd Methods

We retrospectively reviewed 125 consecutive wrist arthroscopies performed in two Orthopaedic Upper Limb Units over a ten year period (2006-2015) performed or supervised by two surgeons (AP and JC). There were 54 male and 71 female patients with a mean age at operation of 37 years old (range 12-64 years). All patients had chronic wrist pain (more than 6 months) unresponsive to conservative treatment. The duration of symptoms ranged from 6 to 230 months. Fifty-seven patients (45.6%) had a documented previous injury and 22 had received at least one operative intervention in the past. The preoperative diagnostic work-up included thorough clinical examination of the wrist and hand, standard and special X-rays of the wrist and MRI scan in all patients. Additional investigations (CT and bone scans) was necessary in 27 patients. Our database review revealed a total of 380 positive conventional diagnostic wrist tests and 476 imagine studies (3.04 clinical tests and 3.8 imagine studies per patient in respect).

Patients were categorised into three distinct groups: The 94 patients (75.2%) in *Group I* had an established preoperative clinical and/or radiological diagnosis and arthroscopy was carried out for diagnostic confirmation, further investigation or therapeutic procedures (e.g. known TFCC tear). Those in *Group II* (12 patients, 9.6%) had persistent unexplained pain in the presence of normal physical and/or radiological findings and arthroscopy was conducted with diagnostic intent. The remaining 19 patients (15.2%) of *Group III* had also an established diagnosis and underwent arthroscopy mainly for staging and preoperative planning (e.g. degenerative arthritis).

All patients underwent the same technique of wrist arthroscopy according to standard guidelines in an outpatient base. Under general anaesthesia, the upper extremity was placed at 90° of flexion at the elbow joint and longitudinal traction of 5 kilos was applied by a custom sling over the tourniquet (**Fig. 1**). The index and middle fingers were secured

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***Fig. 1.*** *Set up of the patient for wrist arthroscopy; a shoulder strap is adjusted to the tourniquet with 5 kilos of weight for joint distraction*

in sterile finger traps hanging from the ceiling. Sterile drapes were applied in both sides of the wrist and one single dose of 2nd generation cephalosporin was administered for perioperative prophylaxis. Under tourniquet control, a 30° angled, 2.7-mm diameter arthroscope was used to evaluate both the radiocarpal and midcarpal joints. Fluid inflow was through the arthroscopic cannula *via* hand pump control. A standardized 2-mm tip probe was used in the radiocarpal arthroscopy through standard portals; 3-4 portal, 1 cm distal to Lister's tubercle and 6R portal, radial to the ECU tendon. For midcarpal arthroscopy the MCR, 1 cm distal to the 3-4 portal and the MCU, 1 cm distal to the 4-5 portal were used. All patients had been informed for the purposes of the arthroscopic investigation, especially if the treatment was about to change and had signed an informed consent; in 69/125 patients (55.2%) subsequent arthroscopic procedures were carried out according to the preoperative planning and/or the new established diagnosis. The rest received conservative, immediate open or 2nd stage operative treatment.

Therapeutic arthroscopy was considered worthwhile when the procedure could be technically performed, independently of the ultimate outcome. In Group I (established diagnosis) the arthroscopy was considered beneficial when the pre-operative diagnosis was changed, excluded or limited in such a way that the management was changed; in Group II (no diagnosis) when a diagnosis was established (especially when the intra-articular pathology corresponded to the patient symptoms) and in Group III (staging) when the pre-operative planning was changed.

## 3. **Results**

The mean operative time of diagnostic arthroscopy was 38 minutes (29-87 minutes). No cases of infection and early wound complications were noted. Four patients were admitted for 24-48 hours to the ward due to uncontrolled postoperative pain. The results are summarized in **Table 1**.

In Group I (known preoperative diagnosis, n=94) arthroscopy confirmed the diagnosis in 43/94 cases (46%), and altered it in the rest; there were 13 wrong diagnoses, 7 showed less pathology than expected and 31 shown more severe pathological lesions. Arthroscopy was beneficial in 25/43 (58.2%) patients of the group with confirmed diagnosis and in 32/51 (62.8%) of the group with altered diagnosis.

In Group III (preoperative planning or confirmation of findings in a given diagnosis *n*=19) arthroscopy fulfilled surgeons expectations in five patients, the procedure was of no value or inconclusive in 3 and led to modification of treatment plan to the worst in 11 cases. Arthroscopy was beneficial in 5 of these cases, as the rest patients had been scheduled for open surgery at the same session or in a second stage.

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TABLE 1. *Overview of clinical data, intraoperative findings, beneficial role of wrist arthroscopy*

| | | Diagnosis after arthroscopy | | | Treatment (confirmed/altered) | | | |
|---|---|---|---|---|---|---|---|---|
| Cases /confirmed/ altered) | Right | Wrong | Reduced | Extended | Arthroscopic | Open after scope | Open 2nd stage | Conservative |
| Group I: preoperative diagnosis known (94/43/51) | 43 | 13 | 7 | 31 | 25/32 | 13/7 | 5/8 | 0/4 |
| Group III: preop planning with known diagnosis (19/5/14) | 5 | 2 | 1 | 11 | 1/4 | 3/3 | 1/5 | 0/2 |
| Total 113 (48/65) | 48 | 15 | 8 | 42 | 26/36 (*n*= 62) | 16/10 (*n*= 26) | 6/13 (*n*= 19) | 0/6 (*n*= 6) |
| | | | Confirmed | None | | | | |
| Group II: Undiagnosed (12) | | | 9 | 3 | 7 | 1 | - | 4 |

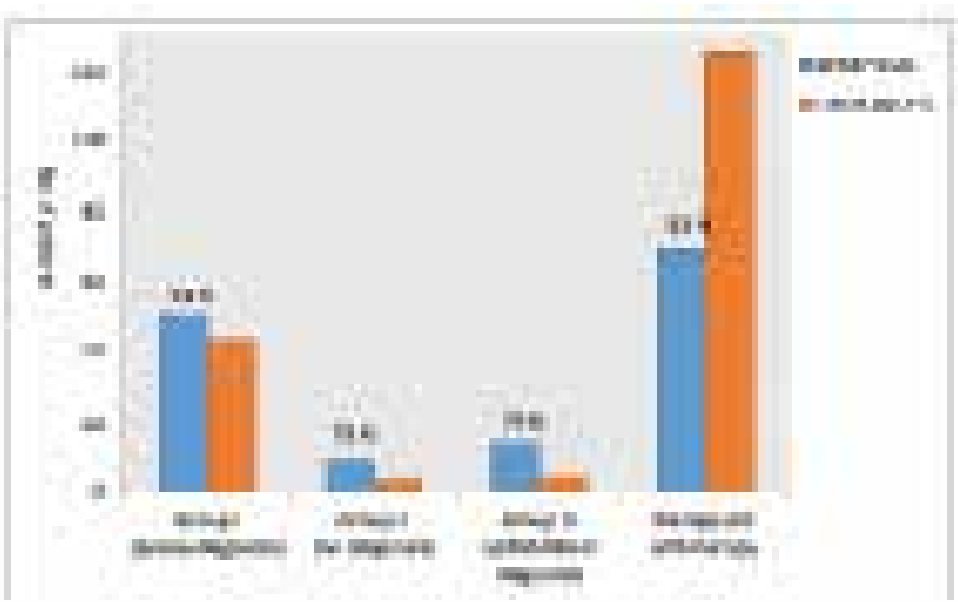

TABLE 2. *Demonstrates how beneficial wrist arthroscopy was in different group of patients and overall. More than 50% of patients were benefit from a therapeutic arthroscopy*

Finally, in Group II (no diagnosis, *n*=12) a new diagnosis related to preoperative symptoms was found in 9 cases (75%) and treated arthroscopically in 7 (78%) and open at the same time in 1 whereas in 3 patients arthroscopy was negative (**Table 1**).

According to our criteria, therapeutic arthroscopy was considered worthwhile in 69/125 patients (55.2%) in all groups (**Table 2**). These data demonstrate the importance of wrist arthroscopy both as a diagnostic and therapeutic tool in the management of wrist disorders. There were two interesting findings; first that still 3/12 (25%) of the patients in Group II (no diagnosis) had a normal arthroscopic appearance, representing a mean of 9.4 investigations per patient, which can be attributed to matters such as work compensation, malingering, simulation or even undiagnosed chronic wrist pain and second that 31/51 (61%) arthroscopies in Group I (altered or sufficiently augmented pre-operative diagnosis) revealed significant unsuspected intra-articular pathology which could be either unrelated to the clinical findings or just misdiagnosed or

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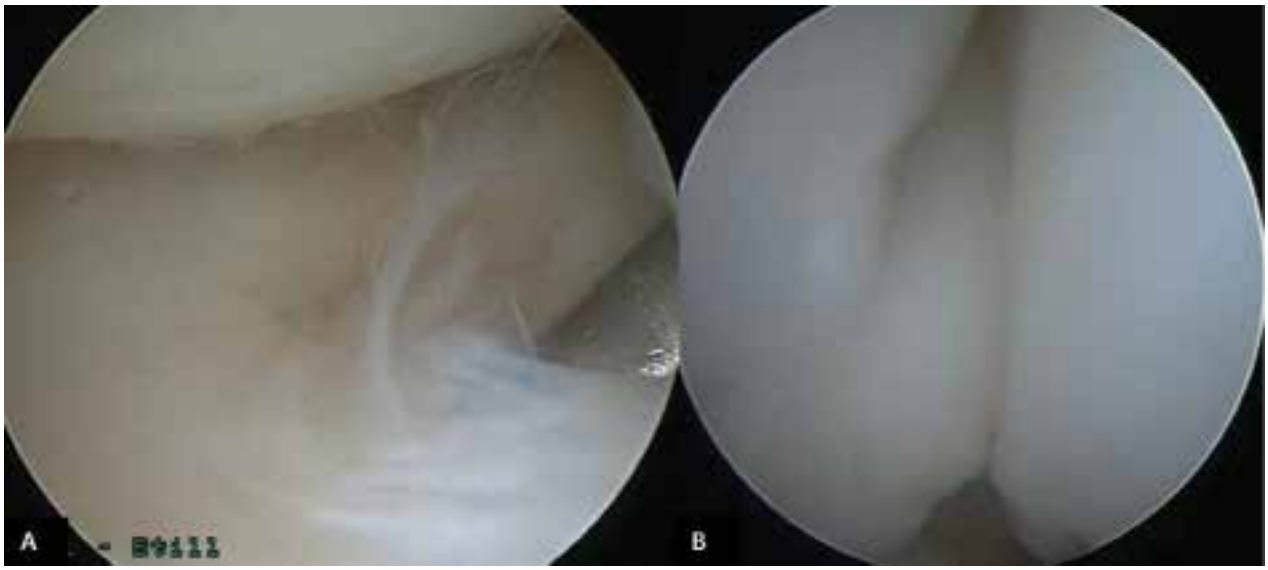


***Fig. 2.*** *Example of altered pre-operative diagnosis in a 36 year-old female patient of Group I. Except from the preoperatively diagnosed TFCC tear (A) wrist arthroscopy revealed also a dynamic scapholunate instability (B)*

underestimated to the clinical and radiological examination (**Fig. 2**).

**4. Discussion**

Wrist arthroscopy has a wide range of applications, from simple irrigation and débridement to complex ligament repair or reconstruction. With the evolution of new surgical techniques and instrumentation the indications for wrist arthroscopy have expanded to include apart from TFCC repair, complex ligament reconstructions, assisted reduction and fixation of fractures, carpometacarpal and intercarpal arthritis, wrist ganglion cysts excision as well as bone resections, such as radial styloidectomy, distal ulnar excision (wafer procedure), and proximal-row carpectomy [2,3,12].

Its value as a diagnostic tool is even more important when a clinical and/or radiological diagnosis cannot be established especially in patients with chronic wrist pain after occult trauma. Old reports, before the widespread use of MRI, have shown the diagnostic value of wrist arthroscopy; Kelly and Stanley [13] found that their diagnostic rate improved from 40% to 95% after diagnostic arthroscopy, while Nagle and Benson [14] were able to establish a diagnosis in 98% of their patients with a previously unknown diagnosis. Arthroscopies were categorized in this report as "diagnostic"--to identify unknown pathology, "staging"--to assess the severity of known pathology, and "operative"--to treat known pathology. Interestingly, ninety-six percent of staging arthroscopies helped guide future clinical management. Jones and Lovell [15] investigated 48 patients arthroscopically and they followed them for 4.5 years; in 36 cases considered clinically to have either carpal instability or TFC pathology, the clinical and arthroscopic findings concurred in 22 (45.8%). The extent of soft tissue injury was clinically over diagnosed in 3 cases and underdiagnosed in 6 cases. Of the remaining five cases, four had normal arthroscopies and one was a wrong diagnosis. De Smet et al. [16] reported the largest so far series of wrist arthroscopies in 129 patients (77 therapeutic & 52 diagnostic) which have been followed for at least 6 months. There were diagnostic benefits in 55 arthroscopies (42.5%), therapeutic benefits in 29 arthroscopies (22.5%), combined diagnostic and therapeutic benefits in 39 (30%) and no benefits in six (5%). In 65/77 cases of the therapeutic group (with preoperative diagnosis) the authors found that the arthroscopy had been worthwhile. For the diagnostic group without a

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preoperative diagnosis, an arthroscopic diagnosis was made in 44/52 cases. Adolfsson & Povlsen [8], assessed the role of diagnostic arthroscopy in patients with known wrist injury, normal standard radiographs, unclear clinical diagnosis and persistent severe pain for up to 12 weeks; forty-three patients underwent arthroscopic examination within 12 weeks from their injury. Arthroscopy revealed recent pathology in 41 (95%) wrists, of which 17 (40%) had significant ligament lesions that might have benefited from acute repair. The authors recommended that under these circumstances an arthroscopy must be carried out within 4 weeks if the patient and surgeon wish to acutely repair significant ligament injuries. Finally, Hofmeister et al. [17] demonstrated that midcarpal arthroscopy yields significant information in addition to that found during a radiocarpal examination; in their acute wrist instability group, midcarpal arthroscopy added to the radiocarpal diagnosis in 21 of 26 (82%) of the wrists whereas in the chronic wrist instability group the procedure was beneficial in 46 of 55 (84%) of the wrists. We believe that wrist arthroscopy performed without a midcarpal examination is an incomplete evaluation of the wrist. In our study midcarpal arthroscopy was beneficial and added or significantly altered the preoperative diagnosis in 59/125 (47%) patients.

**5. Conclusions**

Wrist arthroscopy has become an essential tool for the hand and upper extremity surgeon. It is useful in diagnosing and/or staging a wide range of conditions of the wrist, with its greater benefit to evaluate wrist pain of unclear cause when imaging studies and clinical examination fail to elucidate the disease. Subsequently, the number of conditions that are amenable to arthroscopic treatment continues to grow and expand. In our Group II (no preoperative diagnosis) we were able to establish a diagnosis in 9/12 cases and apply arthroscopic treatment in 78%, whereas in Groups I and III (known diagnosis), the percentage of concurred diagnosis was 43/113 (42.5%), the preoperative diagnosis was altered in 57.5% and a therapeutic arthroscopy was given in 55% of the patients. The arthroscopy was beneficial in more than half of the patients (53%) in all groups showing its value in the evaluation and treatment of various wrist disorders.

***Conflict of interest***

*The authors declared no conflicts of interest.*

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# ΠΕΡΙΛΗΨΗ

Σκοπός της εργασίας ήταν να αξιολογηθεί ο ευεργετικός ρόλος της αρθροσκόπησης στην αντιμετώπιση 125 ασθενών που έπασχαν από διάφορες παθήσεις του καρπού, για τις οποίες απαιτήθηκε αρθροσκοπική διερεύνηση. Αναλύθηκαν 125 αρθροσκοπήσεις καρπού που πραγματοποιήθηκαν σε δύο Ορθοπαιδικά Κέντρα Άνω άκρου στη δεκαετία 2006-2015, σε 54 άνδρες και 71 γυναίκες μέσης ηλικίας 37 ετών (εύρος 12-64 έτη). Ο προεγχειρητικός διαγνωστικός έλεγχος περιελάμβανε την κλινική εξέταση του καρπού, τις ακτινογραφίες και την MRI σε όλες τις περιπτώσεις. Οι ασθενείς χωρίστηκαν σε τρεις ομάδες: Στην ομάδα I, ανήκαν 94 ασθενείς (75,2%) που είχαν διαγνωσθεί προεγχειρητικά και η αρθροσκόπηση πραγματοποιήθηκε για την επιβεβαίωση της διάγνωσης, για περαιτέρω διερεύνηση ή για θεραπεία. Στην ομάδα II, 12 ασθενείς (9,6%) είχαν χρόνιο ανεξήγητο πόνο, χωρίς ευρήματα από την κλινική εξέταση και τις ακτινογραφίες, στους οποίους η αρθροσκόπηση είχε μόνο διαγνωστικό χαρακτήρα. Στους υπόλοιπους 19 ασθενείς (15,2%) της ομάδας III, με γνωστή διάγνωση, η αρθροσκόπηση πραγματοποιήθηκε για σταδιοποίηση της πάθησης και για τον προεγχειρητικό σχεδιασμό. Η θεραπευτική αρθροσκόπηση θεωρήθηκε απαραίτητη όταν οι τεχνικές προϋποθέσεις την εξασφάλιζαν, ανεξάρτητα με την τελική έκβαση. Στην ομάδα I, η αρθροσκόπηση θεωρήθηκε ευεργετική όταν η αρχική διάγνωση άλλαξε, αποκλείστηκε, ή περιορίστηκε έτσι ώστε να απαιτηθεί η αλλαγή των θεραπευτικών στόχων, ενώ στην ομάδα II όταν τέθηκε η σωστή διάγνωση και στην ομάδα III όταν ο προεγχειρητικός σχεδιασμός άλλαξε.

Στην ομάδα I ($n$=94), η διάγνωση επιβεβαιώθηκε σε 43/94 ασθενείς (46%) και άλλαξε στους υπόλοιπους, ενώ η αρθροσκόπηση αποδείχθηκε ευεργετική στους 25/43 (58,2%) ασθενείς με επιβεβαιωμένη διάγνωση και σε 32/51 (62,8%) ασθενείς με τροποποιημένη διάγνωση. Στην ομάδα II ($n$=12), σε 9 ασθενείς (75%) διαγνώστηκε νέα πάθηση, συμβατή με τα προεγχειρητικά συμπτώματα και η αρθροσκόπηση θεράπευσε τους 7 (78%). Στην ομάδα III ($n$=19), η αρθροσκόπηση ανταποκρίθηκε στις προσδοκίες των χειρουργών σε 5 ασθενείς, ήταν μη πειστική σε 3, ενώ οδήγησε σε αλλαγή του θεραπευτικού σχεδιασμού σε 11 (58%).

Συμπερασματικά, η αρθροσκόπηση του καρπού διαθέτει ένα μεγάλο εύρος εφαρμογών, από τις απλές πλύσεις και τον χειρουργικό καθαρισμό μέχρι τις σύνθετες αποκαταστάσεις συνδεσμικών κακώσεων. Η διαγνωστική αξία της μεθόδου είναι περισσότερο σημαντική όταν η κλινική εξέταση και οι ακτινογραφίες δεν βοηθούν, ειδικά σε ασθενείς με χρόνιο πόνο. Στην αδιάγνωστη ομάδα II, η διάγνωση εξασφαλίστηκε στις 9/12 περιπτώσεις και εφαρμόστηκε θεραπευτική αρθροσκόπηση στο 78%. Στις ομάδες I και III (με γνωστή τη διάγνωση), η διάγνωση επιβεβαιώθηκε στους 43/113 ασθενείς, άλλαξε στο 57,5% των περιπτώσεων και εφαρμόστηκε θεραπευτική αρθροσκόπηση στο 55% των ασθενών. Σε όλες τις ομάδες η αρθροσκόπηση ήταν ευεργετική στο 53% των περιπτώσεων της μελέτης, γεγονός που αποδεικνύει την αξία της στην αξιολόγηση και τη θεραπεία των διαφόρων παθήσεων του καρπού.

**ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: αρθροσκόπηση καρπού, εκτίμηση, θεραπεία, ευεργετικός ρόλος, σπουδαιότητα**